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# NFPA 491 Guide to Hazardous Chemical Reactions 1997 Edition

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**NFPA 491**

**Guide to**

# Hazardous Chemical Reactions

**1997 Edition**

This edition of NFPA 491, *Guide to Hazardous Chemical Reactions*, was prepared by the Technical Committee on Classification and Properties of Hazardous Chemical Data and acted on by the National Fire Protection Association, Inc., at its Annual Meeting held May 19–22, 1997, in Los Angeles, CA. It was issued by the Standards Council on July 24, 1997, with an effective date of August 15, 1997, and supersedes all previous editions.

Changes other than editorial are indicated by a vertical rule in the margin of the pages on which they appear. These lines are included as an aid to the user in identifying changes from the previous edition.

This edition of NFPA 491 was approved as an American National Standard on August 15, 1997.

## Origin and Development of NFPA 491

This guide was prepared by the Technical Committee on Classification and Properties of Hazardous Chemical Data. This 1997 edition is an extensive revision of the 1991 edition. The guide, originally published in 1975, revised in 1986, and reconfirmed in 1991, includes over 3500 entries of hazardous or potentially hazardous chemical reactions. As further information on hazardous reactions is accumulated, the Committee plans to publish revised editions. Those who know of references to reactions not included or who have personal knowledge of hazardous reactions are requested to send the information to the Committee Secretary, using the tear sheets at the end of the manual.

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**Robert A. Michaels,** *Secretary*
RAM TRAC Corp., NY [SE]

**Jacqueline E. Alpert,** Underwriters Laboratories Inc., IL [RT]
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**Norman V. Steere,** Norman V. Steere Assoc. Inc., MN [SE]

**Alternate**

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(Alt. to J. E. Alpert)

**Nonvoting**

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**Jan Van der Linde,** Samsom Chemical Publishers, The Netherlands
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**Guy R. Colonna,** NFPA Staff Liaison

**Committee Scope:** This Committee shall have primary responsibility for documents on the classification of the relative hazards of all chemical solids, liquids, and gases and to compile data on the hazard properties of these hazardous chemicals.

*This list represents the membership at the time the Committee was balloted on the text of this edition. Since that time, changes in the membership may have occurred. A key to classifications is found at the back of this document.*

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## Foreword

This guide had its beginnings in an extensive literature survey conducted by the late George W. Jones of the U.S. Bureau of Mines during his work with NFPA and American Chemical Society Technical Committees. The current 1997 edition contains approximately 3550 documented reactions. Readers are encouraged to submit documentation of additional reactions to be considered for inclusion in this guide.

The purpose of the guide is to provide users of chemicals with a compilation of recorded experience with chemical reactions that have potential for danger. Thus, the abstracts presented here range from reactions that produce incandescence or flame at moderate or slightly elevated temperatures to those that produce explosions or detonations. However, when presenting such a large compilation of data as is presented in this guide, one must be aware of some possible limitations and considerations when using the data. Since some of the information was obtained from very old references, its validity may be questioned; many of the reported hazardous reactions may have been due to impurities or contaminants in the materials involved. At the same time, the user should be cautioned that the absence of a reaction from this listing in no way implies that combinations of materials may be mixed with impunity with or without heating. Similarly, the comments that may be appended to particular reactions regarding their violence should be tempered by consideration of quantities involved, temperatures, confinement, and many other factors.

For convenience, many potentially hazardous reaction mixtures have been brought together into groups. For example, the reactions of mixtures of inorganic perchlorates with many fuels can be quite violent. This association of different reactants in the same group should not be taken, however, as an indication that all such related compounds will react with equal rates or ease with a given fuel, that the violence will be equivalent in every case, or that potential contaminants such as moisture will have the same effect. The reader is warned that trace quantities of contaminants acting as catalysts may have a profound effect on the course and rate of the reaction. Unless there is unusual reactivity with air, oxygen, or water, the usual combustion reactions involving these oxidants have not been included for all possible fuel substances. Finally, any mixture of oxidizing and reducing agents should be suspected of being able to undergo a hazardous reaction.

## Organization of this Guide

In this alphabetic tabulation, the reactions are presented in the following format:

**PRIMARY ENTRY**

**Secondary Entries**
Remarks and literature references.

For example,

**ALUMINUM**

**Sodium Carbonate**
When sodium carbonate was applied to redhot aluminum, an explosion occurred.
Price and Baker, *Chem. & Met. Eng.* **29:** 878 (1923).

means that aluminum and sodium carbonate react under the conditions stated and that the reference can be consulted for possible additional information. At the end of the guide, the full titles of the abbreviated names of references are listed.

This same reaction will also appear alphabetically under "sodium carbonate" as a cross-entry in bold-faced capital letters on the left margin as follows:

**SODIUM CARBONATE**

**Aluminum**
See ALUMINUM plus Sodium Carbonate.

The reactant under which the specific remarks are made (the Primary Entry) is chosen under an arbitrary system of priorities. Generally, the primary entry was selected from the higher on the following list:

| CHEMICAL | EXAMPLE |
|---|---|
| Metallic Elements | Magnesium |
| Other Elements | Bromine |
| Classes of Compounds | Nitrates |
| Uncommon Compounds | Cesium Acetylene Carbide |
| Specific Compounds of a Class | Ammonium Nitrate |
| Common Acids | Nitric Acid |
| Common Bases | Sodium Hydroxide |
| Common Organic Compounds | Ethyl Alcohol |
| Nonchemical Names | Organic Matter |

Additional guides for finding reactions in the manual are listed below:

1. There is a cross-reference of chemical names and synonyms. Synonyms are listed alphabetically with the corresponding primary entry and page number.

2. If the CAS number is available, the cross-reference of chemical names and CAS numbers can be used. The CAS numbers are listed in order with the name of the primary entry chemical.

3. When two chemical compounds are of equal importance, the first in alphabetic listing has usually received priority as the primary entry.

4. Most of the secondary entries appear also as primary cross-entries; exceptions are air, water, common chemical names like alcohol and ether, and trivial or common names like caustic soda or wood. For these common substances, refer to the other reactant or to the specific chemical name. Since so many reactions concern charcoal, this material is a primary entry.

5. For some common organic chemicals, popular names were used in preference to scientific nomenclature; for example, methyl bromide, rather than monobromomethane.

6. A chemical name is used in preference to its creator's name; thus, permonosulfuric acid, rather than Caro's acid.

7. A few proprietary names appear in preference to the relatively unknown chemical identification of the compound; e.g., Teflon®instead of polytetrafluoroethylene.

8. If no hazardous reaction is listed for a particular pair of chemicals, the reader should look up possible reactions between chemicals with similar properties. For example, if no reaction is given between cesium and hydrochloric acid, see sodium and hydrochloric acid. The violence of the reaction between the similar chemicals might not be the same, but the combination should be regarded as suspect.


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9. The guide does not list explosive fuel-air mixtures, but does list pyrophoric or hypergolic (self-igniting) mixtures.

10. The guide also lists a number of individual chemicals that explode or detonate spontaneously or in response to impact or heat. In such cases the chemical is listed as the primary entry, under which is printed the term, "self-reactive."

11. A number of entries by "families" of chemicals, e.g., nitrates, sulfates, aldehydes, and ethers, are included to facilitate the search for reactions. Frequently, these entries cross-refer to reactions of individual chemicals of the family.

12. Isomeric designations such as "iso" and "n" do not affect the alphabetic arrangement of chemical names in this guide.

### References

An effort has been made to furnish references complete enough to lead the reader to the source of information. At the end of the guide, the full titles are listed for the abbreviated names of references that accompany the reactions. If a statement about a reaction might disclose proprietary information, the source is protected by the reference, "Confidential information furnished to NFPA."

### Information on Errors and Omissions Welcomed

The Technical Committee on Classification and Properties of Hazardous Chemical Data will welcome comments on and criticisms of the present compilation. If a reader can cite more up-to-date references or experiences concerning any of the listed reactions, the information also will be welcomed. Similarly, the Committee would very much appreciate receiving brief details of incidents involving hazardous chemical reactions not yet included in the guide, so that these can be compiled and included in a later revision. Such material should be transmitted to Guy R. Colonna, Staff Liaison, Technical Committee on Classification and Properties of Hazardous Chemical Data, National Fire Protection Association, 1 Batterymarch Park, P.O. Box 9101, Quincy, MA 02269-9101. Tear-out pages for forwarding new material are at the back of the guide.

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# NFPA 491

## Guide to

# Hazardous Chemical Reactions

## 1997 Edition

### ACETALDEHYDE $CH_3CHO$

**Acetic Acid**
Acetaldehyde was put in drums previously pickled with acetic acid. The acid caused the acetaldehyde to polymerize, and the drums became hot and vented.
*MCA Case History* **1764** (1971).

**Acid Anhydrides**
Condensation reaction of acetaldehyde with acid anhydrides, alcohols, ketones, and phenols can be violent.
*Chem. Safety Data Sheet* **SD-43** (1952).

**Air**
Acetaldehyde oxidizes readily in air to unstable peroxides that may explode spontaneously.
*Chem. Safety Data Sheet* **SD-43** (1952).

**Alcohols**
See ACETALDEHYDE plus Acid Anhydrides.
*Chem. Safety Data Sheet* **SD-43** (1952).

**Ammonia (Anhydrous)**
Reaction of anhydrous ammonia, hydrogen cyanide, or hydrogen sulfide can be violent.
*Chem. Safety Data Sheet* **SD-43** (1952).

**Bromine**
See BROMINE plus Acetaldehyde.

**Chlorine**
See CHLORINE plus Acetaldehyde.

**Fluorine**
See BROMINE plus Acetaldehyde.

**Hydrogen Cyanide**
See ACETALDEHYDE plus Ammonia (Anhydrous).

**Hydrogen Sulfide**
See ACETALDEHYDE plus Ammonia (Anhydrous).

**Iodine**
See BROMINE plus Acetaldehyde.

**Ketones**
See ACETALDEHYDE plus Acid Anhydrides.

**Phenols**
See ACETALDEHYDE plus Acid Anhydrides.

**Phosphorus Isocyanate**
See PHOSPHORUS ISOCYANATE plus Acetaldehyde.

**Sodium Hydroxide**
A violent polymerization of acetaldehyde results from reactions with alkaline materials such as sodium hydroxide.
*Doyle* (1966).

### ACETIC ACID $CH_3COOH$

**Acetaldehyde**
See ACETALDEHYDE plus Acetic Acid.

**2-Aminoethanol**
Mixing acetic acid and 2-aminoethanol in a closed container caused the temperature and pressure to increase.
*Flynn and Rossow* (1970). See Note under complete reference.

**Ammonium Nitrate**
See AMMONIUM NITRATE plus Acetic Acid.

**Ammonium Thiosulfate**
See AMMONIUM THIOSULFATE plus Acetic Acid.

**Bromine Pentafluoride**
See BROMINE PENTAFLUORIDE plus Acetic Acid.

**Chlorine Trifluoride**
See CHLORINE TRIFLUORIDE plus Acetic Acid.

**Chlorosulfonic Acid**
Mixing glacial acetic acid and chlorosulfonic acid in a closed container caused the temperature and pressure to increase.
*Flynn and Rossow* (1970). See Note under complete reference.

**Chromic Acid**
See CHROMIC ANHYDRIDE plus Acetic Acid.

**Chromic Anhydride and Acetic Anhydride**
See CHROMIC ANHYDRIDE plus Acetic Acid and Acetic Anhydride.

**Diallyl Methyl Carbinol and Ozone**
See DIALLYL METHYL CARBINOL plus Ozone and Acetic Acid.

**Ethylene Diamine**
Mixing acetic acid and ethylene diamine in a closed container caused the temperature and pressure to increase.
*Flynn and Rossow* (1970). See Note under complete reference.

**Ethyleneimine**
Mixing glacial acetic acid and ethyleneimine in a closed container caused the temperature and pressure to increase.
*Flynn and Rossow* (1970). See Note under complete reference.

**Hydrogen Peroxide**
See HYDROGEN PEROXIDE plus Acetic Acid.

**Nitric Acid**
See NITRIC ACID plus Acetic Acid.

**Nitric Acid and Acetone**
See NITRIC ACID plus Acetone and Acetic Acid.

**Oleum**
Mixing glacial acetic acid and oleum in a closed container caused the temperature and pressure to increase.
*Flynn and Rossow* (1970). See Note under complete reference.

**Perchloric Acid**
See PERCHLORIC ACID plus Acetic Acid.

**Permanganates**
See PERMANGANATES plus Acetic Acid.

**Phosphorus Isocyanate**
See PHOSPHORUS ISOCYANATE plus Acetaldehyde.

**Phosphorus Trichloride**
See PHOSPHORUS TRICHLORIDE plus Acetic Acid.


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**Potassium Hydroxide**
Potassium hydroxide residue in a catalyst pot reacted violently when acetic acid was added.
*MCA Case History* **920** (1963).

**Potassium Tert.-Butoxide**
See ACETONE plus Potassium Tert.-Butoxide.

**Sodium Hydroxide**
See SODIUM HYDROXIDE plus Acetic Acid.

**Sodium Peroxide**
See SODIUM PEROXIDE plus Acetic Acid.

**n-Xylene**
During the production of terephthalic acid, n-xylene is oxidized in the presence of acetic acid. During these processes, detonating mixtures may be produced. Addition of a small amount of water may largely eliminate the risk of explosion.
B. I. Sraer, *Himiceskaja promyslennost* **46** (10): 27–30 (1970).

## ACETIC ANHYDRIDE $CH_3COOCOCH_3$

**2-Aminoethanol**
Mixing acetic anhydride and 2-aminoethanol in a closed container caused the temperature and pressure to increase.
*Flynn and Rossow* (1970). See Note under complete reference.

**Aniline**
See ANILINE plus Acetic Anhydride.

**Boric Acid**
See BORIC ACID plus Acetic Anhydride.

**Chlorosulfonic Acid**
Mixing acetic anhydride and chlorosulfonic acid in a closed container caused the temperature and pressure to increase.
*Flynn and Rossow* (1970). See Note under complete reference.

**Chromic Acid**
See CHROMIC ANHYDRIDE plus Acetic Anhydride.

**Chromic Anhydride**
See CHROMIC ANHYDRIDE plus Acetic Anhydride.

**Chromic Anhydride and Acetic Acid**
See CHROMIC ANHYDRIDE plus Acetic Anhydride and Acetic Acid.

**Ethylene Diamine**
Mixing acetic anhydride and ethylene diamine in a closed container caused the temperature and pressure to increase.
*Flynn and Rossow* (1970). See Note under complete reference.

**Ethyleneimine**
Mixing acetic anhydride and ethyleneimine in a closed container caused the temperature and pressure to increase.
*Flynn and Rossow* (1970). See Note under complete reference.

**Glycerol**
A violent reaction occurs between these reactants in the presence of phosphorus oxychloride as a catalyst.
*Hexagon Alpha Chi Sigma* **40** (Oct. 1949).

**Hydrochloric Acid**
Mixing acetic anhydride and 36% hydrochloric acid in a closed container caused the temperature and pressure to increase.
*Flynn and Rossow* (1970). See Note under complete reference.

**Hydrofluoric Acid**
Mixing acetic anhydride and 48.7% hydrofluoric acid in a closed container caused the temperature and pressure to increase.
*Flynn and Rossow* (1970). See Note under complete reference.

**Hydrogen Peroxide**
See HYDROGEN PEROXIDE plus Acetic Acid.

**Nitric Acid**
Mixing acetic anhydride and 70% nitric acid in a closed container caused the temperature and pressure to increase.
*Flynn and Rossow* (1970). See Note under complete reference.
See NITRIC ACID plus Acetic Anhydride.
See NITRIC ACID plus Acetic Acid.

**Nitrogen Tetroxide**
See NITROGEN TETROXIDE plus Acetic Anhydride.

**Oleum**
Mixing acetic anhydride and oleum in a closed container caused the temperature and pressure to increase.
*Flynn and Rossow* (1970). See Note under complete reference.

**Perchloric Acid**
See PERCHLORIC ACID plus Acetic Acid.
See PERCHLORIC ACID plus Acetic Anhydride.

**Permanganates**
See PERMANGANATES plus Acetic Acid.

**Sodium Hydroxide**
See SODIUM HYDROXIDE plus Acetic Anhydride.

**Sodium Peroxide**
See SODIUM PEROXIDE plus Acetic Acid.

**Sulfuric Acid**
Mixing acetic anhydride and 96% sulfuric acid in a closed container caused the temperature and pressure to increase.
*Flynn and Rossow* (1970). See Note under complete reference.

**Water**
The mixing of acetic anhydride with water can be dangerously explosive, especially when mineral acids are present.
*Chem. and Eng. News* **25:** 3458.

## ACETONE $CH_3COCH_3$

**Chloroform**
A mixture of acetone and chloroform in a residue bottle exploded. Since addition of chloroform to acetone in the presence of a base will result in a highly exothermic reac-



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tion, it is thought that a base may have been in the bottle.
*MCA Case History* **1661** (1970).

**Chromic Anhydride**
See CHROMIC ANHYDRIDE plus Acetone.

**Chromyl Chloride**
See CHROMYL CHLORIDE plus Acetone.

**Hexachloromelamine**
See HEXACHLOROMELAMINE plus Organic Contaminants.

**Hydrogen Peroxide**
See HYDROGEN PEROXIDE plus Organic Matter.

**Nitric Acid and Acetic Acid**
See NITRIC ACID plus Acetone and Acetic Acid.

**Nitric Acid and Sulfuric Acid**
See NITRIC ACID plus Acetone and Sulfuric Acid.

**Nitrosyl Chloride**
See NITROSYL CHLORIDE plus Acetone.

**Nitrosyl Perchlorate**
See NITROSYL PERCHLORATE plus Acetone.

**Nitryl Perchlorate**
See NITRYL PERCHLORATE plus Benzene.

**Permonosulfuric Acid**
See PERMONOSULFURIC ACID plus Acetone.

**Potassium Tert.-Butoxide**
Ignition occurs when potassium t-butoxide reacts with the following: acetone, ethyl methyl ketone, methyl isobutyl ketone, methanol, ethanol, n-propanol, isopropanol, ethyl acetate, n-butyl acetate, n-propyl formate, acetic acid, sulfuric acid, methylene chloride, chloroform, carbon tetrachloride, epichlorohydrin, dimethyl carbonate, and diethyl sulfate.
*MCA Case History* **1948** (1973).

**Sodium Hypobromite**
An explosion occurred during an attempt to prepare bromoform from acetone by the haloform reaction.
*Chem. and Eng. News* **9:** 229 (1931).

**Sulfuric Acid and Potassium Dichromate**
Acetone ignited when it was accidentally splashed into a sulfuric acid-dichromate solution.
*Wischmeyer* (1969).

**Thiodiglycol and Hydrogen Peroxide**
See THIODIGLYCOL plus Hydrogen Peroxide and Acetone.

**Trichloromelamine**
See HEXACHLOROMELAMINE plus Organic Contaminants.

## ACETONITRILE $CH_3CN$

**Chlorosulfonic Acid**
Mixing acetonitrile and chlorosulfonic acid in a closed container caused the temperature and pressure to increase.
*Flynn and Rossow* (1970). See Note under complete reference.

**Erbium Perchlorate**
In the preparation of anhydrous erbium perchlorate an acetonitrile extraction was made. During the final stages of the procedure a glossy material was formed that exploded when scratched with a spatula. It was concluded that acetonitrile was trapped in the glossy erbium perchlorate and that this material was shock-sensitive as are many organic-containing perchlorates.
*J. Chem. Edu.* **50** (6): A336-7 (1973).

**Oleum**
Mixing acetonitrile and oleum in a closed container caused the temperature and pressure to increase.
*Flynn and Rossow* (1970). See Note under complete reference.

**Sulfuric Acid**
Mixing acetonitrile and 96% sulfuric acid in a closed container caused the temperature and pressure to increase.
*Flynn and Rossow* (1970). See Note under complete reference.

## ACETYL BROMIDE $CH_3COBr$

**Alcohols**
Acetyl bromide reacts violently with alcohols or water.
*Merck Index* **7th Ed.** (1960).

**Water**
See ACETYL BROMIDE plus Alcohols.

## ACETYL CHLORIDE $CH_3COCl$

**Dimethyl Sulfoxide**
See DIMETHYL SULFOXIDE plus Acyl Halides.

**Ethyl Alcohol**
Acetyl chloride reacts violently with ethyl alcohol or water.
*Rose* (1961).

**Water**
Acetyl chloride reacts violently with water.
*Haz. Chem. Data* (1966).

## ACETYLENE $CH{\equiv}CH$

**Brass**
See COPPER plus Acetylene.

**Bromine**
See BROMINE plus Acetylene.

**Cesium Hydride**
See CESIUM HYDRIDE plus Acetylene.

**Chlorine**
See CHLORINE plus Acetylene.

**Cobalt**
See COBALT plus Acetylene.

**Copper**
See COPPER plus Acetylene.

**Copper Salts**
See COPPER SALTS plus Acetylene.

**Cuprous Acetylide**
See CUPROUS ACETYLIDE plus Acetylene.

**Fluorine**
See FLUORINE plus Acetylene.

**Iodine**
See IODINE plus Acetylene.


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**Mercuric Nitrate**
See MERCURIC NITRATE plus Acetylene.

**Mercury**
See MERCURY plus Acetylene.

**Mercury Salts**
See MERCURY SALTS plus Acetylene.

**Nitric Acid**
See NITRIC ACID plus Acetylene.

**Potassium**
See POTASSIUM plus Acetylene.

**Potassium Hydroxide**
Ignition occurred when acetylene and potassium hydroxide came in contact. The incendivity of potassium hydroxide on acetylene and acetylene/nitrogen mixtures is reported in various temperature and pressure ranges.
H. P. Schildberg, M. Heider, B. Maurer, and W. Berthold, *Loss Prevention and Safety Promotion in the Process Industries,* **1** (1995).

**Rubidium Hydride**
See RUBIDIUM HYDRIDE plus Acetylene.

**Silver**
See SILVER plus Acetylene.

**Silver Salts**
See MERCURY SALTS plus Acetylene.
See also SILVER NITRATE plus Acetylene and Ammonium Hydroxide.

**Sodium Hydride**
See SODIUM HYDRIDE plus Acetylene.

**2-ACETYL-3-METHYLTHIOPHEN-4-ONE**
$SC(COCH_3)=C(CH_3)COCH_2$

**(self-reactive)**
A vacuum distillation of 2-acetyl-3-methylthiophen-4-one was being performed on a laboratory bench when suddenly there was an explosion.
*MCA Guide for Safety,* Appendix 3 (1972).

**ACETYL NITRATE** $CH_3COONO_2$

**(self-reactive)**
Acetyl nitrate has been reported to explode during vacuum distillation; also, when touched by a glass rod.
J. P. Wilaut, *Chem. Zentr.* **112**(I):384 (1943).
Pichet and Khotinsky, *Berichte* **40**:1164 (1907).

**ACID ANHYDRIDES**
(See also specific Anhydride)

**Acetaldehyde**
See ACETALDEHYDE plus Acid Anhydrides.

**ACIDS**
(See also specific acid)

**Acrolein**
See ACROLEIN plus Sulfur Dioxide.

**Benzyl Alcohol**
Benzyl alcohol containing acidic constituents and dissolved iron was found to polymerize with a rapid temperature increase when heated in excess of 100°C. Amines, pyridene, and alkali hydroxides act as inhibitors and prevent polymerization.
*Chem. Abst.* **77**:7816w (1972).

**Lithium Aluminum Hydride**
See LITHIUM ALUMINUM HYDRIDE plus Water.

**Nickel Nitride**
See NICKEL NITRIDE plus Acids.

**Sodium Ozonate**
See SODIUM OZONATE plus Acids.

**Thorium Phosphide**
See THORIUM PHOSPHIDE plus Acids.

**Tri-iso-Butyl Aluminum**
See TRI-iso-BUTYL ALUMINUM plus Acids.

**ACROLEIN** $CH_2=CHCHO$

**Acids**
See ACROLEIN plus Sulfur Dioxide.

**Alkalis**
See ACROLEIN plus Sulfur Dioxide.

**Amines**
See ACROLEIN plus Sulfur Dioxide.
See SODIUM HYDROXIDE plus Acrolein.

**2-Aminoethanol**
Mixing acrolein and 2-aminoethanol in a closed container caused the temperature and pressure to increase.
*Flynn and Rossow* (1970). See Note under complete reference.

**Ammonia**
See SODIUM HYDROXIDE plus Acrolein.

**Ammonium Hydroxide**
Mixing acrolein and 28% ammonium hydroxide in a closed container caused the temperature and pressure to increase.
*Flynn and Rossow* (1970). See Note under complete reference.

**Chlorosulfonic Acid**
Mixing acrolein and chlorosulfonic acid in a closed container caused the temperature and pressure to increase.
*Flynn and Rossow* (1970). See Note under complete reference.

**Ethylene Diamine**
Mixing acrolein and ethylene diamine in a closed container caused the temperature and pressure to increase.
*Flynn and Rossow* (1970). See Note under complete reference.

**Ethyleneimine**
Mixing acrolein and ethyleneimine in a closed container caused the temperature and pressure to increase.
*Flynn and Rossow* (1970). See Note under complete reference.

**Hydroxides**
See SODIUM HYDROXIDE plus Acrolein.

**Nitric Acid**
Mixing acrolein and 70% nitric acid in a closed container caused the temperature and pressure to increase.
*Flynn and Rossow* (1970). See Note under complete reference.



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**Oleum**
Mixing acrolein and oleum in a closed container caused the temperature and pressure to increase.
*Flynn and Rossow* (1970). See Note under complete reference.

**Potassium Hydroxide**
See SODIUM HYDROXIDE plus Acrolein.

**Sodium Hydroxide**
See SODIUM HYDROXIDE plus Acrolein.

**Sulfur Dioxide**
Acrolein polymerizes with release of heat on contact with minor amounts of acids (including sulfur dioxide), alkalis, volatile amines, salts, thiourea, oxidants (air) and on exposure to light and heat.
*BCISC* **44**:174 (1973).

**Sulfuric Acid**
Mixing acrolein and 96% sulfuric acid in a closed container caused the temperature and pressure to increase.
*Flynn and Rossow* (1970). See Note under complete reference.

**Thiourea**
See ACROLEIN plus Sulfur Dioxide.

**ACRYLAMIDE** $H_2C=CHCONH_2$
It can polymerize violently on melting at 85°C.
*Muir* (1977).

**ACRYLIC ACID** $H_2C=CHCOOH$

**2-Aminoethanol**
Mixing acrylic acid and 2-aminoethanol in a closed container caused the temperature and pressure to increase.
*Flynn and Rossow* (1970). See Note under complete reference.

**Ammonium Hydroxide**
Mixing acrylic acid and 28% ammonium hydroxide in a closed container caused the temperature and pressure to increase.
*Flynn and Rossow* (1970). See Note under complete reference.

**Chlorosulfonic Acid**
Mixing acrylic acid and chlorosulfonic acid in a closed container caused the temperature and pressure to increase.
*Flynn and Rossow* (1970). See Note under complete reference.

**Ethylene Diamine**
Mixing acrylic acid and ethylene diamine in a closed container caused the temperature and pressure to increase.
*Flynn and Rossow* (1970). See Note under complete reference.

**Ethyleneimine**
Mixing acrylic acid and ethyleneimine in a closed container caused the temperature and pressure to increase.
*Flynn and Rossow* (1970). See Note under complete reference.

**Oleum**
Mixing acrylic acid and oleum in a closed container caused the temperature and pressure to increase.
*Flynn and Rossow* (1970). See Note under complete reference.

**ACRYLONITRILE** $CH_2=CHCN$

**Acids (Strong)**
See ACRYLONITRILE plus Sulfuric Acid and Water.

**2-Aminoethanol**
Mixing acrylonitrile and 2-aminoethanol in a closed container caused the temperature and pressure to increase.
*Flynn and Rossow* (1970). See Note under complete reference.

**Bromine**
See BROMINE plus Acrylonitrile.

**Chlorosulfonic Acid**
Mixing acrylonitrile and chlorosulfonic acid in a closed container caused the temperature and pressure to increase.
*Flynn and Rossow* (1970). See Note under complete reference.

**Ethylene Diamine**
Mixing acrylonitrile and ethylene diamine in a closed container caused the temperature and pressure to increase.
*Flynn and Rossow* (1970). See Note under complete reference.

**Nitric Acid**
Acrylonitrile and 70% Nitric Acid detonates at 90°C.
*Flynn and Rossow* (1970). See Note under complete reference.

**Oleum**
Mixing acrylonitrile and oleum in a closed container caused the temperature and pressure to increase.
*Flynn and Rossow* (1970). See Note under complete reference.

**Potassium Hydroxide**
See SODIUM HYDROXIDE plus Acrylonitrile.

**Sodium Hydroxide**
See SODIUM HYDROXIDE plus Acrylonitrile.

**Sulfuric Acid**
A mixture with concentrated sulfuric acid must be kept well chilled; otherwise, a vigorous exothermic reaction occurs.
*Chem. Safety Data Sheet* **SD-31:** 8 (1949).
A vigorous reaction between acrylonitrile and strong acids occurs with hydroquinone and powdered copper as catalysts. In the preparation of acrylic acid from these ingredients, using concentrated sulfuric acid, an eruption will occur in the flask, due to a strong exothermic reaction, unless the ingredients are kept well chilled.
F. J. Kaszuba, *Chem. and Eng. News* **30:** 824 (1952). Mixing acrylonitrile and 96% sulfuric acid in a closed container caused the temperature and pressure to increase.
*Flynn and Rossow* (1970). See Note under complete reference.

**1,2,3,4-Tetrahydrocarbazole**
See 1,2,3,4-TETRAHYDROCARBAZOLE plus Acrylonitrile.

**ACRYLONITRILE-BUTADIENE COPOLYMER**
$[-CH_2CH=CHCH_2CH_2CH(CN)-]n$

**Fluorine**
See FLUORINE plus Solid Nonmetals and Oxygen.


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## ACYL HALIDES

**Dimethyl Sulfoxide**
See DIMETHYL SULFOXIDE plus Acyl Halides.

## AIR (LIQUID)

**Charcoal**
Explosions have occurred when liquid air contacts organic matter. A cracked tube of activated charcoal immersed in liquid air exploded violently.
J. Taylor, *J. Sci. Instr.* **5:** 24 (1928).

**Diethyl Ether**
See DIETHYL ETHER plus Air (Liquid).

**Hydrocarbons**
Almost any reducing agent and all hydrocarbons can form explosive mixtures with liquid air.
*Chem. and Eng. News* **27:** 2612 (1949).

## ALCOHOLS

**Acetaldehyde**
See ACETALDEHYDE plus Acid Anhydrides.

**Barium Perchlorate**
See BARIUM PERCHLORATE plus Alcohols.

**Chlorine**
See ALCOHOLS plus Hypochlorous Acid.

**Diethyl Aluminum Bromide**
See DIETHYL ALUMINUM BROMIDE plus Air.

**Ethylene Oxide**
See ETHYLENE OXIDE plus Alcohols.

**Hexamethylene Diisocyanate**
See ALCOHOLS plus Isocyanates.

**Hydrogen Peroxide and Sulfuric Acid**
Mixtures of alcohols with concentrated sulfuric acid and strong hydrogen peroxide can cause explosions. Examples: An explosion will occur if dimethylbenzylcarbinol is added to 90% hydrogen peroxide and then acidified with concentrated sulfuric acid. Mixtures of ethyl alcohol with concentrated hydrogen peroxide form powerful explosives. Mixtures of hydrogen peroxide and 1-phenyl-2-methyl propyl alcohol tend to explode if acidified with 70% sulfuric acid.
*Chem. and Eng. News* **45** (43): 73 (1967). *J. Org. Chem.* **28:** 1893 (1963).

**Hypochlorous Acid**
Alkyl hypochlorites are violently explosive. They are readily obtained by reacting hypochlorous acid and alcohols either in aqueous solution or in mixed water-carbon tetrachloride solutions. Obviously CHLORINE plus Alcohols would similarly produce alkyl hypochlorites. They decompose in the cold and explode on exposure to sunlight or heat. Tertiary hypochlorites are less unstable than secondary or primary hypochlorites.
*Whitmore,* 157 (1937). *Mellor,* **Supp. II, Part I:** 560 (1956).

**Isocyanates**
Base-catalyzed reactions of isocyanates such as hexamethylene diisocyanate with alcohols should generally be carried out in inert solvents. Such reactions in the absence of solvents often occur with explosive violence.
*Wischmeyer* (1969).

**Lithium Aluminum Hydride**
See LITHIUM ALUMINUM HYDRIDE plus Water.

**Nitrogen Tetroxide**
See NITROGEN TETROXIDE plus Alcohols.

**Perchloric Acid**
See PERCHLORIC ACID plus Alcohols.

**Permonosulfuric Acid**
See PERMONOSULFURIC ACID plus Alcohols.

**Tri-iso-Butyl Aluminum**
See TRI-iso-BUTYL ALUMINUM plus Acids.

## ALKALI CARBONATES

**Silicon**
See SILICON plus Alkali Carbonates.

## ALKALI HYDROXIDES

**Zirconium**
See ZIRCONIUM plus Alkali Hydroxides.

## ALKALI METAL CHROMATES

**Zirconium**
See ZIRCONIUM plus Alkali Metal Salts.

## ALKALI METAL DICHROMATES

**Zirconium**
See ZIRCONIUM plus Alkali Metal Salts.

## ALKALI METAL MOLYBDATES

**Zirconium**
See ZIRCONIUM plus Alkali Metal Salts.

## ALKALI METALS

**Boron Trifluoride**
Boron trifluoride reacts with incandescence when heated with alkali metals or alkaline earth metals, except magnesium.
*Merck Index,* p. 163 (1960).

**Hydrazine and Ammonia**
See HYDRAZINE plus Alkali Metals and Ammonia.

**Maleic Anhydride**
Maleic anhydride decomposes explosively in the presence of alkali metals.
*Chem. Safety Data Sheet* **SD-88** (1962).
*Chem. Haz. Info. Series* **C-71** (1960).

## ALKALI METAL SULFATES

**Zirconium**
See ZIRCONIUM plus Alkali Metal Salts.

## ALKALI METAL TUNGSTATES

**Zirconium**
See ZIRCONIUM plus Alkali Metal Salts.

## ALKALINE EARTH METALS

**Boron Trifluoride**
See ALKALI METALS plus Boron Trifluoride.



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**ALKENES**

**Fluorine**
See FLUORINE plus Alkenes.

**ALKYD AZIDES**

**(heat sensitive)**
See AZIDES, ORGANIC (heat sensitive).

**ALKYLALUMINUM FLUOROALKOXIDES**

Tests show that neat diethylaluminum 2,2,2-trifluoroethoxide (DEAL-FE) is shock sensitive. A slow exothermic decomposition occurs at about 75°C, and above 100°C, decomposition occurs violently.
*Chem. and Eng. News,* p.2 (April 2, 1990).

**ALKYL AZIDES**

**(self-reactive)**
Low molecular weight alkyl azides and diazido alkanes are considered to be particularly dangerous in the absence of suitable precautions. Introduction of more than one azide group into the molecule increases its instability.
*Chem. and Eng. News* **42** (31):6 (1964).

**ALKYL BENZENES**

**Fluorine**
See FLUORINE plus Alkyl Benzenes.

**ALKYLISOTHIOUREA SALTS**

**Chlorine**
See CHLORINE plus Alkylisothiourea Salts.

**ALKYLPHOSPHINES**

**Chlorine**
See CHLORINE plus Alkylphosphines.

**ALLENE** $H_2C=C=CH_2$

**(self-reactive)**
Pure allene can decompose explosively at two atmospheres.
*Rutledge,* p. 13 (1968).

**ALLYL ALCOHOL** $CH_2=CHCH_2OH$

**Carbon Tetrachloride**
A reaction between allyl alcohol and carbon tetrachloride produces trichlorobutylene epoxide (oxide) and dichlorobutylene epoxide (oxide), a mixture which during distillation proved to be unstable and detonated in the still.
*Doyle* (1969).

**Chlorosulfonic Acid**
Mixing allyl alcohol and chlorosulfonic acid in a closed container caused the temperature and pressure to increase.
*Flynn and Rossow* (1970). See Note under complete reference.

**Diallyl Phosphite and Phosphorus Trichloride**
See DIALLYL PHOSPHITE plus Allyl Alcohol and Phosphorus Trichloride.

**Nitric Acid**
Mixing allyl alcohol and 70% nitric acid in a closed container caused the temperature and pressure to increase.
*Flynn and Rossow* (1970). See Note under complete reference.

**Oleum**
Mixing allyl alcohol and oleum in a closed container caused the temperature and pressure to increase.
*Flynn and Rossow* (1970). See Note under complete reference.

**Sodium Hydroxide**
As a benzene extract of allyl benzenesulfonate was prepared from allyl alcohol and benzene sulfonyl chloride in the presence of aqueous sodium hydroxide, under vacuum distillation two fractions came off, then the temperature rose to 135°C, when the residue darkened and exploded.
W. T. Dye, and G. E. Ham, *Chem. and Eng. News* **28:**3452 (1950).
This reaction was almost certainly a caustic-catalyzed polymerization of allyl alcohol.
*Doyle* (1966).

**Sulfuric Acid**
Mixing allyl alcohol and 96% sulfuric acid in a closed container caused the temperature and pressure to increase.
*Flynn and Rossow* (1970). See Note under complete reference.

**Tri-n-Bromomelamine**
These compounds exploded fifteen minutes after mixing at room temperature.
*Chem. and Eng. News* **30:**1916 (1952).

**ALLYL BENZENESULFONATE** $CH_2=CHCH_2OSO_2C_6H_5$

**(self-reactive)**
During distillation of crude allyl benzenesulfonate, from which the benzene solvent had been removed, two fractions came off — the first at 86–92°C and the second at 92–135°C — then the remaining residue darkened, thickened, and exploded probably owing to uncontrolled polymerization.
*Chem. and Eng. News* **28:**3452 (1950).

**ALLYL CHLORIDE** $CH_2=CHCH_2Cl$

**Aluminum Chloride**
See SULFURIC ACID plus Allyl Chloride.

**Benzene and Diethyl Aluminum Chloride**
See ALLYL CHLORIDE plus Benzene and Ethyl Aluminum Dichloride.

**Benzene and Ethyl Aluminum Dichloride**
It has been found that allyl chloride or other alkyl halides will react vigorously with benzene or toluene, even at minus 70°C, in the presence of ethyl aluminum dichloride or ethyl aluminum sesquichloride. Explosions have been reported.
*Wischmeyer* (1970).

**Benzene and Ethyl Aluminum Sesquichloride**
See ALLYL CHLORIDE plus Benzene and Ethyl Aluminum Dichloride.

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**Chlorosulfonic Acid**
Mixing allyl chloride and chlorosulfonic acid in a closed container caused the temperature and pressure to increase.
*Flynn and Rossow* (1970). See Note under complete reference.

**Ethylene Diamine**
Mixing allyl chloride and ethylene diamine in a closed container caused the temperature and pressure to increase.
*Flynn and Rossow* (1970). See Note under complete reference.

**Ethyleneimine**
Mixing allyl chloride and ethyleneimine in a closed container caused the temperature and pressure to increase.
*Flynn and Rossow* (1970). See Note under complete reference.

**Ferric Chloride**
See SULFURIC ACID plus Allyl Chloride.

**Lewis-Type Catalysts**
See SULFURIC ACID plus Allyl Chloride.

**Nitric Acid**
Mixing allyl chloride and 70% nitric acid in a closed container caused the temperature and pressure to increase.
*Flynn and Rossow* (1970). See Note under complete reference.

**Oleum**
Mixing allyl chloride and oleum in a closed container caused the temperature and pressure to increase.
*Flynn and Rossow* (1970). See Note under complete reference.

**Sodium Hydroxide**
See SODIUM HYDROXIDE plus Allyl Chloride.

**Sulfuric Acid**
Mixing allyl chloride and 96% sulfuric acid in a closed container caused the temperature and pressure to increase.
*Flynn and Rossow* (1970). See Note under complete reference.
See SULFURIC ACID plus Allyl Chloride.

**Toluene and Diethyl Aluminum Chloride**
See ALLYL CHLORIDE plus Benzene and Ethyl Aluminum Dichloride.

**Toluene and Ethyl Aluminum Dichloride**
See ALLYL CHLORIDE plus Benzene and Ethyl Aluminum Dichloride.

**Toluene and Ethyl Aluminum Sesquichloride**
See ALLYL CHLORIDE plus Benzene and Ethyl Aluminum Dichloride.

**Ziegler-Type Catalysts**
See SULFURIC ACID plus Allyl Chloride.

## ALLYLDIMETHYL ARSINE $CH_2CHCH_2AS(CH_3)_2$

**Air**
Dimethylallylarsine ignites in air and on filter paper.
*Ellern,* pp. 24, 25 (1968).

## ALUMINUM Al

**Ammonium Nitrate**
A mixture of aluminum powder and ammonium nitrate can be used as an explosive. A number of explosions in which ammonium nitrate and aluminum are mixed with carbon, hydrocarbons, with or without oxidizing agents, have occurred.
*Mellor* **5:** 219 (1946–1947).

**Ammonium Persulfate**
A mixture of aluminum powder with ammonium persulfate powder and water may cause an explosion.
*Pieters,* p. 30 (1957).

**Antimony Trichloride**
See ALUMINUM plus Phosphorus Trichloride.

**Arsenic Trichloride**
See ALUMINUM plus Phosphorus Trichloride.

**Barium Bromate**
See ALUMINUM plus Bromates.

**Barium Chlorate**
See ALUMINUM plus Bromates.

**Barium Iodate**
See ALUMINUM plus Bromates.

**Barium Sulfate**
See ALUMINUM plus Sulfates.

**Bismuth Trioxide**
When bismuth trioxide is heated with powdered aluminum, the reduction occurs with explosive violence.
*Mellor* **9:** 649 (1946–1947). *Ellern,* pp. 244, 280 (1968).

**Bromates**
A combination of finely divided aluminum with finely divided bromates (also chlorates or iodates) of barium, calcium, magnesium, potassium, sodium, or zinc can be exploded by heat, percussion, and sometimes, light friction.
*Mellor* **2:** 310 (1946–1947).

**Bromine**
Bromine vapor reacts with warm aluminum foil with brilliant incandescence. The reaction is vigorous, even at 15°C.
*Chem. News* **121:** 178 (1920).
*Mellor* **1:** 135 (1946–1947).
*Mellor* **5:** 209 (1946–1947).

**Calcium Bromate**
See ALUMINUM plus Bromates.

**Calcium Chlorate**
See ALUMINUM plus Bromates.

**Calcium Iodate**
See ALUMINUM plus Bromates.

**Calcium Sulfate**
See ALUMINUM plus Sulfates.

**Carbon Disulfide**
Powdered aluminum burns in the vapor of carbon disulfide, sulfur dioxide, sulfur dichloride, nitrous oxide, nitric oxide, or nitrogen peroxide.
*Mellor* **5:** 209–212 (1946–1947).



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**Carbon Tetrachloride**

A bomb containing powdered aluminum and carbon tetrachloride exploded violently when heated to 153°C.
C. C. Clogston, *UL Technical Report* **34** (1945).
A mixture of powdered aluminum and carbon tetrachloride in a ball mill exploded.
*Chem. and Eng. News* **32:** 258 (1954).
Impact sensitivity tests have shown that mixtures of carbon tetrachloride and aluminum will detonate.
*ASESB Pot. Incid.* **39** (1968).

**Chlorates**

See ALUMINUM plus Bromates.

**Chlorinated Hydrocarbons**

When hot vapors contact powdered aluminum, an explosion results.
*Tech. Ind. Fire & Expl. Hazards* **2:** 26 (1947).

**Chlorine**

Aluminum powder burns in chlorine, even at 20°C.
*Mellor* **2:** 92; **5:** 209 (1946–1947).

**Chlorine Trifluoride**

In the presence of carbon, the combination of chlorine trifluoride with aluminum, copper, lead, magnesium, silver, tin or zinc results in a violent reaction.
*Mellor* **2, Supp. 1:** (1956).
See also CHLORINE TRIFLUORIDE plus Elements.

**Chlorofluorohydrocarbons**

It has been experimentally determined that mixtures of powdered aluminum with monofluorotrichloroethane or with trifluorotrichloroethane will flash or spark on heavy impact.
*ASESB Pot. Incid.* **39** (1968).
See also ALUMINUM plus Dichlorodifluoromethane.

**Chloroform**

Chloroform, methyl chloride, and carbon tetrachloride, and mixtures of these chemicals explode when in contact with aluminum powder or magnesium powder.
C. C. Clogston, *UL Technical Report* **34** (1945).

**Chromic Anhydride**

A violent reaction or flaming is likely in the reaction of chromic anhydride and aluminum powder.
*Mellor* **11:**237 (1946–1947).

**Copper Oxide**

A strong explosion occurred when aluminum was heated with copper oxide. With lead oxide, the crucible was broken to pieces and the doors of the furnace were blown off.
*Mellor* **5:**217–19 (1946–1947). *Ellern,* pp. 244, 280 (1968).

**Diborane**

Diborane reacts spontaneously with aluminum and lithium to form hydrides that ignite in air.
*Haz. Chem. Data* (1966).

**Dichlorodifluoromethane**

Destruction of the impellers in a centrifugal compressor occurred when abrasion exposed and heated fresh aluminum surfaces. These surfaces and dichlorodifluoromethane joined in a self-sustaining reaction with sufficient heat generation to melt and react much of the aluminum impeller material. Similar results were obtained in large test compressors using monochlorodifluoromethane. Follow-up laboratory test reactions between aluminum and (a) 1,1,2-trichloro-1,2,2-trifluoroethane; (b) monofluorotrichloromethane; (c) 1,2-dichloro-1,1,2,2-tetrafluoroethane; (d) dichlorodifluoromethane; (e) monobromotrifluoromethane; (f) monochlorodifluoromethane; (g) tetrafluoromethane established that vigorous reactions and heat outputs occurred in all cases. The vigor of the reactions and heat outputs increased in the given order, and were dependent on the combined effects of vapor pressure and degree of fluorination.
B. J. Eiseman, Jr., *ASHRAE Journal* **5:**63 (1963). C. C. Clogston, *UL Technical Report* **34** (1945). *Chem. and Eng. News* **39** (27):44 (1961);**39** (32): 4 (1961).

**1,2-Dichloro-1,1,2,2- tetrafluoroethane**

See ALUMINUM plus Dichlorodifluoromethane.

**Ethylene Dichloride, Propylene Dichloride, and Orthodichlorobenzene**

Orthodichlorobenzene had been mixed with ethylene dichloride and propylene dichloride.
This mixture dissolved the oxide coating from the aluminum containing vessel. Subsequent reaction between the aluminum vessel and the chlorinated olefins caused rupture of the vessel.
*Doyle* (1966).

**Fluorine**

See FLUORINE plus Metals.

**Fluorochloro-lubricants**

An explosive reaction occurs with fluorochloro oils or greases in contact with fresh aluminum surfaces under high loads. Examples cited: a spinning aluminum rod under pressure on an aluminum surface; a freshly bored aluminum cylinder under pressure from an aluminum piston; threading an aluminum rod into a dural tube with a fluorochloro oil as a lubricant.
*Laccabue* (1958).

**Iodates**

See ALUMINUM plus Bromates.

**Iodine**

Aluminum powder and iodine in close contact will ignite spontaneously.
*Ellern,* p. 46 (1968).

**Iodine Monochloride**

Aluminum foil, after continued contact with iodine monochloride, ignites spontaneously and burns with a bluish-white flame.
*Mellor* **2:** 119 (1946–1947).

**Iron Oxide**

The reaction of powdered aluminum and iron oxide, usually started by burning magnesium, proceeds vigorously, with evolution of intense heat. The mixture is known as "thermite."
*Mellor* **5:** 217–19 (1946–1947).
The reaction can be initiated by impact between an aluminum object and a rusty surface.
*Morse* (1966). *Abbey* (1964). *Health & Safety Inf.* **161** (1963).

**Lead Oxides**

The reduction of lead oxide by aluminum is violent. See also ALUMINUM plus Copper Oxide.
*Mellor* **7:** 658 (1946–1947). *Ellern,* pp. 244, 280 (1968).

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**Magnesium and Potassium Perchlorate**
There have been three industrial explosions involving a photoflash composition containing potassium perchlorate with aluminum and magnesium powders.
*ACS* **146:** 210. *BM Info. Circ.* **7349** (1945).

**Magnesium Bromate**
See ALUMINUM plus Bromates.

**Magnesium Chlorate**
See ALUMINUM plus Bromates.

**Magnesium Iodate**
See ALUMINUM plus Bromates.

**Manganese and Air**
See MANGANESE plus Aluminum and Air.

**Methyl Bromide**
Methyl bromide in a steel tank reacted with an aluminum tube (part of a level gage) producing methyl aluminum bromide. When the latter was subsequently exposed to air, enough heat was produced to ignite the methyl bromide-compressed air mixture above the liquid level. The ensuing explosion shattered the tank.
*Chem. Eng. Progr.* **58** (8): 46–9 (1962).

**Methyl Chloride**
Methyl chloride in the presence of a small amount of aluminum chloride will attack powdered aluminum, forming spontaneously flammable (in air) aluminum trimethyl.
C. C. Clogston, *UL Technical Report* **34** (1945).
See also ALUMINUM plus Chlorinated Hydrocarbons.

**Monobromotrifluoromethane**
See ALUMINUM plus Dichlorodifluoromethane.

**Monochlorotrifluoromethane**
See ALUMINUM plus Dichlorodifluoromethane.

**Monofluorotrichloromethane**
See ALUMINUM plus Dichlorodifluoromethane.

**Niobium Oxide and Sulfur**
A mixture of aluminum, niobium oxide and sulfur caused a serious fire.
*Poole* (1971).

**Nitrate-Nitrite and Organic Matter**
Aluminum and aluminum alloys contaminated with organic matter are likely to explode in nitrate-nitrite salt baths.
*Pieters,* p. 30 (1957).

**Nitrates**
Two explosions occurred in mixtures containing aluminum dust, nitrates, water, sulfur, and vegetable glues.
*Chem. and Eng. News* **32:** 258 (1954).

**Nitric Oxide**
See ALUMINUM plus Carbon Disulfide.

**Nitrogen Peroxide**
See ALUMINUM plus Carbon Disulfide.

**Nitrosyl Chloride**
Aluminum is attacked by nitrosyl chloride when cold.
*Mellor* **5:** 212 (1946–1947).

**Nitrous Oxide**
See ALUMINUM plus Carbon Disulfide.

**Oxygen**
Flash bulbs containing aluminum foil plus oxygen, when ignited, cause similar bulbs up to 8 inches away to be ignited by radiated heat.
W. Zimmerman, *Naturwissenschaften* **18:** 857 (1930).
Liquid oxygen gives a detonable mixture when combined with powdered aluminum.
*Kirschenbaum* (1956).
A lecturer was demonstrating the ignition of powdered aluminum mixed with liquid oxygen when the mixture exploded. Seventeen persons were injured. This experiment, which is described in several places as a lecture demonstration, has been carried out successfully hundreds of times but there have been a few explosions when the conditions were just right.
*Chem. and Eng. News* **35**(25): 90 (June 17, 1957).

**Palladium**
If an aluminum sheath surrounding a palladium core of about .0025-inch diameter is heated to the melting point of aluminum, 600°C, an alloying reaction takes place with production of a brilliant flash and a temperature of 2,800°C.
*Tricon* (1965). *Woodcock* (1967). *U.S. Pat. Gaz.,* p. 224 (Nov. 3, 1959). *Ellern,* p. 279 (1968).

**Performic Acid**
Powdered aluminum decomposes performic acid violently.
*Berichte* ***48:***1139 (1915).

**Phosgene**
See ALUMINUM plus Phosphorus Trichloride.

**Phosphorus Trichloride**
Powdered aluminum burns in the vapor of phosphorus trichloride, antimony trichloride, arsenic trichloride, and phosgene.
*Mellor* **5:**214 (1946–1947).

**Potassium Bromate**
See ALUMINUM plus Bromates.

**Potassium Chlorate**
See ALUMINUM plus Bromates.

**Potassium Iodate**
See ALUMINUM plus Bromates.

**Potassium Sulfate**
See ALUMINUM plus Sulfates.

**Propylene Dichloride**
An aluminum transfer line failed completely after only a few hours' service in refined propylene dichloride under hot weather conditions. Following this failure, a time sequence study illustrated the nature and rapidity with which this reaction may occur.
*Chem. Abst.* **52:**7986h (1958). *Corrosion* ***14:*** 186t–190t (1958).

**Silicon and Lead Oxide**
See SILICON plus Aluminum and Lead Oxide.

**Silver Chloride**
A reaction between silver chloride and aluminum, once started, proceeds with explosive violence.
*Mellor* **3:**402 (1946–1947).

**Sodium Bromate**
See ALUMINUM plus Bromates.



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**Sodium Carbide**
See MERCURY plus Sodium Carbide.

**Sodium Carbonate**
When sodium carbonate was applied to red-hot aluminum, an explosion occurred.
Price and Baker, *Chem. & Met. Eng.* **29:**878 (1923).

**Sodium Chlorate**
See ALUMINUM plus Bromates.

**Sodium Hydroxide**
A 25 per cent sodium hydroxide solution was filtered into a tank trailer thought to be made of mild steel. By the time it was discovered that the tank was made of aluminum, copious volumes of hydrogen were already boiling off.
*MCA Case History* **1115** (1965).
Aluminum reacts vigorously in sodium hydroxide.
*Mellor* **5:**207 (1946–1947).

**Sodium Iodate**
See ALUMINUM plus Bromates.

**Sodium Peroxide**
A mixture of sodium peroxide and aluminum powder reacts with incandescence. The mixture explodes when heated to redness. When the mixture is exposed to moist air, spontaneous ignition occurs.
*Mellor* **2:**490; **5:**217 (1946–1947).

**Sodium Peroxide and Carbon Dioxide**
When carbon dioxide gas is passed over a mixture of powdered aluminum and sodium peroxide, the mixture explodes.
*Mellor* **2:**490 (1946–1947).

**Sodium Sulfate**
See ALUMINUM plus Sulfates.

**Sulfates**
Violent explosions occur when potassium sulfate and sodium sulfate are melted with aluminum.
*Chem. and Eng. News* **32:** 258 (1954).
The reduction of barium sulfate and of calcium sulfate by aluminum is attended by violent explosions.
*Mellor* **5:**217–19 (1946–1947).

**Sulfur Dichloride**
See ALUMINUM plus Carbon Disulfide.

**Sulfur Dioxide**
See ALUMINUM plus Carbon Disulfide.

**Tetrafluoromethane**
See ALUMINUM plus Dichlorodifluoromethane.

**Trichloroethylene**
In the presence of dilute hydrochloric acid (0.1–0.2%) aluminum and trichloroethylene formed aluminum chloride, which catalyzed polymerization of the trichloroethylene with a very high release of heat. Under this condition subsequent oxidation of aluminum fines caused an explosion.
J. van Hints, *Veiligheid* **28:**121–23 (1952).
*Fire and Accident Prev.* (Dec. 22, 1953).

**1,1,2-Trichloro-1,2,2-trifluoroethane**
See ALUMINUM plus Dichlorodifluoromethane.

**Zinc Bromate**
See ALUMINUM plus Bromates.

**Zinc Chlorate**
See ALUMINUM plus Bromates.

**Zinc Iodate**
See ALUMINUM plus Bromates.

**Zinc Peroxide**
Zinc peroxide explodes when heated to about 212°C; and when mixed with aluminum powder or zinc powder, it burns with a dazzling light.
*Mellor* **4:**530 (1946–1947).

## ALUMINUM AMINOBOROHYDRIDES

**Air**
Oily aluminum borohydrides are spontaneously flammable in air and are attacked by water.
A. B. Burg and C. L. Randolph, Jr., *J. Am. Chem. Soc.* **73:**953 (1951).

**Water**
See ALUMINUM AMINOBOROHYDRIDES plus Air.

## ALUMINUM BROMIDE $AlBr_3$

**Potassium**
See POTASSIUM plus Aluminum Bromide.

**Sodium**
See SODIUM plus Aluminum Bromide.

## ALUMINUM CARBIDE $Al_4C_3$

**Lead Peroxide**
Aluminum carbide reduces lead peroxide with incandescence.
*Mellor* **5:**872 (1946–1947).

**Potassium Permanganate**
Aluminum carbide reduces potassium permanganate with incandescence.
*Mellor* **5:**872 (1946–1947).

## ALUMINUM CHLORIDE $AlCl_3$

**(self-reactive)**
After long storage of aluminum chloride in closed containers, an explosion often occurs when the container is opened.
*Chem. Abst.* **41:**6723d (1947).

**Allyl Chloride**
See SULFURIC ACID plus Allyl Chloride.

**Ethylene**
Ethylene in the presence of aluminum chloride may undergo a violent reaction.
Waterman, *J. Inst. Pet.* **33:**254 (1947).

**Ethylene Oxide**
See ETHYLENE OXIDE plus Aluminum Oxide.
See ETHYLENE OXIDE plus Acids and Bases.

**Nitrobenzene and Phenol**
Aluminum chloride added to nitrobenzene containing about 5% phenol caused a violent explosion.
*Chem. and Eng. News* **31:**4915 (1953).

**Nitromethane and Organic Matter**
Mixtures of nitromethane and aluminum chloride may explode when organic matter is present.
*Chem. and Eng. News* **26:**2257 (1948).


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**Oxygen Difluoride**
See OXYGEN DIFLUORIDE plus Aluminum Chloride.

**Perchloryl Fluoride and Benzene**
See PERCHLORYL FLUORIDE plus Benzene and Aluminum Chloride.

**Potassium**
See POTASSIUM plus Aluminum Bromide.

**Sodium**
See SODIUM plus Aluminum Bromide.

**Water**
When water was added to sublimed anhydrous aluminum chloride, a very vigorous reaction with a release of much heat and toxic hydrogen chloride resulted.
*Scott* (1966).
This salt dissolves in water with hissing and much heat.
*Mellor* **5:**314 (1946–1947).

## ALUMINUM FLUORIDE $AlF_3$

**Potassium**
See POTASSIUM plus Aluminum Bromide.

**Sodium**
See SODIUM plus Aluminum Bromide.

## ALUMINUM HYDRIDE $AlH_3$

**Air**
Aluminum hydride will burn violently in air.
*Lab. Govt. Chemist* (1965).

**Dimethyl Ether**
Occasional explosions involving these materials have been traced to carbon dioxide impurity in the ether.
*J. Am. Chem. Soc.* **70:**877 (1948).

**Oxygen**
See OXYGEN plus Aluminum Hydride.

## ALUMINUM HYDROXIDE $Al(OH)_3$

**Bismuth**
See BISMUTH plus Aluminum Hydroxide.

## ALUMINUM HYPOPHOSPHITE $Al(PH_2O_2)_3$

**Air**
Aluminum hypophosphite releases spontaneously flammable phosphine at about 220°C.
*Mellor* **8, Supp. 3:**623 (1971).

## ALUMINUM OXIDE $Al_2O_3$

**Chlorine Trifluoride**
See CHLORINE TRIFLUORIDE plus Aluminum Oxide.

**Ethylene Oxide**
See ETHYLENE OXIDE plus Aluminum Oxide.
See ETHYLENE OXIDE plus Acids and Bases.

## ALUMINUM PHOSPHIDE AlP

**Water**
Aluminum phosphide yields phosphine on reaction with water. Phosphine is spontaneously flammable in air.
*Merck Index,* pp. 46, 823 (1968).

## ALUMINUM TETRAAZIDOBORATE $Al[B(N_3)_4]_3$

**(self-reactive)**
This compound is very explosive on shock.
*Mellor* **8, Supp. 2:** 2 (1967).

## ALUMINUM TETRAHYDROBORATE $Al(BH_4)_3$

**Air**
Oily liquid aluminum borohydrides are spontaneously flammable in air; the reaction is violent with air containing moisture.
*Gaylord,* p. 8 (1956). *Pease,* p. 1 (1950). H. I. Schlesinger et al., *J. Am. Chem. Soc.* **75:**210–211 (1953).

**Oxygen**
See OXYGEN plus Aluminum Borohydride.

**Water**
Aluminum borohydride will flame when in contact with water.
*Ellern,* p. 45 (1968).

## AMINE PERCHOLORATES

**(self-reactive)**
There are a large number of amine perchlorates that ignite or explode at temperatures above 215°C.
*J. Chem. Soc.* **115:** 1006–10 (1909).
*Analyst* **80:** 4–15 (1955). *ACS* **146:** 211.

## AMINES $RNH_2$

**Acrolein**
See ACROLEIN plus Sulfur Dioxide.
See SODIUM HYDROXIDE plus Acrolein.

**Calcium Hypochlorite**
See CALCIUM HYPOCHLORITE plus Amines.

**Maleic Anhydride**
See SODIUM HYDROXIDE plus Maleic Anhydride.

**Nitrosyl Perchlorate**
See NITROSYL PERCHLORATE plus Amines.

**Sodium Hypochlorite**
See CALCIUM HYPOCHLORITE plus Amines.

**Tri-iso-Butyl Aluminum**
See TRI-iso-BUTYL ALUMINUM plus Acids.

## 2-AMINOETHANOL $NH_2CH_2CH_2OH$

**Acetic Acid**
See ACETIC ACID plus 2-Aminoethanol.

**Acetic Anhydride**
See ACETIC ANHYDRIDE plus 2-Aminoethanol.

**Acrolein**
See ACROLEIN plus 2-Aminoethanol.

**Acrylic Acid**
See ACRYLIC ACID plus 2-Aminoethanol.

**Acrylonitrile**
See ACRYLONITRILE plus 2-Aminoethanol.

**Chlorosulfonic Acid**
Mixing 2-aminoethanol and chlorosulfonic acid in a closed container caused the temperature and pressure to increase.
*Flynn and Rossow* (1970). See Note under complete reference.



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**Epichlorohydrin**
Mixing 2-aminoethanol and epichlorohydrin in a closed container caused the temperature and pressure to increase.
*Flynn and Rossow* (1970). See Note under complete reference.

**Hydrochloric Acid**
Mixing 2-aminoethanol and 36% hydrochloric acid in a closed container caused the temperature and pressure to increase.
*Flynn and Rossow* (1970). See Note under complete reference.

**Hydrofluoric Acid**
Mixing 2-aminoethanol and 48.7% hydrofluoric acid in a closed container caused the temperature and pressure to increase.
*Flynn and Rossow* (1970). See Note under complete reference.

**Mesityl Oxide**
See MESITYL OXIDE plus 2-Aminoethanol.

**Nitric Acid**
Mixing 2-aminoethanol and 70% nitric acid in a closed container caused the temperature and pressure to increase.
*Flynn and Rossow* (1970). See Note under complete reference.

**Oleum**
Mixing 2-aminoethanol and oleum in a closed container caused the temperature and pressure to increase.
*Flynn and Rossow* (1970). See Note under complete reference.

**Propiolactone (BETA-)**
Mixing 2-aminoethanol and propiolactone (BETA-) in a closed container caused the temperature and pressure to increase.
*Flynn and Rossow* (1970). See Note under complete reference.

**Sulfuric Acid**
Mixing 2-aminoethanol and 96% sulfuric acid in a closed container caused the temperature and pressure to increase.
*Flynn and Rossow* (1970). See Note under complete reference.

**Vinyl Acetate**
Mixing 2-aminoethanol and vinyl acetate in a closed container caused the temperature and pressure to increase.
*Flynn and Rossow* (1970). See Note under complete reference.

## AMINOGUANIDINE NITRATE $CH_6N_4 \cdot HNO_3$

**(self-reactive)**
Aminoguanidine nitrate in water solution exploded violently while being evaporated to dryness in vacuo on the steam bath.
H. Koopman, *Chem. Weekblad* **53:** 97, 98 (1957).

## 2-AMINOTHIAZOLE (SCHCHNC)$NH_2$

**(self-reactive)**
2-Aminothiazole ignited in a tray dryer and was entirely consumed. Stability tests show that 2-aminothiazole will ignite spontaneously in 3½ hours at 100°C.
*MCA Case History* **1587** (1969).

## AMMONIA (ANHYDROUS) $NH_3$

**Acetaldehyde**
See ACETALDEHYDE plus Ammonia (Anhydrous).

**Acrolein**
See SODIUM HYDROXIDE plus Acrolein.

**Boron**
See BORON plus Ammonia.

**Boron Triiodide**
See BORON TRIIODIDE plus Ammonia.

**Bromine**
See BROMINE plus Ammonia.

**Bromine Pentafluoride**
See BROMINE PENTAFLUORIDE plus Acetic Acid.

**Chloric Acid**
See ANTIMONY plus Chloric Acid.

**Chlorine**
See CHLORINE plus Ammonia.

**Chlorine Monoxide**
See CHLORINE MONOXIDE plus Ammonia.

**Chlorine Trifluoride**
See CHLORINE TRIFLUORIDE plus Ammonia.

**Chlorites**
See CHLORITES plus Ammonia.

**Chlorosilane**
See CHLOROSILANE plus Ammonia.

**Chromic Anhydride**
See CHROMIC ANHYDRIDE plus Ammonia.

**Chromium Trioxide**
See CHROMIC ANHYDRIDE plus Ammonia.

**Chromyl Chloride**
See CHROMYL CHLORIDE plus Ammonia.

**Ethylene Dichloride**
Liquid ammonia and ethylene dichloride can cause an explosion when mixed.
*Mukerjee* (1970).

**Ethylene Oxide**
During manufacture of ethanolamine, an excess of ammonia during a period of high pressure resulted in an ammonia-ethylene oxide explosion.
*MCA Case History* **792** (1962).

**Fluorine**
See FLUORINE plus Ammonia.

**Gold**
See GOLD plus Ammonia.

**Hexachloromelamine**
See HEXACHLOROMELAMINE plus Organic Contaminants.

**Hydrazine and Alkali Metals**
See HYDRAZINE plus Alkali Metals and Ammonia.

**Hydrogen Bromide**
See HYDROGEN BROMIDE plus Ammonia.

**Hypochlorous Acid**
See HYPOCHLOROUS ACID plus Ammonia.


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**Iodine**
See IODINE plus Ammonia.

**Magnesium Perchlorate**
See MAGNESIUM PERCHLORATE plus Ammonia.

**Mercury**
See MERCURY plus Ammonia. See also GOLD plus Ammonia.

**Nitric Acid**
See NITRIC ACID plus Ammonia.

**Nitrogen Peroxide**
See NITRIC OXIDE plus Ammonia.

**Nitrogen Tetroxide**
See NITROGEN TETROXIDE plus Ammonia.

**Nitrogen Trichloride**
See NITROGEN TRICHLORIDE plus Ammonia.

**Nitrogen Trifluoride**
See HYDROGEN plus Nitrogen Trifluoride.

**Nitryl Chloride**
See NITRYL CHLORIDE plus Ammonia.

**Oxygen Difluoride**
See OXYGEN DIFLUORIDE plus Ammonia.

**Phosphorus Pentoxide**
See PHOSPHORUS PENTOXIDE plus Ammonia.

**Phosphorus Trioxide**
See PHOSPHORUS TRIOXIDE plus Ammonia.

**Picric Acid**
See PICRIC ACID plus Ammonia.

**Potassium and Arsine**
See POTASSIUM plus Arsine and Ammonia.

**Potassium and Phosphine**
See POTASSIUM plus Phosphine and Ammonia.

**Potassium and Sodium Nitrite**
See POTASSIUM plus Sodium Nitrite and Ammonia.

**Potassium Chlorate**
See POTASSIUM CHLORATE plus Ammonia.

**Potassium Ferricyanide**
See POTASSIUM FERRICYANIDE plus Ammonia.

**Potassium Mercuricyanide**
See POTASSIUM MERCURICYANIDE plus Ammonia.

**Silver**
See GOLD plus Ammonia.

**Silver Chloride**
See SILVER CHLORIDE plus Ammonia.

**Sodium and Carbon Monoxide**
See SODIUM plus Carbon Monoxide and Ammonia.

**Stibine**
See STIBINE plus Ammonia.

**Sulfur**
See SULFUR plus Ammonia.

**Sulfur Dichloride**
See SULFUR DICHLORIDE plus Ammonia.

**Tellurium Hydropentachloride**
See TELLURIUM HYDROPENTACHLORIDE plus Ammonia.

**Trichloromelamine**
See HEXACHLOROMELAMINE plus Organic Contaminants.

## AMMONIUM ACETATE $CH_3COONH_4$

**Sodium Hypochlorite**
See SODIUM HYPOCHLORITE plus Ammonium Acetate.

## AMMONIUM AZIDE $NH_4N_5$

**(self-reactive)**
Ammonium azide decomposes at 160°C.
*Mellor* **8, Supp. 2:** 43 (1967).

## AMMONIUM BROMIDE $NH_4Br$

**Bromine Trifluoride**
See BROMINE TRIFLUORIDE plus Ammonium Bromide.

**Iodine Heptafluoride**
See IODINE HEPTAFLUORIDE plus Ammonium Bromide.

**Potassium**
See POTASSIUM plus Ammonium Bromide.

## AMMONIUM CARBONATE $(NH_4)_2CO_2$

**Sodium Hypochlorite**
See SODIUM HYPOCHLORITE plus Ammonium Acetate.

## AMMONIUM CHLORATE $NH_4ClO_3$

**(self-reactive)**
The solid is an explosive compound. Solutions may decompose violently if much solid phase is present.
*Mellor* **2, Supp. 1:** 591 (1956).

## AMMONIUM CHLORIDE $NH_4Cl$

**Ammonium Nitrate**
See AMMONIUM NITRATE plus Ammonium Chloride.

**Bromine Trifluoride**
See BROMINE TRIFLUORIDE plus Ammonium Bromide.

**Iodine Heptafluoride**
See IODINE HEPTAFLUORIDE plus Ammonium Bromide.

**Potassium Chlorate**
See POTASSIUM CHLORATE plus Ammonium Chloride.

## AMMONIUM DICHROMATE $(NH_4)_2Cr_2O_7$

**(self-reactive)**
Ammonium dichromate decomposes vigorously with luminescence around 200°C. It is feebly explosive if confined.
*Mellor* **11:** 324 (1946–1947).



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**AMMONIUM HEXANITROCOBALTATE**
$(NH_4)_3CO(NO_2)_6$

**(self-reactive)**
Ammonium hexanitrocobaltate explodes at 230°C and is impact sensitive.
W. R. Tomlinson, Jr., and L. F. Audrieth, *J. Chem. Ed.* **27:** 606–9 (1950).

**AMMONIUM HYDROXIDE** $NH_4OH$

**Acrolein**
See ACROLEIN plus Ammonium Hydroxide.

**Acrylic Acid**
See ACRYLIC ACID plus Ammonium Hydroxide.

**Chlorosulfonic Acid**
See CHLOROSULFONIC ACID plus Ammonium Hydroxide.

**Dimethyl Sulfate**
Pure dimethyl sulfate and concentrated aqueous ammonia react extremely violently with one another.
*Berichte* **13:** 1700 (1880).

**Fluorine**
See FLUORINE plus Ammonium Hydroxide.

**Gold and Aqua Regia**
See GOLD plus Ammonium Hydroxide and Aqua Regia.

**Hydrochloric Acid**
See HYDROCHLORIC ACID plus Ammonium Hydroxide.

**Hydrofluoric Acid**
See HYDROFLUORIC ACID plus Ammonium Hydroxide.

**Hydrogen Peroxide**
See HYDROGEN PEROXIDE plus Ammonium Hydroxide.

**Iodine**
See IODINE plus Ammonium Hydroxide.

**Nitric Acid**
See NITRIC ACID plus Ammonium Hydroxide.

**Oleum**
See OLEUM plus Ammonium Hydroxide.

**Propiolactone (BETA)**
See PROPIOLACTONE (BETA) plus Ammonium Hydroxide.

**Propylene Oxide**
See PROPYLENE OXIDE plus Ammonium Hydroxide.

**Silver Nitrate**
See SILVER NITRATE plus Acetylene and Ammonium Hydroxide. See SILVER NITRATE plus Ammonium Hydroxide.

**Silver Oxide**
See SILVER OXIDE plus Ammonium Hydroxide.

**Silver Oxide and Ethyl Alcohol**
See SILVER OXIDE plus Aqueous Ammonia and Ethyl Alcohol.

**Silver Permanganate**
See SILVER PERMANGANATE plus Ammonium Hydroxide.

**Sulfuric Acid**
See SULFURIC ACID plus Ammonium Hydroxide.

**AMMONIUM HYPOPHOSPHITE** $NH_2PH_2O_2$

**(self-reactive)**
Ammonium hypophosphite liberates spontaneously flammable phosphine at about 240°C.
*Mellor* **8:** 880 (1946–1947).

**AMMONIUM IODIDE** $NH_4I$

**Bromine Trifluoride**
See BROMINE TRIFLUORIDE plus Ammonium Bromide.

**Iodine Heptafluoride**
See IODINE HEPTAFLUORIDE plus Ammonium Bromide.

**Potassium**
See POTASSIUM plus Ammonium Bromide.

**AMMONIUM NITRATE** $NH_4NO_3$

**Acetic Acid**
A mixture of ammonium nitrate and acetic acid ignites when warmed, especially if concentrated.
*Von Schwartz,* p. 322 (1918).

**Aluminum**
See ALUMINUM plus Ammonium Nitrate.

**Ammonium Chloride**
The decomposition of ammonium nitrate in the presence of ammonium chloride (0.1%) becomes violent around 175°C. The gases liberated contain chlorine.
*Pascal* **10:** 216 (1931–1934).

**Antimony**
See AMMONIUM NITRATE plus Metals (powdered).

**Bismuth**
See AMMONIUM NITRATE plus Metals (powdered).

**Cadmium**
See AMMONIUM NITRATE plus Metals (powdered).

**Carbon**
See CARBON plus Ammonium Nitrate.

**Chlorides**
See AMMONIUM NITRATE plus Ammonium Chloride.

**Chromium**
See AMMONIUM NITRATE plus Metals (powdered).

**Cobalt**
See AMMONIUM NITRATE plus Metals (powdered).

**Contaminant**
During the flame-cutting of a pipeline plugged with impure ammonium nitrate, the pipe contents exploded violently.
*MCA Case History* **873** (1963).

**Copper**
See AMMONIUM NITRATE plus Metals (powdered).
See COPPER plus Ammonium Nitrate.

**Lead**
See AMMONIUM NITRATE plus Metals (powdered).

**Magnesium**
See AMMONIUM NITRATE plus Metals (powdered).

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**Magnesium, Copper Sulfate (anhydrous), Potassium Chlorate and Water**
See MAGNESIUM plus Copper Sulfate (anhydrous), Ammonium Nitrate, Potassium Chlorate and Water.

**Metals (powdered)**
Fused ammonium nitrate with powdered metals is often a violent and sometimes an explosive reaction. Zinc, cadmium, copper, magnesium, lead, cobalt, nickel, bismuth, chromium, and antimony are the metals that reacted in this way.
*Mellor* **Supp. I, Part I, 8:** 545 (1964).
See also SULFUR plus Ammonium Nitrate.
See also ALUMINUM plus Ammonium Nitrate.

**Nickel**
See AMMONIUM NITRATE plus Metals (powdered).

**Organic Matter**
Ammonium nitrate forms explosive mixtures with organic matter.
*Hazardous Chemicals Data* (1966); *Lab. Govt. Chemist.*

**Phosphorus**
See PHOSPHORUS plus Ammonium Nitrate.

**Potassium and Ammonium Sulfate**
See POTASSIUM plus Ammonium Sulfate and Ammonium Nitrate.

**Sodium**
See SODIUM plus Ammonium Nitrate.

**Sodium Hypochlorite**
See SODIUM HYPOCHLORITE plus Ammonium Acetate.

**Sodium Perchlorate**
See SODIUM PERCHLORATE plus Ammonium Alloy Nitrate.

**Sodium-Potassium and Ammonium Sulfate**
See POTASSIUM plus Ammonium Sulfate and Ammonium Nitrate.

**Sulfur**
See SULFUR plus Ammonium Nitrate.

**Zinc**
See ZINC plus Ammonium Nitrate.
See also AMMONIUM NITRATE plus Metals (powdered).

## AMMONIUM NITRIDOOSMATE $NH_4OsNO_3$

**(self-reactive)**
Ammonium osmiamate decomposes explosively at 150°C.
*Mellor* **15:** 727 (1946–1947).

## AMMONIUM OXALATE $(NH_4OOC\text{-})_2$

**Sodium Hypochlorite**
See SODIUM HYPOCHLORITE plus Ammonium Acetate.

## AMMONIUM PERCHLORATE $NH_4ClO_4$

**(self-reactive)**
Ammonium perchlorate decomposes at 130°C and explodes at 380°C.
*Mellor* **2, Supp. 1:** 608 (1956).

**Carbon**
See CARBON plus Ammonium Perchlorate.

**Dicyclopentadienyliron**
Explosions have occurred in propellant formulations using dicyclopentadienyliron (ferrocene), as a burning rate catalyst. Although the definite cause has not been established, the most probable cause is the heat of friction between the mixer sidewall and the spatula while the latter was scraping through a mixture of ammonium perchlorate and sublimed recrystallized ferrocenes.
*ASESB Expl. Report* **211** (1966).

**Ferrocene**
See AMMONIUM PERCHLORATE plus Dicyclopentadienyliron.

**Metals**
See SULFUR plus Ammonium Perchlorate.

**Organic Matter**
See SULFUR plus Ammonium Perchlorate.

**Sulfur**
See SULFUR plus Ammonium Perchlorate.

## AMMONIUM PERMANGANATE $NH_4MnO_4$

**(self-reactive)**
Dry ammonium permanganate is explosive at 60°C and is likely to explode when rubbed.
*Lab. Govt. Chemist* (1965).

## AMMONIUM PERSULFATE $(NH_4)_2S_2O_8$

**Aluminum**
See ALUMINUM plus Ammonium Persulfate.

**Sodium Peroxide**
A mixture of ammonium persulfate and sodium peroxide will explode if subjected to crushing (in a mortar), heating, or if a stream of carbon dioxide is passed over it.
*Mellor* **10:** 464 (1946–1947).

## AMMONIUM PHOSPHATE $NH_4H_2PO_4$

**Sodium Hypochlorite**
See SODIUM HYPOCHLORITE plus Ammonium Acetate.

## AMMONIUM PICRATE $C_6H_2(NO_3)_3ONH_4$

**(self-reactive)**
Small traces of metallic picrates may lower appreciably the temperature at which such mixtures will explode.
*Military Explosives*, p. 96.

**Metals**
Explodes when heated to a temperature of about 300°C.
*Military Explosives*, p. 96.

## AMMONIUM SALTS

**(See also specific ammonium salt)**

**Potassium Chlorate**
See POTASSIUM CHLORATE plus Ammonium Salts.

**Sodium Nitrite**
See SODIUM NITRITE plus Ammonium Salts.

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**AMMONIUM SULFATE** $(NH_4)_2SO_4$

**Potassium and Ammonium Nitrate**
See POTASSIUM plus Ammonium Sulfate and Ammonium Nitrate.

**Potassium Chlorate**
See POTASSIUM CHLORATE plus Ammonium Sulfate.

**Potassium Nitrite**
See POTASSIUM NITRITE plus Ammonium Sulfate.

**Sodium-Potassium Alloy and Ammonium Nitrate**
See POTASSIUM plus Ammonium Sulfate and Ammonium Nitrate.

**AMMONIUM TETRACHLOROCUPRATE** $(NH_4)_2CuCl_4$

**Potassium**
See POTASSIUM plus Aluminum Bromide.

**Sodium**
See SODIUM plus Aluminum Bromide.

**AMMONIUM TETRACHROMATE** $(NH_4)_2Cr_4O_{13}$

**(self-reactive)**
Ammonium tetrachromate decomposes suddenly at 175°C.
*Mellor* **11:** 352 (1946–1947).

**AMMONIUM TETRAPEROXYCHROMATE**
$(NH_4)_3Cr\ (OO)_4$

**(self-reactive)**
Ammonium triperchromate explodes from percussion or if heated just to 50°C.
*Mellor* **11:** 356 (1946–1947).

**Sulfuric Acid**
Contact between these compounds results in an explosion.
*Mellor* **11:** 356 (1946–1947).

**AMMONIUM THIOCYANATE** $NH_4SCN$

**Lead Nitrate**
An explosion of guanidine nitrate demolished an autoclave built to withstand 50 atmospheres, in which it was being made from ammonium thiocyanate and lead nitrate. C. Schopf and H. Klapproth.
*Angew. Chem.* **49:** 23 (1936).

**AMMONIUM THIOSULFATE** $NH_4S_2O_3$

**Acetic Acid**
40–60% ammonium thiosulfate reacts under ambient conditions with 80% acetic acid to release sulfur dioxide. There is a mass yield of 25% $SO_2$ relative to the ammonium thiosulfate.
Acknowledge reported hazards as per correspondence from Gary H. Mosher.

**Sodium Chlorate**
See SODIUM CHLORATE plus Ammonium Thiosulfate.

**AMMONIUM TRICHROMATE** $(NH_4)_2Cr_3O_{10}$

**(self-reactive)**
Ammonium trichromate detonates at about 190°C.
*Mellor* **11:** 350 (1946–1947).

**AMYL ALCOHOL** $C_5H_{11}OH$

**Hydrogen Trisulfide**
See HYDROGEN TRISULFIDE plus Amyl Alcohol.

**ANILINE** $C_6H_5NH_2$

**Acetic Anhydride**
Mixing aniline and acetic anhydride in a closed container caused the temperature and pressure to increase.
*Flynn and Rossow* (1970). See Note under complete reference.

**Chlorosulfonic Acid**
Mixing aniline and chlorosulfonic acid in a closed container caused the temperature and pressure to increase.
*Flynn and Rossow* (1970). See Note under complete reference.

**Hexachloromelamine**
See HEXACHLOROMELAMINE plus Organic Contaminants.

**Nitric Acid**
See NITRIC ACID plus Aniline.

**Nitric Acid, Nitrogen Tetroxide, and Sulfuric Acid**
See UNSYMMETRICAL DIMETHYLHYDRAZINE plus Nitric Acid, Nitrogen Tetroxide, and Sulfuric Acid.

**Nitrobenzene and Glycerine**
In the reaction of these three ingredients to form quinoline, with ferrous sulfate as catalyst, there was too much sulfuric acid and too little water present. The resultant excessive temperature initiated a runaway reaction. The rupture disc and the manhole cover of the vessel blew out; the contents erupted from the vessel.
*MCA Case History* **1008** (1964).

**Oleum**
Mixing aniline and oleum in a closed container caused the temperature and pressure to increase.
*Flynn and Rossow* (1970). See Note under complete reference.

**Ozone**
See OZONE plus Aniline.

**Perchloric Acid and Formaldehyde**
See PERCHLORIC ACID plus Aniline and Formaldehyde.

**Perchromates**
See PERCHROMATES plus Aniline.

**Performic Acid**
See PERFORMIC ACID plus Aniline.

**Potassium Peroxide**
See SODIUM PEROXIDE plus Aniline.

**Propiolactone (BETA-)**
Mixing aniline and propiolactone (BETA-) in a closed container caused the temperature and pressure to increase.
*Flynn and Rossow* (1970). See Note under complete reference.

**Silver Perchlorate**
See SILVER PERCHLORATE plus Toluene.
See SILVER PERCHLORATE plus Acetic Acid.

**Sodium Peroxide**
See SODIUM PEROXIDE plus Aniline.

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**Sulfuric Acid**
Mixing aniline and 96% sulfuric acid in a closed container caused the temperature and pressure to increase.
*Flynn and Rossow* (1970). See Note under complete reference.

**Trichloromelamine**
See HEXACHLOROMELAMINE plus Organic Contaminants.

## ANISOYL CHLORIDE $CH_3OC_6H_4COCl$

**(self-reactive)**
A 5-pound bottle containing anisoyl chloride on the laboratory shelf exploded during the night. During cleanup, workers sustained painful eye burns. After several weeks storage in a dessicator at room temperature, a 200-gram bottle of commercial anisoyl chloride exploded with copious emission of hydrogen chloride.
*Chem. and Eng. News* **38** (34): 40 (1960); **38** (43): 5 (1960).

## ANTHRACENE $C_6H_4(CH)_2C_6H_4$

**Calcium Hypochlorite**
See CALCIUM HYPOCHLORITE plus Anthracene.

**Chromic Acid**
See CHROMIC ANHYDRIDE plus Anthracene.

## ANTIMONY Sb

**Ammonium Nitrate**
See AMMONIUM NITRATE plus Metals (powdered).

**Bromine**
Antimony is spontaneously flammable in fluorine, chlorine, or bromine. With iodine, the reaction produces heat, which can cause flame or even an explosion if the quantities are great enough.
*Mellor* **9:** 379 (1946–1947).

**Bromine Trifluoride**
Even at 10°C., bromine trifluoride reacts with antimony incandescently. Bromine trifluoride reacts similarly with arsenic, boron, bromine, iodine, phosphorus, and sulfur.
*Mellor* **2:** 113 (1946–1947).

**Bromoazide**
Bromoazide explodes on contact with antimony, arsenic, phosphorus, silver foil or sodium. It is very sensitive to shock and the resulting explosions appear to be spontaneous.
*Mellor* **8:** 336 (1946–1947).

**Chloric Acid**
Explosions of chloric acid have been due to the formation of explosive compounds with antimony, bismuth, ammonia, and organic matter.
*Chem. Abst.* **46:** 2805c (1952).

**Chlorine**
Antimony burns spontaneously in gaseous chlorine. With liquid chlorine, antimony ignites at 33°C.
*Mellor* **2:** 92–95; **9:** 379, 626 (1946–1947).

**Chlorine Monoxide**
See POTASSIUM plus Chlorine Monoxide.

**Chlorine Trifluoride**
Chlorine trifluoride reacts vigorously with antimony, arsenic, osmium, phosphorus, potassium, rhodium, selenium, silicon, sulfur, tellurium, or tungsten, producing flame.
*Mellor* **2, Supp. 1:** 156 (1956).

**Fluorine**
See ANTIMONY plus Bromine.

**Iodine**
See ANTIMONY plus Bromine.

**Nitric Acid**
The reaction of finely divided antimony and nitric acid can be violent.
*Pascal* **10:** 504 (1931–1934).

**Potassium Nitrate**
Powdered antimony mixed with an alkali nitrate explodes when heated.
*Mellor* **9:** 282 (1946–1947).

**Potassium Permanganate**
When antimony or arsenic and solid potassium permanganate are ground together, the metals ignite.
*Mellor* **12:** 322 (1946–1947).

**Potassium Peroxide**
See POTASSIUM plus Potassium Peroxide.

**Sodium Nitrate**
See ANTIMONY plus Potassium Nitrate.

**Sodium Peroxide**
Sodium peroxide oxidizes antimony, arsenic, copper, potassium, tin and zinc with incandescence.
*Mellor* **2:** 490–93 (1946–1947).

## ANTIMONY COMPOUNDS (Trivalent)

**Perchloric Acid**
Trivalent antimony compounds tend to form explosive mixtures with perchloric acid when hot.
*Analyst* **84:** 215 (April 1959). *Chem. and Eng. News* **41** (31): 47 (1963).

## ANTIMONYL CHLORIDE SbOCl

**Bromine Trifluoride**
See BROMINE TRIFLUORIDE plus Antimony Trioxide.

## ANTIMONYL PERCHLORATE $SbOClO_4$

**(self-reactive)**
This chemical decrepitates when heated above 60°C.
*Mellor* **2, Supp. 1:** 613 (1956).

## ANTIMONY PENTACHLORIDE $SbCl_5$

**Oxygen Difluoride**
Mixtures with chlorine, bromine, or iodine explode on warming. Antimony pentachloride with oxygen difluoride explodes mildly at 150C.
A. G. Streng, *Chem. Reviews* (1963).

**Phosphonium Iodide**
Interaction at ambient temperature proceeds explosively.
*Mellor* (1947).

## ANTIMONY PENTAFLUORIDE $SbF_5$

**Phosphorus**
See PHOSPHORUS plus Antimony Pentafluoride.



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**ANTIMONY SULFIDE** $Sb_2S_3$; $Sb_2S_5$

**(See also ANTIMONY TRISULFIDE)**

**Air**
When the crystalline form of antimony trisulfide is heated in air, it burns with a blue flame.
*Mellor* **9:** 522 (1946–1947).

**Cadmium Chlorate**
See CHLORATES plus Antimony Sulfide.

**Chlorates**
See CHLORATES plus Antimony Sulfide.

**Chloric Acid**
Antimony sulfide and concentrated solutions of chloric acid react with incandescence.
*Mellor* **Supp. II, Part I:** 584 (1956).

**Chlorine Monoxide**
See CHLORINE MONOXIDE plus Calcium Phosphide.

**Magnesium Chlorate**
See CHLORATES plus Antimony Sulfide.

**Thallic Oxide**
See THALLIC OXIDE plus Antimony Sulfide.

**Zinc Chlorate**
See CHLORATES plus Antimony Sulfide.

**ANTIMONY TRIBROMIDE** $SbBr_3$

**Potassium**
See POTASSIUM plus Aluminum Bromide.

**Sodium**
See SODIUM plus Aluminum Bromide.

**ANTIMONY TRICHLORIDE** $SbCl_3$

**Aluminum**
See ALUMINUM plus Phosphorus Trichloride.

**Potassium**
See POTASSIUM plus Aluminum Bromide.

**Sodium**
See SODIUM plus Aluminum Bromide.

**ANTIMONY TRIIODIDE** $SbI_3$

**Potassium**
See POTASSIUM plus Aluminum Bromide.

**Sodium**
See SODIUM plus Aluminum Bromide.

**ANTIMONY TRIOXIDE** $Sb_2O_3$

**Air**
When powdered antimony trioxide is heated in air, it ignites and burns.
*Mellor* **9:** 425 (1946–1947).

**Bromine Trifluoride**
See BROMINE TRIFLUORIDE plus Antimony Trioxide.

**ANTIMONY TRISULFIDE** $Sb_2S_3$

**Chlorine Monoxide**
See CHLORINE MONOXIDE plus Calcium Phosphide.

**Fluorine**
See FLUORINE plus Antimony Trisulfide.

**Hydrogen Peroxide**
Hydrogen peroxide reacts vigorously with antimony trisulfide, arsenic trisulfide, cupric sulfide, lead sulfide, molybdenum disulfide, and ferrous sulfide.
*Mellor* **1:** 937 (1946–1947).

**Potassium Chlorate**
See POTASSIUM CHLORATE plus Antimony Trisulfide.

**Potassium Nitrate**
See POTASSIUM NITRATE plus Antimony Trisulfide.

**Silver Oxide**
See SILVER OXIDE plus Antimony Trisulfide.

**ARSENIC** As

**Barium Bromate**
See ARSENIC plus Bromates.

**Barium Chlorate**
See ARSENIC plus Bromates.

**Barium Iodate**
See ARSENIC plus Bromates.

**Bromates**
A combination of finely divided arsenic with finely divided bromates (also chlorates and iodates) of barium, calcium, magnesium, potassium, sodium, or zinc can be exploded by heat, percussion, and sometimes, by light friction.
*Mellor* **2:** 310 (1946–1947).

**Bromine Pentafluoride**
Bromine pentafluoride reacts readily in the cold with arsenic, charcoal, selenium, sulfur, iodine, and alkaline chlorides, bromides, and iodides; ignition usually occurs. A few drops of the liquid falling in water produces an explosion.
*Sidgwick,* p. 1158 (1950).

**Bromine Trifluoride**
See ANTIMONY plus Bromine Trifluoride.

**Bromoazide**
See ANTIMONY plus Bromoazide.

**Calcium Bromate**
See ARSENIC plus Bromates.

**Calcium Chlorate**
See ARSENIC plus Bromates.

**Calcium Iodate**
See ARSENIC plus Bromates.

**Cesium Acetylene Carbide**
The carbide becomes incandescent when warmed in contact with arsenic.
*Mellor* **5:** 848–50 (1946–1947).

**Chlorates**
See ARSENIC plus Bromates.

**Chlorine**
Arsenic burns spontaneously in gaseous chlorine. With liquid chlorine, arsenic ignites at 33°C.
*Mellor* **2:** 92, 95; **9:** 626 (1946–1947).

**Chlorine Monoxide**
See POTASSIUM plus Chlorine Monoxide.

**Chlorine Trifluoride**
See ANTIMONY plus Chlorine Trifluoride.


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**Chromium Trioxide**
Arsenic reacts with chromium trioxide with incandescence.
*Mellor* **11:** 232 (1946–1947).

**Fluorine**
See FLUORINE plus Arsenic.

**Hypochlorous Acid**
Arsenic ignites with hypochlorous acid.
*Mellor* **2:** 254 (1946–1947).

**Iodates**
See ARSENIC plus Bromates.

**Iodine Pentafluoride**
Iodine pentafluoride reacts spontaneously with sulfur, red phosphorus, silicon, bismuth, tungsten, and arsenic, usually with incandescence. Organic compounds react violently, usually carbonizing and often igniting.
*Durrant,* p. 515 (1953). *Sidgwick,* p. 1159 (1950).

**Lithium**
See LITHIUM plus Arsenic.

**Magnesium Bromate**
See ARSENIC plus Bromates.

**Magnesium Chlorate**
See ARSENIC plus Bromates.

**Magnesium Iodate**
See ARSENIC plus Bromates.

**Nitrogen Tribromide**
Nitrogen tribromide explodes violently in contact with arsenic or phosphorus.
*Ann. Chim. et Phys.* (2) **42:** 200.

**Nitrogen Trichloride**
Nitrogen trichloride explodes in contact with powdered arsenic. Also see NITROGEN TRICHLORIDE plus Ammonia.
*Mellor* **8:** 602 (1946–1947).

**Potassium Bromate**
See ARSENIC plus Bromates.

**Potassium Chlorate**
See ARSENIC plus Bromates.

**Potassium Iodate**
See ARSENIC plus Bromates.

**Potassium Nitrate**
A mixture of arsenic and potassium nitrate explodes when ignited.
*Mellor* **9:** 35 (1946–1947).

**Potassium Permanganate**
See ANTIMONY plus Potassium Permanganate.

**Potassium Peroxide**
See POTASSIUM plus Potassium Peroxide.

**Rubidium Acetylene Carbide**
Rubidium acetylene carbide becomes incandescent when warmed in contact with arsenic.
*Mellor* **5:** 849 (1946–1947).

**Rubidium Carbide**
A mixture of rubidium carbide and arsenic ignites when heated.
*Mellor* **5:** 848 (1946–1947).

**Silver Nitrate**
A mixture of sublimed arsenic ground with 10 times its weight of silver nitrate ignites immediately when shaken out on paper.
*Mellor* **3:** 470 (1946–1947).

**Sodium Bromate**
See ARSENIC plus Bromates.

**Sodium Chlorate**
See ARSENIC plus Bromates.

**Sodium Iodate**
See ARSENIC plus Bromates.

**Sodium Peroxide**
Sodium peroxide oxidizes arsenic with incandescence.
*Mellor* **2:** 490–93 (1946–1947).

**Zinc Bromate**
See ARSENIC plus Bromates.

**Zinc Chlorate**
See ARSENIC plus Bromates.

**Zinc Iodate**
See ARSENIC plus Bromates.

## ARSENIC DISULFIDE $As_2S_2$

**Air**
Arsenic disulfide burns with a blue flame when heated in air.
*Mellor* **9:** 270 (1946–1947).

**Chlorine**
See CHLORINE plus Arsenic Disulfide.

**Potassium Nitrate**
See POTASSIUM NITRATE plus Arsenic Disulfide.

## ARSENIC OXIDE $As_2O_3$; $As_2O_5$

**Rubidium Carbide**
See RUBIDIUM CARBIDE plus Arsenic Oxide.

## ARSENIC SULFIDE $As_2S_2$; $As_2S_3$; $As_2S_5$

**Cadmium Chlorate**
See CHLORATES plus Arsenic Sulfide.

**Chlorates**
See CHLORATES plus Arsenic Sulfide.

**Chloric Acid**
Arsenic sulfide and concentrated solutions of chloric acid react with incandescence.
*Mellor* **Supp. II, Part I:** 584 (1956).

**Magnesium Chlorate**
See CHLORATES plus Arsenic Sulfide.

**Zinc Chlorate**
See CHLORATES plus Arsenic Sulfide.

## ARSENIC TRICHLORIDE $AsCl_3$

**Aluminum**
See ALUMINUM plus Phosphorus Trichloride.

**Aluminum Fluoride**
See SODIUM plus Aluminum Bromide.

**Ammonium Chlorocuprate**
See SODIUM plus Aluminum Bromide.



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**Antimony Tribromide**
See SODIUM plus Aluminum Bromide.

**Antimony Trichloride**
See SODIUM plus Aluminum Bromide.

**Antimony Triiodide**
See SODIUM plus Aluminum Bromide.

**Arsenic Trichloride**
See SODIUM plus Aluminum Bromide.

**Arsenic Triiodide**
See SODIUM plus Aluminum Bromide.

**Potassium**
See POTASSIUM plus Aluminum Bromide.

**Sodium**
See SODIUM plus Aluminum Bromide.

## ARSENIC TRIFLUORIDE $AsF_3$

**Phosphorus Trioxide**
This reaction is very violent.
*Mellor* **8, Supp. 3:** 382 (1971).

## ARSENIC TRIIODIDE $AsI_3$

**Potassium**
See POTASSIUM plus Aluminum Bromide.

**Sodium**
See SODIUM plus Aluminum Bromide.

## ARSENIC TRIOXIDE $As_2O_3$

**Chlorine Trifluoride**
See CHLORINE TRIFLUORIDE plus Arsenic Trioxide.

**Fluorine**
See FLUORINE plus Arsenic Trioxide.

**Hydrogen Fluoride**
See HYDROGEN FLUORIDE plus Arsenic Trioxide.

**Oxygen Difluoride**
See OXYGEN DIFLUORIDE plus Aluminum Chloride.

**Sodium Chlorate**
See SODIUM CHLORATE plus Arsenic Trioxide.

## ARSENIC TRISULFIDE $As_2S_3$

**Hydrogen Peroxide**
See ANTIMONY TRISULFIDE plus Hydrogen Peroxide.

**Sulfur and Potassium Nitrate**
See SULFUR plus Potassium Nitrate and Arsenic Trisulfide.

## ARSINE $AsH_3$

**Chlorine**
See CHLORINE plus Arsine.

**Nitric Acid**
See NITRIC ACID plus Arsine.

**Potassium and Ammonia**
See POTASSIUM plus Arsine and Ammonia.

## ASPHALT

**Fluorine**
See FLUORINE plus Common Materials and Oxygen.

## AZIDES

**(See also specific azide)**

**Carbon Disulfide**
Carbon disulfide plus any of the azides produces violently explosive, extremely sensitive salts.
*Mellor* **8:** 338 (1946–1947).

**Methylene Chloride**
Explosive reaction can occur with methylene chloride and other halogenated solvents.
*Chem. and Eng. News* (Dec. 13, 1993).

## AZIDES (ORGANIC)

**(heat sensitive)**
An explosion occurred during purification of 1,4-diazido-2-butene by high vacuum short path distillation.
*Chem. and Eng. News,* p. 2, (March 11, 1991).

**Acids**
Trace amounts of strong acid, certain metal salts, or conceivably other materials may catalyze explosive reactions with organic azides.
*Chem. and Eng. News* **42** (31): 6 (1964).

**Metal Salts**
See AZIDES (ORGANIC) plus Acids.

## 4-AZIDO-N,N-DIETHYLANILINE $NNNC_6H_4N(C_2H_5)_2$

**(self-reactive)**
An attempt to distill this compound resulted in violent decomposition.
*NSC Newsletter, R & D Sec.* (July 1973).

## 3-AZIDO-S-TRIAZOLE $HC{=}N{\cdot}N{=}C(N_3)NH$

**(self-reactive)**
Samples of this compound detonated during melting point determinations, breaking combustion tubes.
DeNault, Marx and Takimoto, *J. Chem. Eng. Data* **13:** 514–516 (1968).

## AZODICARBONAMIDE $H_2NCON{\cdot}NCONH_2$

A damaging explosion occurred during the manufacture of an azodicarbonamide formulation. It is reported that the event was a bottom-initiated spreading decomposition or deflagration that achieved very high mass rates due to a critical degree of confinement probably initiated by mechanical friction.
M. W. Whitmore, J. P. Gladwell, and P. V. Rutledge, *J. Loss Prev. Process Ind.,* **6** (3) (1993).

## a,a′-AZODIISOBUTYRONITRILE $[NCC(CH_3)_2N{=}]_2$

**(self-reactive)**
An explosion occurred when a solution of a,a′-azodiisobutyronitrile in acetone was concentrated in a glass-lined, steam-jacketed vessel.
P. J. Carlisle, *Chem. and Eng. News* **27:** 150 (1949).

## BAKELITE

**Fluorine**
See FLUORINE plus Solid Nonmetals.


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**BARIUM** Ba

**Acids**
Barium reacts violently with acids.
*Lab. Govt. Chemist* (1965).

**Carbon Tetrachloride**
A violent reaction occurred when small chunks of barium were cleaned by submerging in chemically pure carbon tetrachloride. See also BARIUM plus Trichlorotrifluoroethane.
*Serious Acc. Series* **23** (1952) and **Supp.** (Sept. 30, 1952).

**Monofluorotrichloromethane**
See BARIUM plus Trichlorotrifluoroethane.

**Tetrachloroethylene**
See BARIUM plus Trichlorotrifluoroethane.

**Trichloroethylene**
See BARIUM plus Trichlorotrifluoroethane.

**Trichlorotrifluoroethane**
It has been determined experimentally that mixtures of finely divided barium metal and a number of halogenated hydrocarbons possess an explosive capability. Specifically, impact sensitivity tests have shown that granular barium in contact with monofluorotrichloromethane, trichlorotrifluoroethane, carbon tetrachloride, trichloroethylene, or tetrachloroethylene can detonate.
*ASESB Pot. Incid.* **39** (1968). *Aero. and Astro.* **6** (3):82 (1968). *Chem. and Eng. News* **46** (9):38 (1968).

**Water**
Barium rapidly decomposes water. The heat of reaction is sufficient that the evolved hydrogen may ignite.
*Lab. Govt. Chemist* (1965).

**BARIUM ALLOYS**

**Acids**
Alloys containing a substantial proportion of barium react violently with acids.
*Lab. Govt. Chemist* (1965).

**Water**
Alloys containing a substantial proportion of barium rapidly decompose water. The heat of reaction is sufficient that the evolved hydrogen may ignite.
*Lab. Govt. Chemist* (1965).

**BARIUM AZIDE** $Ba(N_3)_2$

**(self-reactive)**
Barium azide decomposes at 275°C. It is explosively unstable.
*Mellor* **8, Supp. 2:** 43 (1967).

**Air**
Barium azide is spontaneously flammable in air.
*Ripley* (1966).

**BARIUM BROMATE** $Ba(BrO_3)_2$

**Aluminum**
See ALUMINUM plus Bromates.

**Arsenic**
See ARSENIC plus Bromates.

**Carbon**
See CARBON plus Bromates.

**Copper**
See COPPER plus Bromates.

**Metal Sulfides**
See METAL SULFIDES plus Bromates.

**Organic Matter**
See BROMATES plus Organic Matter.

**Phosphorus**
See PHOSPHORUS plus Bromates.

**Sulfur**
See SULFUR plus Bromates.

**BARIUM CARBIDE** $BaC_2$

**Selenium**
See SELENIUM plus Barium Carbide.

**Sulfur**
See SULFUR plus Barium Carbide.

**Water**
Barium carbide will flame in contact with water.
*Ellern,* p. 45 (1968).

**BARIUM CHLORATE** $Ba(ClO_3)_2$

**Aluminum**
See ALUMINUM plus Bromates.

**Arsenic**
See ARSENIC plus Bromates.

**Carbon**
See CARBON plus Bromates.

**Charcoal**
See CHLORATES plus Organic Matter.

**Copper**
See COPPER plus Bromates.

**Manganese Dioxide**
See CHLORATES plus Manganese Dioxide.

**Metal Sulfides**
See METAL SULFIDES plus Bromates.

**Nitrogen Sulfide**
See NITROGEN SULFIDE plus Barium Chlorate.

**Organic Matter**
See BROMATES plus Organic Matter.
See CHLORATES plus Organic Matter.

**Phosphorus**
See PHOSPHORUS plus Bromates.

**Sulfur**
See SULFUR plus Bromates. See SULFUR plus Chlorates.
See SULFUR plus Barium Chlorate.

**BARIUM CHLORIDE** $BaCl_2$

**Bromine Trifluoride**
See BROMINE TRIFLUORIDE plus Barium Chloride.

**2-Furan Percarboxylic Acid**
See 2-FURAN PERCARBOXYLIC ACID (self-reactive).

**BARIUM HYDRIDE** $BaH_2$

**Air**
See BARIUM HYDRIDE plus Water.



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**Water**
Barium hydride reacts vigorously with water. If finely powdered, it ignites spontaneously in moist air or dry air.
*Hurd,* p. 48 (1952).

**BARIUM HYPOPHOSPHITE** $Ba(H_2PO_2)_2 \cdot H_2O$

**Potassium Chlorate**
See POTASSIUM CHLORATE plus Barium Hypophosphite.

**BARIUM IODATE** $Ba(IO_3)_2$

**Aluminum**
See ALUMINUM plus Bromates.

**Arsenic**
See ARSENIC plus Bromates.

**Carbon**
See CARBON plus Bromates.

**Copper**
See COPPER plus Bromates.

**Metal Sulfides**
See METAL SULFIDES plus Bromates.

**Organic Matter**
See BROMATES plus Organic Matter.

**Phosphorus**
See PHOSPHORUS plus Bromates.

**Sulfur**
See SULFUR plus Bromates.

**BARIUM NITRATE** $Ba(NO_3)_2$

**Barium Dioxide, Magnesium, and Zinc**
See MAGNESIUM plus Barium Nitrate, Barium Dioxide and Zinc.

**BARIUM NITRIDOOSMATE** $Ba(OsNO_3)_2$

**(self-reactive)**
Barium osmiamate detonates at 150°C.
*Mellor* **15:** 728 (1946–1947).

**BARIUM OXIDE** BaO

**Hydrogen Sulfide**
See HYDROGEN SULFIDE plus Soda Lime.

**Hydroxylamine**
Hydroxylamine is ignited on contact with barium oxide.
*Mellor* **8:** 291 (1946–1947).

**Nitrogen Dioxide**
See NITROGEN TETROXIDE plus Barium Oxide.

**BARIUM PERCHLORATE** $Ba(ClO_4)_2H_2O$

**Alcohols**
Reflux heating of an alcohol and barium perchlorate yields a perchloric ester, all of which are highly explosive.
*Kirk and Othmer, Second Ed.* **5:** 75 (1963).

**BARIUM PEROXIDE** $BaO_2$

**Hydroxylamine**
Reaction of an aqueous solution of hydroxylamine with barium dioxide causes flaming.
See also LEAD DIOXIDE plus Hydroxylamine.
*Mellor* **3:** 670 (1946–1947).

**Magnesium, Zinc and Barium Nitrate**
See MAGNESIUM plus Barium Nitrate, Barium Dioxide, and Zinc.

**Organic Matter**
Mixtures of barium peroxide and combustible, organic or readily oxidizable materials are explosive and are ignited easily by friction or on contact with a small amount of water.
*Haz. Chem. Data* (1969).

**BARIUM RHODANIDE** $Ba[N{=}C(O)CH_2SC(S)]_2$

**Sodium Nitrate**
A mixture of the two may cause an explosion.
*Pieters,* p. 30 (1957).

**BARIUM SULFATE** $BaSO_4$

**Aluminum**
See ALUMINUM plus Sulfates.

**BARIUM SULFIDE** BaS

**Chlorine Monoxide**
See CHLORINE MONOXIDE plus Calcium Phosphide.

**Lead Dioxide**
Oxidizing agents like lead dioxide, potassium chlorate and potassium nitrate react vigorously when heated with sulfides of the alkaline earth group.
*Mellor* **3:** 745 (1946–1947).

**Potassium Chlorate**
See BARIUM SULFIDE plus Lead Dioxide.

**Potassium Nitrate**
See BARIUM SULFIDE plus Lead Dioxide.

**BENZALDEHYDE** $C_6H_5CHO$

**Performic Acid**
See PERFORMIC ACID plus Benzaldehyde.

**BENZENE** $C_6H_6$

**Bromine Pentafluoride**
See BROMINE PENTAFLUORIDE plus Acetic Acid.

**Chlorine**
See CHLORINE plus Benzene.

**Chlorine Trifluoride**
See CHLORINE TRIFLUORIDE plus Benzene.

**Chromic Anhydride**
See CHROMIC ANHYDRIDE plus Benzene.

**Nitryl Perchlorate**
See NITRYL PERCHLORATE plus Benzene.

**Oxygen**
See OXYGEN (LIQUID) plus Benzene.

**Ozone**
See OZONE plus Benzene.

**Perchlorates**
See PERCHLORATES plus Benzene.


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**Perchloryl Fluoride and Aluminum Chloride**
See PERCHLORYL FLUORIDE plus Benzene and Aluminum Chloride.

**Permanganates and Sulfuric Acid**
See PERMANGANATES plus Sulfuric Acid and Benzene.

**Potassium Peroxide**
See SODIUM PEROXIDE plus Aniline.

**Silver Perchlorate**
See SILVER PERCHLORATE plus Benzene.
See SILVER PERCHLORATE plus Acetic Acid.
See SILVER PERCHLORATE plus Toluene.

**Sodium Peroxide**
See SODIUM PEROXIDE plus Aniline.

## BENZENEDIAZONIUM 2-CARBOXYLATE HYDROCHLORIDE $N{\equiv}N\text{-}C_6H_4\text{-}2\text{-}CO_2\cdot HCl$

**(self-reactive)**
An explosion occurred during the transfer of dry crystals. H. D. *Embry, Chem. and Eng. News* **49** (30): 3 (1971). R. M. Stiles et al., *J. Am. Chem. Soc.* ***85,*** p. 1795 (1963). C. A. Matuszak, *Chem. and Eng. News* **49** (24): 39 (1971).

## BENZENEDIAZONIUM CHLORIDE $C_6H_5NNCl$

**(self-reactive)**
Phenylchlorodiazirine is extremely shock sensitive. It should not be handled in an undiluted state.
*Chem. Eng. and News* **48** (2): 10 (1970). W. H. Graham, *J. Am. Chem. Soc.* **87:** 4396 (1965). A. Padwa and D. Eastman, *J. Org. Chem. 34:* 2728 (1969).

**Hydrogen Sulfide**
An explosive product is obtained when hydrogen sulfide and phenyl diazonium chloride are mixed.
*Berichte* **15:** 1683.

## BENZENESULFONYL CHLORIDE $C_6H_5SO_2Cl$

**Dimethyl Sulfoxide**
See DIMETHYL SULFOXIDE plus Acyl Halides.

**Methylformamide**
See METHYL ISONITRILE (self-reactive).

## BENZOTRIAZOLE $C_6H_4N_3H$

**(self-reactive)**
During the vacuum distillation of 2,000 lbs. of benzotriazole in a 500-gallon glass-lined kettle at 160°C and a pressure of 2 mm of mercury, the vessel suddenly pressurized, the temperature rose to a recorded 220°C, and the contents detonated. This same process had been in trouble-free operation for months.
*Chem. and Eng. News* **34:** 2450 (1956).

## BENZOYL CHLORIDE $C_6H_5COCl$

**Dimethyl Sulfoxide**
See DIMETHYL SULFOXIDE plus Acyl Halides.

**Sodium Azide and Potassium Hydroxide**
See SODIUM AZIDE plus Benzoyl Chloride and Potassium Hydroxide.

## BENZOYL PEROXIDE $(C_6H_5CO)_2O_2$

**(See also DIBENZOYL PEROXIDE)**

**(self-reactive)**
Benzoyl peroxide has been reported to explode for apparently no specific reason. Friction while opening bottles has caused other explosions. Purification of benzoyl peroxide in hot chloroform solutions has also resulted in several explosions. Purification in cold chloroform by addition of methanol is without danger.
*Chem. and Eng. News* **37:** 46 (Jan. 3, 1949).
*Chem. Abst.* **25:** 4127 (1931).

**Carbon Tetrachloride and Ethylene**
A reaction of ethylene, carbon tetrachloride and benzoyl peroxide caused an explosion.
R. O. Bolt, R. M. Joyce, *Chem. and Eng. News* **25:** 1866 (1947).

**Methyl Methacrylate**
Benzoyl peroxide was weighed into a stainless steel beaker that had been rinsed previously with methyl methacrylate. The peroxide catalyzed polymerization of the methacrylate and the build-up of heat was sufficient to ignite the remainder of the peroxide.
*MCA Case History* **996** (1964).

**Organic Matter**
While a bottle of benzoyl peroxide was being opened, it exploded. Organic matter may have been entrapped in the threads of the bottle. When cap was unscrewed, friction caused explosion.
G. R. Lappin, *Chem. and Eng. News* **26:** 3518 (1948).

## BENZYL ALCOHOL $C_6H_5CH_2OH$

**Acids**
See ACIDS plus Benzyl Alcohol.

## BENZYL FLUORIDE $C_6H_5CH_2F$

A bottle decomposed spontaneously after storage for approximately one year.
*Chem. and Eng. News* (August 20, 1990).

## BENZYL SILANE $C_6H_5CH_2SiH_3$

**Air**
Benzyl silane is spontaneously flammable in air.
*Lehman and Wilson,* p. 53 (1949).

## BENZYL SODIUM $C_6H_5CH_2Na$

**Air**
Benzyl sodium is spontaneously flammable in air.
*Ellern* (1961).

## BERYLLIUM Be

**Carbon Tetrachloride**
It has been determined experimentally that a mixture of beryllium powder with carbon tetrachloride or with trichloroethylene will flash or spark on heavy impact.
*ASESB Pot. Incid.* **39** (1968).

**Lithium**
See LITHIUM plus Vanadium.



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**Phosphorus**
The reaction between beryllium and the vapors of phosphorus proceeds with incandescence.
*Mellor* **8:** 842 (1946–1947).

**Trichloroethylene**
See BERYLLIUM plus Carbon Tetrachloride.

**BERYLLIUM OXIDE** BeO

**Magnesium**
See MAGNESIUM plus Beryllium Oxide.

**BERYLLIUM TETRAHYDROBORATE** $Be(BH_4)_2$

**Air**
Beryllium borohydride is spontaneously flammable in air.
*Douda* (1966).

**Oxygen**
See OXYGEN plus Beryllium Borohydride.

**Water**
See OXYGEN plus Beryllium Borohydride.

**BIS (2-CHLOROETHYL) ETHER** $ClCH_2CH_2OCH_2CH_2Cl$

**Chlorosulfonic Acid**
Mixing dichloroethyl ether and chlorosulfonic acid in a closed container caused the temperature and pressure to increase.
*Flynn and Rossow* (1970). See Note under complete reference.

**Oleum**
Mixing dichloroethyl ether and oleum in a closed container caused the temperature and pressure to increase.
*Flynn and Rossow* (1970). See Note under complete reference.

**BIS(DIMETHYLSTIBINE) OXIDE** $[(CH_3)_2Sb]_2O$

**Air**
Bisdimethylstibine oxide is spontaneously flammable in air.
*Coates,* p. 555 (1956).

**BIS(ETHYLAMINO) CYCLOTRISILOXANE**
$[(C_2H_5)_2N]_2SiOSiH_2OSiH_2O$

**Air**
Bisethylamino siloxane is spontaneously flammable in air.
*Douda* (1966).

**BISMUTH** Bi

**Aluminum and Air**
A mixture of bismuth hydroxide and aluminum hydroxide, coprecipitated, and reduced by hydrogen at 170°–210°C, is spontaneously flammable in air at ordinary temperatures.
*Mellor* **9:** 626 (1946–1947).

**Ammonium Nitrate**
See AMMONIUM NITRATE plus Metals (powdered).

**Chloric Acid**
See ANTIMONY plus Chloric Acid.

**Chlorine**
Powdered bismuth burns spontaneously in gaseous chlorine. With liquid chlorine, bismuth ignites at 80°C.
*Mellor* **2:** 92, 95; **9:** 626 (1946–1947).

**Iodine Pentafluoride**
See ARSENIC plus Iodine Pentafluoride.

**Nitric Acid**
If fuming nitric acid is poured over powdered bismuth, the metal becomes red hot.
*Mellor* **9:** 627 (1946–1947).

**Perchloric Acid**
When bismuth is heated with perchloric acid at 100°C or below, the metal dissolves slowly, but at 110°a brown coating forms, which on further heating explodes violently.
*J. Am. Chem. Soc.* **57:** 817–18 (May 1935).
*ACS* **146:** 188.
The preparation of a salt from these two chemicals is dangerous.
*Mellor* **2, Supp. 1:** 613 (1956).

**BISMUTHIC ACID** $HBiO_3$

**Hydrofluoric Acid**
When bismuthic acid is treated with 40 per cent hydrofluoric acid at ordinary temperatures, a violent reaction occurs.
*Mellor* **9:** 657 (1946–1947).

**BISMUTH PENTAFLUORIDE** $BiF_5$

**Water**
Bismuth pentafluoride reacts violently with water, sometimes with ignition.
*Brauer* (1965).

**BISMUTH PENTOXIDE** $Bi_2O_5$

**Bromine Trifluoride**
See BROMINE TRIFLUORIDE plus Bismuth Pentoxide.

**BISMUTH TRIBROMIDE** $BiBr_3$

**Potassium**
See POTASSIUM plus Aluminum Bromide.

**Sodium**
See SODIUM plus Aluminum Bromide.

**BISMUTH TRICHLORIDE** $BiCl_3$

**Potassium**
See POTASSIUM plus Aluminum Bromide.

**Sodium**
See SODIUM plus Aluminum Bromide.

**BISMUTH TRIIODIDE** $BiI_3$

**Potassium**
See POTASSIUM plus Aluminum Bromide.

**Sodium**
See SODIUM plus Aluminum Bromide.

**BISMUTH TRIOXIDE** $Bi_2O_3$

**Aluminum**
See ALUMINUM plus Bismuth Trioxide.


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**Chlorine Trifluoride**
See CHLORINE TRIFLUORIDE plus Arsenic Trioxide.

**Potassium**
See POTASSIUM plus Bismuth Trioxide.

**Sodium**
See SODIUM plus Bismuth Trioxide.

**BIS(TRIFLUOROMETHYL) CHLOROPHOSPHINE**
$(CF_3)_2PCl$

**Air**
Bistrifluoromethyl chlorophosphine is spontaneously flammable in air.
*Handbook Chem. Phys.*, p. C-428 (1970–1971).

**BIS(TRIFLUOROMETHYL) CYANOPHOSPHINE**
$(CF_3)PCN$

**Air**
Bistrifluoromethyl cyanophosphine is spontaneously flammable in air.
*Handbook Chem. Phys.*, p. C-428 (1970–1971).

**BIS(TRIFLUOROMETHYL) PHOSPHINE** $(CF_3)_2PH$

**Air**
Bistrifluoromethyl phosphine is spontaneously flammable in air.
*Douda* (1966). *Handbook Chem. Phys.*, p. C-428 (1970–1971).

**BORAX** $Na_2B_4O_7{\cdot}10H_2O$

**Zirconium**
See ZIRCONIUM plus Borax.

**BORIC ACID** $B(OH)_3$

**Acetic Anhydride**
During an attempt to make triacetyl borate, a mixture of boric acid and acetic anhydride exploded when heated to 58–60°C.
M. L. Lerner. *Chem. and Eng. News.* **51:** (34) (Aug. 20, 1973).

**Potassium**
See POTASSIUM plus Boric Acid.

**BORIC OXIDE** $B_2O_3$

**Calcium Oxide and Calcium Chloride**
When a mixture of boric oxide and calcium oxide in any proportion is projected into fused calcium chloride, the mass becomes incandescent.
*Mellor* **5:** 141 (1946–1947).

**BORON** B

**Ammonia**
When amorphous boron is heated in dry ammonia, the reaction proceeds with incandescence and hydrogen is evolved.
*Mellor* **8:**109 (1946–1947).

**Bromine**
Boron ignites in bromine vapor at 700°C.
*Mellor* **5:** 15 (1946–1947).

**Bromine Trifluoride**
See ANTIMONY plus Bromine Trifluoride.

**Cesium Carbide**
See SILICON plus Cesium Carbide.

**Chlorine**
Boron burns spontaneously in gaseous chlorine.
*Mellor* **2:** 92, 95; **9:** 626 (1946–1947).
Boron ignites in chlorine at 410°C.
*Mellor* **5:** 15 (1946–1947).

**Cupric Oxide**
Boron reacts violently with cupric oxide after warming, melting glass tubing.
*Mellor* **5:** 17 (1946–1947).

**Fluorine**
Fluorine attacks boron at ordinary temperatures, the mass becoming incandescent.
*Mellor* **2:** 12; **5:** 15 (1946–1947).

**Iodic Acid**
Iodic acid attacks boron below 40°C. and the mass becomes incandescent.
*Mellor* **5:** 15 (1946–1947).

**Lead Dioxide**
A mixture of boron and lead dioxide explodes violently when ground in a mortar.
*Mellor* **5:** 17 (1946–1947).

**Nitric Acid**
Concentrated nitric acid and boron react so violently that the mass is raised to incandescence.
*Mellor* **5:** 16 (1946–1947).

**Nitric Oxide**
See BORON plus Nitrous Oxide.

**Nitrosyl Fluoride**
The reaction between nitrosyl fluoride and boron (also phosphorus or silicon) is accompanied by incandescence.
*Z. Anorg. Chemie* **47:** 190.

**Nitrous Oxide**
Amorphous boron ignites when heated in dry nitrous oxide. With nitric oxide, the reaction proceeds with blinding flashes.
*Mellor* **8:** 109 (1946–1947).

**Potassium Chlorate**
The reaction of boron and fused potassium chlorate is vigorous.
*Mellor* **5:** 15 (1946–1947).

**Potassium Nitrate**
Portions of boron powder and potassium nitrate were blended, screened, and placed in aluminum containers. When one of the covered containers was accidentally dropped, there was a flash fire followed by explosions.
*MCA Case History* **1334** (1967).

**Potassium Nitrite**
Molten potassium nitrite is violently decomposed by boron.
*Mellor* **5:** 16 (1946–1947).

**Rubidium Carbide**
See SILICON plus Rubidium Carbide.

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**Silver Fluoride**
Fused silver fluoride reacts explosively with boron at ordinary temperatures.
*Mellor* **3:** 389 (1946–1947).

**Sulfur**
A mixture of boron and sulfur becomes incandescent at 600°C.
*Mellor* **5:** 15 (1946–1947).

## BORON ARSENOTRIBROMIDE $BAs_2Br_3$

**Air**
See OXYGEN plus Boron Arsenotribromide.

**Oxygen**
See OXYGEN plus Boron Arsenotribromide.

## BORON BROMODIIODIDE $BBrI_2$

**Water**
Boron bromodiiodide hydrolyzes violently.
*Mellor* **5:** 136 (1946–1947).

## BORON DIBROMOIODIDE $BBr_2I$

**Water**
Boron dibromoiodide hydrolyzes violently.
*Mellor* **5:** 136 (1946–1947).

## BORON NITRIDE BN

**Sodium Dioxide**
When powdered boron nitride is added to molten sodium dioxide, the reaction proceeds with incandescence.
*Mellor* **8:** 111 (1946–1947).

## BORON PHOSPHIDE BP

**Nitrates**
See BORON PHOSPHIDE plus Nitric Acid.

**Nitric Acid**
Boron phosphide ignites in concentrated nitric acid; with fused alkali nitrates, there is a deflagration.
*Mellor* **8:** 845–46 (1946–1947).

## BORON PHOSPHODIIODIDE $BPI_2$

**Chlorine**
See CHLORINE plus Boron Phosphodiiodide.

**Magnesium**
See MAGNESIUM plus Boron Phosphodiiodide.

**Mercury**
See MERCURY plus Boron Phosphodiiodide.

## BORON TRIAZIDE $B(N_3)_3$

**(self-reactive)**
Boron triazide, lithium boroazide, and silicon tetraazide and some of their intermediates are extremely sensitive and explosive.
Egon Wibergand Horst Michaud, *Z. Naturforsch.* **9b:** 497–500 (1954).

## BORON TRIBROMIDE $BBr_3$

**Potassium**
See POTASSIUM plus Boron Tribromide.

**Sodium**
See SODIUM plus Aluminum Bromide.

**Water**
When boron tribromide and water are mixed, there is an explosion.
*Mellor* **5:** 134 (1946–1947). *BCISC* **41**(1962):19 (1970).

## BORON TRICHLORIDE $BCl_3$

**Nitrogen Peroxide**
Boron trichloride reacts energetically with nitrogen peroxide, phosphine, or fat and grease.
*Mellor* **5:** 132 (1946–1947).

**Organic Matter**
See BORON TRICHLORIDE plus Nitrogen Peroxide.

**Oxygen**
See OXYGEN plus Boron Trichloride.

**Phosphine**
See BORON TRICHLORIDE plus Nitrogen Peroxide.

## BORON TRIFLUORIDE $BF_3$

**Alkali Metals**
See ALKALI METALS plus Boron Trifluoride.

**Alkaline Earth Metals**
See ALKALI METALS plus Boron Trifluoride.

**Calcium Oxide**
See CALCIUM OXIDE plus Boron Trifluoride.

## BORON TRIFLUORIDE ETHERATE $BF_3 \cdot (C_2H_5)_2O$

**Lithium Aluminum Hydride**
See LITHIUM ALUMINUM HYDRIDE plus Boron Trifluoride Etherate.

## BORON TRIIODIDE $BI_3$

**Ammonia**
Ammonia reacts with boron triiodide with the development of much heat.
*Mellor* **5:** 136 (1946–1947).

**Carbohydrates**
See BORON TRIIODIDE plus Ethers.

**Ethers**
Boron triiodide and ethers or carbohydrates react vigorously.
*Mellor* **5:** 136 (1946–1947).

**Phosphorus**
See PHOSPHORUS plus Boron Triiodide.

**Phosphoryl Chloride**
See PHOSPHORYL CHLORIDE plus Boron Triiodide.

## BORON TRISULFIDE $B_2S_3$

**Chlorine**
See CHLORINE plus Boron Trisulfide.

## BRASS

**Acetylene**
See COPPER plus Acetylene.

**Chlorine**
See CHLORINE plus Brass.



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**Hydrogen Peroxide**
See IRON plus Hydrogen Peroxide.

**Lead Azide**
See COPPER plus Lead Azide.

## BROMATES

**(See also specific bromates as primary entries or see under other reactants)**

**Acids and Metals (powdered)**
See CHLORATES plus Metals (powdered).

**Aluminum**
See ALUMINUM plus Bromates.

**Arsenic**
See ARSENIC plus Bromates.

**Calcium Hydride**
A mixture of calcium hydride and bromates, chlorates or perchlorates explodes violently when rubbed in a mortar.
*Mellor* **3:** 651 (1946–1947).

**Carbon**
See CARBON plus Bromates.

**Copper**
See COPPER plus Bromates.

**Metals (powdered)**
See CHLORATES plus Metals (powdered).

**Metal Sulfides**
See METAL SULFIDES plus Bromates.

**Organic Matter**
A combination of finely divided organic matter with finely divided bromates (also chlorates or iodates) of barium, calcium, magnesium, potassium, sodium, or zinc can be exploded by heat, percussion, and sometimes, light friction.
*Mellor* **2:** 310 (1946–1947). *MCA Case History* **874** (1963).

**Phosphonium Iodide**
Bromates, chlorates or iodates when dry ignite in phosphonium iodide at ordinary temperatures.
*Ann. Chim. et Phys.* (2) **47:** 87.

**Phosphorus**
See PHOSPHORUS plus Bromates.

**Strontium Hydride**
A mixture of strontium hydride and bromates, chlorates, or perchlorates explodes violently when rubbed in a mortar.
*Mellor* **3:** 651 (1946–1947).

**Sulfur**
See SULFUR plus Bromates.

**Sulfuric Acid and Metals**
See CHLORATES plus Metals (powdered).

## BROMIC ACID $HBrO_3$

**Phosphonium Iodide**
See PHOSPHONIUM IODIDE plus Bromic Acid.

## BROMINE $Br_2$

**Acetaldehyde**
Combination of acetaldehyde with bromine, chlorine, fluorine, or iodine can be violent.
*Chem. Safety Data Sheet* **SD-43** (1952).

**Acetylene**
Acetylene can react explosively with bromine.
*Von Schwartz*, p. 142 (1918).

**Acrylonitrile**
During the drop-wise addition of bromine into a 500 ml. flask containing acrylonitrile, the periodic cooling with an ice bath was insufficient to prevent a runaway exothermic reaction. When the temperature of the reactants exceeded 40°C, the flask exploded.
*MCA Case History* **1214** (1966).

**Aluminum**
See ALUMINUM plus Bromine.

**Ammonia**
Ammonia plus bromine (with heat) explodes due to the formation of extremely sensitive nitrogen tribromide.
*Mellor* **2:** 95 (1946–1947).

**Antimony**
See ANTIMONY plus Bromine.

**Boron**
See BORON plus Bromine.

**Calcium Nitride**
Calcium nitride reacts in the cold with bromine, with incandescence.
*Mellor* **8:** 99 (1946–1947).

**Cesium Acetylene Carbide**
Cesium acetylene carbide burns in the vapors of bromine or iodine.
*Mellor* **5:** 844 (1946–1947).

**Cesium Monoxide**
At ordinary temperatures, cesium monoxide plus bromine, chlorine, fluorine or iodine reacts with incandescence. At temperatures above 150°C., a blue flame appears with fluorine. Chlorine and iodine act similarly.
*Mellor* **2:** 487 (1946–1947).

**Chlorotrifluoroethylene and Oxygen**
See CHLOROTRIFLUOROETHYLENE plus Bromine and Oxygen.

**Copper Hydride**
Copper hydride ignites in bromine, chlorine or fluorine.
*Mellor* **3:** 73 (1946–1947).

**Cuprous Acetylide (Copper Carbide)**
Cuprous acetylide is spontaneously flammable with bromine vapor, chlorine gas or fine iodine.
*Mellor* **5:** 852 (1946–1947).

**Dimethyl Formamide**
The use of dimethyl formamide as a solvent in one of the catalysis reactions of olefins and bromine resulted in the operation of a rupture disk on an autoclave. The investigation indicated that there was a highly exothermic reaction between dimethyl formamide and bromine. In one instance mixing 40 cc of bromine and 150 cc of dimethyl formamide resulted in an increase of temperature to

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above 100°C and an increase in pressure to above 2000 psi.
H. A. Tayim and M. Absi, *Chem. & Ind.*, p. 347 (April 21, 1973).

**Ethyl Phosphine**
A mixture of ethyl phosphine and bromine, chlorine, or nitric acid (fuming) explodes.
*Von Schwartz*, pp. 324, 325 (1918).

**Fluorine**
See FLUORINE plus Bromine.

**Germanium**
See GERMANIUM plus Bromine.

**Hydrogen**
Hydrogen and bromine explode.
*Mellor* **Supp. I:** 707.

**Iron Carbide**
See CHLORINE plus Iron Carbide.

**Isobutyrophenone**
Bromine had been added dropwise at 21–31°C to a solution of isobutyrophenone in carbon tetrachloride. The flask was then packed in ice. After 15 minutes, the flask exploded.
*MCA Guide for Safety*, Appendix 3 (1972).

**Lithium**
See BROMINE plus Potassium.

**Lithium Carbide**
Lithium carbide burns vigorously and spontaneously in cold chlorine or fluorine. With bromine or iodine, the materials must be warm.
*Mellor* **5:** 848 (1946–1947).

**Lithium Silicide**
See FLUORINE plus Lithium Silicide.

**Magnesium Phosphide**
See CHLORINE plus Magnesium Phosphide.

**Methyl Alcohol**
A violent exothermic reaction of these materials occurred in a measuring cylinder.
*MCA Case History* **1863** (1972).

**Nickel Carbonyl**
The reaction between these liquids proceeds with explosive violence.
*Mellor* **2, Supp. 1:** 716 (1956). *J. Am. Chem. Soc.* **48:** 872–82 (1926).

**Nitrogen Triiodide**
Nitrogen triiodide explodes on contact with bromine, chlorine, or ozone, and is almost instantly decomposed by hydrogen sulfide.
Champion and Pellet, *Bull. Soc. Chim.* (2) **24:** 447 (1875).
*Ann. Chim. et Phys.* (2) **42:** 200.
E. Schneider, *Report Anal. Chem.* **1:** 54 (1881).

**Olefins**
See BROMINE plus Dimethyl Formamide.

**Oxygen Difluoride**
A mixture of oxygen difluoride and bromine or iodine explodes on gentle warming.
*Mellor* **2, Supp. 1:** 192 (1956).

**Ozone**
See OZONE plus Bromine.

**Phosphine**
Phosphine ignites with bromine or chlorine at room temperature.
*Berichte* **3:** 660. *Merck Index*, p. 823 (1968).

**Phosphorus**
Ordinary phosphorus reacts with gaseous bromine with incandescence. Red phosphorus reacts with bromine (liquid) at ordinary temperatures with incandescence. Small pieces of yellow (white) phosphorus thrown into liquid bromine ignite and cause dangerous explosions.
*Ann. Chim. et Phys.* (2) **32:** 337. *Lowig* (1829).
See also PHOSPHORUS plus Chlorine.

**Phosphorus Oxide**
See CHLORINE plus Phosphorus Oxide.

**Phosphorus Trioxide**
Phosphorus trioxide, thrown into a jar of chlorine, ignites immediately and burns with a greenish flame. Phosphorus trioxide reacts violently with liquid bromine — generally ignites.
Thorpe and Tutton, *J. Chem. Soc.* **59:** 1019 (1891).

**Potassium**
The reaction between potassium and bromine (gas) is vigorous with incandescence. A violent explosion will occur if potassium is brought in contact with liquid bromine.
R. Cowper, *Chem. News* **47:** 70 (1883). *Sidgwick*, p. 65 (1950). *Mellor* **2:** 469 (1946–1947).
The system bromine-plus-sodium, however, requires a small impact to cause an explosion. The system bromine-plus-lithium requires a much larger impact to explode it.
H. Staudinger, *Z. Elektrochem.* **31:** 549–52 (1925).
*Mellor* **2, Supp. 3:** 1559.

**Rubidium Acetylene Carbide**
Rubidium acetylene carbide burns in cold bromine, chlorine, fluorine, or iodine (vapor).
*Mellor* **5:** 849 (1946–1947).

**Rubidium Carbide**
This carbide burns in bromine gas.
*Mellor* **5:** 848 (1946–1947).

**Silver Azide**
Bromine vapor diluted with some nitrogen plus silver or sodium azides formed bromoazide; explosions often occurred.
*Mellor* **8:** 330 (1946–1947).

**Sodium**
Finely divided sodium reacts with bromine with luminescence. Solid sodium plus liquid bromine can be caused to explode by mechanical shock. See also BROMINE plus Potassium.
*Mellor* **Supp. II, Part I:** 714 (1956).

**Sodium Acetylene Carbide**
Sodium acetylene carbide burns in cold chlorine or bromine.
*Mellor* **5:** 849 (1946–1947).


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**Sodium Carbide**
Sodium carbide explodes on contact with bromine vapor or water.
*Von Schwartz*, p. 328 (1918).

**Strontium Phosphide**
Mixtures of these materials ignite at about 170°C.
*Mellor* **8:** 841 (1946–1947).

**Tin**
See TIN plus Bromine.

**Uranium Dicarbide**
Uranium dicarbide reacts with incandescence with warm fluorine; at 300°C. with chlorine; or at 390°C. with bromine.
*Mellor* **5:** 890–98 (1946–1947).

**Zirconium Dicarbide**
Zirconium dicarbide burns in fluorine, in the cold; in chlorine, at 250°C.; in bromine, at 300°C.; and in iodine, at 400°C.
*Mellor* **5:** 855–57 (1946–1947).

## BROMINE AZIDE $N_3Br$

**(self-reactive)**
Spontaneous explosions have been observed with this compound.
*Mellor* **8, Supp. 2:** 50 (1967)
*Mellor* **8:** 336 (1946–1947).

**Antimony**
See ANTIMONY plus Bromoazide.

**Arsenic**
See ANTIMONY plus Bromoazide.

**Diethyl Ether**
A solution of bromoazide in ether is stable for a few hours, but after a time, or when being concentrated, it is likely to explode on shaking.
*Mellor* **8:** 327, 336, 338 (1946–1947).

**Phosphorus**
See ANTIMONY plus Bromoazide.

**Silver**
See ANTIMONY plus Bromoazide.

**Sodium**
See ANTIMONY plus Bromoazide.

## BROMINE MONOFLUORIDE BrF

**Organic Matter**
See BROMINE MONOFLUORIDE plus water.

**Water**
Halogen fluorides react violently with water and organic compounds.
*Mellor* **2, Supp. 1:** 147 (1956).
See also CHLORINE TRIFLUORIDE plus Elements.

## BROMINE PENTAFLUORIDE $BrF_5$

**Acetic Acid**
In reactions between bromine pentafluoride and acetic acid, ammonia, benzene, cellulose (in paper), ethyl alcohol, organic matter such as grease or wax, hydrogen sulfide, or methane, fire and explosions are likely.
*Mellor* **2, Supp. 1:** 172 (1956).

**Ammonia**
See BROMINE PENTAFLUORIDE plus Acetic Acid.

**Arsenic**
See ARSENIC plus Bromine Pentafluoride.

**Benzene**
See BROMINE PENTAFLUORIDE plus Acetic Acid.

**Bromides (Alkaline)**
See ARSENIC plus Bromine Pentafluoride.

**Cellulose**
See BROMINE PENTAFLUORIDE plus Acetic Acid.

**Charcoal**
See ARSENIC plus Bromine Pentafluoride.

**Chlorides (Alkaline)**
See ARSENIC plus Bromine Pentafluoride.

**Chlorine**
See CHLORINE plus Bromine Pentafluoride.

**Ethyl Alcohol**
See BROMINE PENTAFLUORIDE plus Acetic Acid.

**Hydrogen Sulfide**
See BROMINE PENTAFLUORIDE plus Acetic Acid.

**Iodides (Alkaline)**
See ARSENIC plus Bromine Pentafluoride.

**Iodine**
See ARSENIC plus Bromine Pentafluoride.
See IODINE plus Bromine Pentafluoride.

**Metallic Halides**
See BROMINE PENTAFLUORIDE plus Metal Oxides.

**Metal Oxides**
Bromine pentafluoride reacts violently with metal oxides and metallic halides.
*Mellor* **2, Supp. 1:** 172 (1956).

**Metals**
See METALS plus Bromine Pentafluoride.

**Methane**
See BROMINE PENTAFLUORIDE plus Acetic Acid.

**Nitric Acid**
Bromine pentafluoride reacts violently with strong nitric acid or strong sulfuric acid.
*Mellor* **2, Supp. 1:** 172 (1956).

**Organic Matter**
See BROMINE PENTAFLUORIDE plus Acetic Acid.
See also BROMINE MONOFLUORIDE plus Water.

**Selenium**
See ARSENIC plus Bromine Pentafluoride.

**Sulfur**
See ARSENIC plus Bromine Pentafluoride.

**Sulfuric Acid**
See BROMINE PENTAFLUORIDE plus Nitric Acid.

**Water**
The reaction between bromine pentafluoride and water is very violent.
*Mellor* **2, Supp. 1:** 172 (1956).
See ARSENIC plus Bromine Pentafluoride.
See also BROMINE MONOFLUORIDE plus Water.

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## BROMINE TRIFLUORIDE $BrF_3$

**(See also other reactants)**

**Ammonium Bromide**
Bromine trifluoride reacts explosively with the following: ammonium bromide, ammonium chloride, ammonium iodide.
*Mellor* **2, Supp. 1:** 165 (1956).

**Ammonium Chloride**
See BROMINE TRIFLUORIDE plus Ammonium Bromide.

**Ammonium Iodide**
See BROMINE TRIFLUORIDE plus Ammonium Bromide.

**Antimony**
See ANTIMONY plus Bromine Trifluoride.

**Antimonyl Chloride**
See BROMINE TRIFLUORIDE plus Antimony Trioxide.

**Antimony Trioxide**
Bromine trifluoride produces a violent reaction with antimony trioxide, more violent with antimonyl chloride.
*Mellor* **2, Supp. 1:** 166 (1956).

**Arsenic**
See ANTIMONY plus Bromine Trifluoride.

**Barium Chloride**
Bromine trifluoride rapidly attacks the following salts: barium chloride, cadmium chloride, calcium chloride, cesium chloride, lithium chloride, rubidium chloride, silver chloride.
*Mellor* **2, Supp. 1:** 165 (1956).

**Bismuth Pentoxide**
Bromine trifluoride and bismuth pentoxide, manganous iodate, niobium pentoxide, or tantalum pentoxide react vigorously.
*Mellor* **2, Supp. 1:** 166, 173 (1956).

**Boron**
See ANTIMONY plus Bromine Trifluoride.

**Bromine**
See ANTIMONY plus Bromine Trifluoride.

**Cadmium Chloride**
See BROMINE TRIFLUORIDE plus Barium Chloride.

**Calcium Chloride**
See BROMINE TRIFLUORIDE plus Barium Chloride.

**Carbon Monoxide**
Bromine trifluoride and carbon monoxide react explosively at high temperatures or concentrations.
*Mellor* **2, Supp. 1:** 166 (1956).

**Carbon Tetrachloride**
Bromine trifluoride and carbon tetrachloride react vigorously.
*Mellor* **2, Supp. 1:** 167 (1956).

**Carbon Tetraiodide**
Flaming occurs when bromine trifluoride is dripped onto cooled carbon tetraiodide.
*Mellor* **2, Supp. 1:** 166 (1956).

**Cesium Chloride**
See BROMINE TRIFLUORIDE plus Barium Chloride.

**Iodine**
See ANTIMONY plus Bromine Trifluoride.

**Lithium Chloride**
See BROMINE TRIFLUORIDE plus Barium Chloride.

**Manganous Iodate**
See BROMINE TRIFLUORIDE plus Bismuth Pentoxide.

**Metals**
See METALS plus Bromine Trifluoride.

**Molybdenum**
See MOLYBDENUM plus Bromine Trifluoride.

**Niobium**
See NIOBIUM plus Bromine Trifluoride.

**Niobium Pentoxide**
See BROMINE TRIFLUORIDE plus Bismuth Pentoxide.

**Organic Matter**
See BROMINE MONOFLUORIDE plus Water.

**Phosphorus**
See ANTIMONY plus Bromine Trifluoride.

**Platinic Bromide**
Both platinic bromide and platinic chloride are vigorously attacked by bromine trifluoride.
*Mellor* **2, Supp. 1:** 165 (1956).

**Platinic Chloride**
See BROMINE TRIFLUORIDE plus Platinic Bromide.

**Platinum and Potassium Fluoride**
See PLATINUM plus Bromine Trifluoride and Potassium Fluoride.

**Potassium Bromide**
The following salts are rapidly attacked by bromine trifluoride: potassium bromide, potassium chloride, potassium iodide, rhodium tetrabromide, sodium bromide, sodium chloride, sodium iodide.
*Mellor* **2, Supp. 1:** 164 (1956).

**Potassium Chloride**
See BROMINE TRIFLUORIDE plus Potassium Bromide.

**Potassium Iodide**
See BROMINE TRIFLUORIDE plus Potassium Bromide.

**Rhodium Tetrabromide**
See BROMINE TRIFLUORIDE plus Potassium Bromide.

**Rubidium Chloride**
See BROMINE TRIFLUORIDE plus Barium Chloride.

**Silver Chloride**
See BROMINE TRIFLUORIDE plus Barium Chloride.

**Sodium Bromide**
See BROMINE TRIFLUORIDE plus Potassium Bromide.

**Sodium Chloride**
See BROMINE TRIFLUORIDE plus Potassium Bromide.

**Sodium Iodide**
See BROMINE TRIFLUORIDE plus Potassium Bromide.

**Stannous Chloride**
Bromine trifluoride and stannous chloride react with flame.
*Mellor* **2, Supp. 1:** 164 (1956).

**Sulfur**
See ANTIMONY plus Bromine Trifluoride.

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**Tantalum**
See NIOBIUM plus Bromine Trifluoride.

**Tantalum Pentoxide**
See BROMINE TRIFLUORIDE plus Bismuth Pentoxide.

**Tin**
See TIN plus Bromine Trifluoride.

**Titanium**
See MOLYBDENUM plus Bromine Trifluoride.

**Tungsten**
See MOLYBDENUM plus Bromine Trifluoride.

**Uranium Oxides**
The reaction between bromine trifluoride and oxides of uranium ($UO_2$ $UO_3$, and $U_3O_8$) is rapid and quantitative below the boiling point of bromine trifluoride.
*Mellor* **2, Supp. 1:** 165 (1956).

**Vanadium**
See MOLYBDENUM plus Bromine Trifluoride.

**Water**
Bromine trifluoride reacts violently with water.
*Handbook Chem. Phys.*, **47th Ed.:** B-160 (1966–1967).
Even at –50°C., water (present as 6-normal hydrochloric acid) reacted explosively with bromine trifluoride.
*Swanson* (1965).
See BROMINE MONOFLUORIDE plus Water.

## BROMOACETYLENE BrC≡CH

**Air**
During the preparation of solid bromoacetylene an explosion occurred when air was drawn into the Volman trap containing the solid bromoacetylene. Although it was well known that gaseous bromoacetylene reacts violently with oxygen at room temperature, the explosion of the solid material at minus 190°C was surprising.
*Chem. & Ind.* (3) (1972).

## 1-BROMOACETYLENES BrC≡CR

**(self-reactive)**
The 1-bromoacetylenes should not be distilled. They sometimes explode, even when distilled at reduced pressure.
*Rutledge,* p. 136 (1968).

## p-BROMOBENZOYL ACETANILIDE
p-$BrC_6H_4COC_6H_4NHCOCH_3$

**Dimethyl Sulfoxide**
After a solution of p-bromobenzoyl acetanilide in 600 ml of dimethyl sulfoxide had been heated on a steam bath (100°C) for 30 minutes, an explosion occurred.
*Wischmeyer* (1970).

## BROMOBENZYL TRIFLUORIDE $BrC_6H_4CF_3$

**Magnesium**
See MAGNESIUM plus Bromobenzyl Trifluoride.

## BROMODIBORANE $BrBH(H_2)BH_2$

**Air**
This compound burns with a pale green flame in air.
*Mellor* **5:** 37 (1946–1947).

## BROMODIETHYLALUMINUM $(C_2H_5)_2AlBr$

**Air**
Diethyl aluminum bromide ignites spontaneously in air, water, and alcohol.
*Chem. Eng. Progs.* **62** (12): 116 (1966).

**Alcohol**
See DIETHYL ALUMINUM BROMIDE plus Air.

**Water**
See DIETHYL ALUMINUM BROMIDE plus Air.

## 2-BROMO-3,5-DIMETHOXYANILINE
$NH_2C_6H_2Br(OCH_3)_2$

**(self-reactive)**
During a laboratory distillation of a mixture of 3, 5-dimethoxyaniline, 2-bromo-3, 5-dimethoxyaniline and dibromo 3,5-dimethoxyaniline an explosion occurred. It was traced to the instability of the brominated compounds.
*Wischmeyer* (1970).

## BROMOFORM $CHBr_3$

**Lithium**
See LITHIUM plus Bromoform.

**Sodium-Potassium Alloy**
See SODIUM-POTASSIUM ALLOY plus Bromoform.

## 3-BROMO-1-PROPYNE $CH{\equiv}CCH_2Br$

**(self-reactive)**
Pure propargyl bromide (aka 3-bromo-1-propyne) will decompose violently or detonate at temperatures as low as 220°C.
*Wischmeyer* (1966). R. D. Coffee and J. J. Wheeler, *Chem. Eng. Progr. Tech. Man.* **1:** 6–9 (1968).
Liquid propargyl bromide is easily ignited by impact from such possible sources as "water hammer" or accidental pressurization of the aerated liquid.
D. R. Forshey, J. C. Cooper, G. H. Martindill and J. M. Kuchta, *Fire Tech.* **5** (2): 100–111 (1969).

**Chloropicrin**
Tests at the Bureau of Mines showed the mixture to be shock sensitive.
Forshey, Cooper, Martindill, and Kuchta, *Fire Tech.* **5** (2): 100–111 (1969).

## BROMOSILANE $SiH_3Br$

**Air**
Bromosilane is spontaneously flammable in air.
*Handbook Chem. Phys.*, p. B-132 (1970–1971).

## BROMOTRICHLOROMETHANE $BrCCl_3$

**Ethylene**
During the uncatalyzed addition of bromotrichloromethane to ethylene a violent explosion occurred.
*BCISC* **33:** 131 (1962).
*Chem. Abst.* **57:** 9638 (1953).

## BROMOTRIFLUOROMETHANE $CBrF_3$

**Aluminum**
See ALUMINUM plus Dichlorodifluoromethane.



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**BRONZE**

**Hydrogen Peroxide**
See IRON plus Hydrogen Peroxide.

**BUNA N**

**Fluorine**
See FLUORINE plus Solid Nonmetals and Oxygen.

**BUTADIENE** $CH_2$=CHCH=$CH_2$; CH=C=$CHCH_3$

**(self-reactive)**
Butadiene, when heated under pressure, may undergo violent thermal decomposition.
*Chem. and Eng. News* **18:** 404 (1940).

**Air**
In contact with air, butadiene may form violently explosive peroxides, which can be exploded by mild heat or shock. Solid butadiene absorbs enough oxygen at subatmospheric pressures to make it explode violently when heated just above its melting point.
D. G. Hendry, F. R. Hendry and D. Scheutzle, *Ind. Eng. Chem. Prod. Res. Develop.* **7:** 145–151 (1968). D. G. Hendry et al, *Ind. Eng. Chem. Prod. Res. Develop.* **7:** 151–154 (1968). D. S. Alexander, *Ind. Eng. Chem.* **51:** 733 (1959).

**Chlorine Dioxide**
See CHLORINE DIOXIDE plus Butadiene.

**Crotonaldehyde**
The Diels-Alder reaction between these chemicals under pressure is a logical approach to the preparation of a number of cyclic aldehydes, alcohols, and hydrocarbons. A destructive explosion, including a secondary gas explosion, occurred in carrying out this reaction.
K. W. Greenlee, *Chem. and Eng. News* **26:** 1985 (1948).

**Phenol**
See PHENOL plus Butadiene.

**BUTADIYNE** HC≡C≡CCH

**Air**
In the preparation of butadiyne (aka diacetylene) by adding 1,4-dichloro-2-butyne to 10% sodium hydroxide and a little dioxane at 100°C, no difficulty was experienced if the free diacetylene was collected at minus 25°C and held below that temperature. At temperatures above minus 25°C explosions would occur.
*Rutledge,* pp. 134–135 (1968).

**n-BUTANE** $CH_3CH_2CH_2CH_3$

**Nickel Carbonyl and Oxygen**
See NICKEL CARBONYL plus n-Butane and Oxygen.

**1-BUTANETHIOL** $CH_3(CH_2)_2CH_2SH$

**Nitric Acid**
See NITRIC ACID plus Organic Matter.

**BUTYL ACETATE** $C_4H_9OCOCH_3$

**Potassium Tert.-Butoxide**
See ACETONE plus Potassium Tert.-Butoxide.

**t-BUTYL ALCOHOL** $(CH_3)_3COH$

**Hydrogen Peroxide**
See HYDROGEN PEROXIDE plus t-Butyl Peroxide.

**t-BUTYL AZIDOFORMATE** $(CH_3)_3COCONNN$

**Phosgene**
In the formation of tert-butyl azidoformate by the addition of phosgene to alcohols followed by the addition of sodium nitride or hydrazoic acid in the presence of pyridine, reaction of phosgene with the azide can cause the formation of explosive carbazide. To prevent the reaction complete removal of excess phosgene is advocated by passing nitrogen into the solution prior to addition of the azide.
*Chem. Abst.* **73:** 14099h (1970). *Chem. Phar. Bull.* **18** (4): 850–851 (1970).

**BUTYL DICHLOROBORANE** $C_4H_9BCl_2$

**Air**
Butyl boron dichloride is spontaneously flammable in air.
*Buls, Bimonthly Rept. 5,* p. 3 (1953).

**BUTYL FLUORIDE** $C_4H_9F$

**Magnesium Perchlorate**
See MAGNESIUM PERCHLORATE plus Butyl Fluoride.

**t-BUTYL HYPOCHLORITE** $CH_3C(CH_3)_2OCl$

**(self-reactive)**
Tertiary butyl hypochlorite requires very careful handling to avoid explosive decomposition under relatively mild conditions. At about 25°C., an ampoule containing 10 grams exploded violently after several minutes exposure to fluorescent and north window light.
*Chem. and Eng. News* **40** (42): 63 (1962).

**t-BUTYL PEROXYACETATE** $(CH_3)_3C$-OO-$COCH_3$

**(self-reactive)**
t-Butyl peracetate is sensitive to shock and heat.
*Haz. Chem. Data,* p. 77 (1973).

**Organic Matter**
Upon contact with t-butyl peracetate, combustible organic matter can ignite or give rise to an explosion.
*Haz. Chem. Data,* p. 77 (1973).

**t-BUTYL PEROXYBENZOATE** $(CH_3)_3C$-OO-$COC_6H_5$

**Organic Matter**
Organic substances can ignite or explode upon contact with t-butyl perbenzoate.
*Haz. Chem. Data* p. 79 (1973).

**BUTYLLITHIUM** $LiC_4H_9$

**Air**
Butyllithium above 20% in air can ignite spontaneously if the humidity exceeds 70%. Concentrations above 25% are pyrophoric at any humidity.
S. B. Mirviss *Ind. Eng. Chem.* **53** (1): Supp. 58A-60A (1961). *Handbook Chem. Phys.,* p. C-695 (1970–1971).

**BUTYNEDIOL** $HOCH_2C{\equiv}CCH_2OH$

**Halides**
See BUTYNEDIOL plus Hydroxides.

**Hydroxides**
Pure butynediol is nonexplosive. Small amounts of certain impurities — alkali hydroxides, alkaline earth hy-

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droxides, halides — may cause explosive decomposition upon distillation. Butynediol should not be treated with basic catalysts in the absence of a solvent at room temperature and still less so at elevated temperature; otherwise, uncontrollable decomposition may occur. In strong acids, contamination with mercury salts can also result in violent decomposition.
*Kirk & Othmer,* **Supp. II,** First Ed.: 45 (1960).

**Mercury Salts and Acid**
See BUTYNEDIOL plus Hydroxides.

## n-BUTYRALDEHYDE $CH_3(CH_2)_2CHO$

**Chlorosulfonic Acid**
Mixing n-butyraldehyde and chlorosulfonic acid in a closed container caused the temperature and pressure to increase.
*Flynn and Rossow* (1970). See Note under complete reference.

**Nitric Acid**
Mixing n-butyraldehyde and 70% nitric acid in a closed container caused the temperature and pressure to increase.
*Flynn and Rossow* (1970). See Note under complete reference.

**Oleum**
Mixing n-butyraldehyde and oleum in a closed container caused the temperature and pressure to increase.
*Flynn and Rossow* (1970). See Note under complete reference.

**Sulfuric Acid**
Mixing n-butyraldehyde and 96% sulfuric acid in a closed container caused the temperature and pressure to increase.
*Flynn and Rossow* (1970). See Note under complete reference.

## BUTYRIC ACID $C_4H_8O_2C_4H_8O_2$

**Chromium Trioxide**
A mixture of chromium trioxide and butyric acid became incandescent on heating to 100°C.
R. D. Wilson, *Chem. & Ind.* (1957).

## CADMIUM Cd

**Ammonium Nitrate**
See AMMONIUM NITRATE plus Metals (powdered).

**Hydrazoic Acid**
A violent explosion followed immersion of a cadmium rod in hydrazoic acid after about 30 minutes.
*Mellor* **8, Supp. 2:** 50 (1967).

**Tellurium**
See ZINC plus Selenium.

**Zinc**
See ZINC plus Selenium.

## CADMIUM AMIDE $Cd(NH_2)_2$

**Water**
Cadmium amide, when wetted, heats spontaneously and can explode.
*Mellor* **8:** 261 (1946–1947).

## CADMIUM AZIDE $Cd(N_3)_2$

**(self-reactive)**
This is an extremely hazardous substance, exploding when rubbed with a horn spatula.
*Mellor* **8, Supp. 2:** 25 (1967).

## CADMIUM BROMIDE $CdBr_2$

**Potassium**
See POTASSIUM plus Aluminum Bromide.

## CADMIUM CHLORATE $Cd(ClO_3)_2$

**Antimony Sulfide**
See CHLORATES plus Antimony Sulfide.

**Arsenic Sulfide**
See CHLORATES plus Arsenic Sulfide.

**Copper Sulfide**
See COPPER SULFIDE plus Cadmium Chlorate.

**Stannic Sulfide**
See STANNIC SULFIDE plus Cadmium Chlorate.

**Stannous Sulfide**
See STANNOUS SULFIDE plus Cadmium Chlorate.

## CADMIUM CHLORIDE $CdCl_2$

**Bromine Trifluoride**
See BROMINE TRIFLUORIDE plus Barium Chloride.

**Potassium**
See POTASSIUM plus Aluminum Bromide.

## CADMIUM CYANIDE $Cd(CN)_2$

**Magnesium**
See MAGNESIUM plus Cadmium Cyanide.

## CADMIUM FLUORIDE $CdF_2$

**Potassium**
See POTASSIUM plus Ammonium Bromide.

## CADMIUM-HEXAMMINE CHLORATE $Cd(NH_3)_6(ClO_3)_2$

**(self-reactive)**
This compound detonates when struck.
*Mellor* **2, Supp. 1:** 592 (1956).

## CADMIUM-HEXAMMINE PERCHLORATE $Cd(NH_3)_6\ (ClO_4)_2$

**(self-reactive)**
This compound detonates when struck, but is less sensitive than hexamminocadmium chlorate.
*Mellor* **2, Supp. 1:** 592 (1956).

## CADMIUM IODIDE $CdI_2$

**Potassium**
See POTASSIUM plus Aluminum Bromide.

## CADMIUM NITRIDE $Cd_3N_2$

**Acids**
Cadmium nitride reacts explosively with dilute acids and bases.
*Mellor* **8, Supp. I, Part 1:** 161 (1964).



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**Bases**
See CADMIUM NITRIDE plus Acids.

**Water**
Cadmium nitride explodes violently in contact with water.
*Mellor* **8:** 121, 122, 261 (1946–1947).

**CADMIUM OXIDE** CdO

**Magnesium**
See MAGNESIUM plus Beryllium Oxide.

**CADMIUM SULFIDE** CdS

**Iodine Monochloride**
See IODINE MONOCHLORIDE plus Cadmium Sulfide.

**CADMIUM-TRIHYDRAZINE CHLORATE**
$Cd(N_2H_4)_3(ClO_3)_2$

**(self-reactive)**
This compound detonates when struck.
*Mellor* **2, Supp. 1:** 592 (1956).

**CADMIUM-TRIHYDRAZINE PERCHLORATE**
$Cd(H_2NNH_2)_3(ClO_4)_2Cd$

**(self-reactive)**
This is an extremely explosive salt.
*Mellor* **8, Supp. 2:** 88 (1967).

**CALCIUM** Ca

**Acids**
Calcium reacts violently with acids.
*Lab. Govt. Chemist* (1965).

**Air**
Finely divided calcium burns spontaneously in air.
*Mellor* **3:** 637, 638, 651 (1946–1947).

**Chlorine**
Finely divided calcium burns spontaneously in chlorine. Solid calcium burns spontaneously in chlorine at elevated temperatures.
*Mellor* **3:** 637, 638, 651 (1946–1947).

**Chlorine Trifluoride**
Chlorine trifluoride combined with calcium or sodium forms a protective crust, but reaction is violent on heating.
*Mellor* **2, Supp. 1:** 156 (1956).

**Fluorine**
Finely divided or massive calcium burns spontaneously in fluorine at ordinary temperatures.
*Mellor* **3:** 637, 638, 651 (1946–1947).

**Oxygen**
Solid calcium ignites spontaneously in moist oxygen.
*Chem. and Eng. News* **26:** 1985 (1948).

**Silicon**
Calcium and silicon react violently if heated to 1,050°C.
*Mellor* **6:** 176, 177 (1946–1947).

**Sulfur**
A mixture of calcium and sulfur, when ignited, reacts explosively. Calcium burns in sulfur vapor with a brilliant flame. The reaction begins at about 400°C.
Perkin and Pratt, *Trans. Faraday Soc.* **3:** 176 (1908).
*Mellor* **3:** 639 (1946–1947).

**Vanadium Oxide, Sulfur and Water**
A mixture of calcium and vanadium oxide that was contaminated with sulfur and some moisture caused a severe fire.
*Poole* (1971).

**Water**
Calcium rapidly decomposes water. The heat of reaction is sufficient that the evolved hydrogen may ignite.
*Lab. Govt. Chemist* (1965).

**CALCIUM ALLOYS**

**Acids**
Calcium alloys react violently with acids.
*Lab. Govt. Chemist* (1965).

**Water**
Calcium alloys rapidly decompose water. The heat of reaction is sufficient that the evolved hydrogen may ignite.
*Lab. Govt. Chemist* (1965).

**CALCIUM BROMATE** $Ca(BrO_3)_2$

**Aluminum**
See ALUMINUM plus Bromates.

**Arsenic**
See ARSENIC plus Bromates.

**Carbon**
See CARBON plus Bromates.

**Copper**
See COPPER plus Bromates.

**Metal Sulfides**
See METAL SULFIDES plus Bromates.

**Organic Matter**
See BROMATES plus Organic Matter.

**Phosphorus**
See PHOSPHORUS plus Bromates.

**Sulfur**
See SULFUR plus Bromates.

**CALCIUM CARBIDE** $CaC_2$

**Hydrogen Chloride**
Calcium carbide reacts with hydrogen chloride gas with incandescence.
*Mellor* **5:** 862 (1946–1947).

**Lead Fluoride**
Calcium carbide mixed with lead fluoride, at ordinary temperatures, becomes incandescent.
*Mellor* **5:** 862–64 (1946–1947).

**Magnesium**
See MAGNESIUM plus Calcium Carbide.

**Potassium Hydroxide and Chlorine**
See DICHLOROACETYLENE plus Air.

**Selenium**
See SELENIUM plus Calcium Carbide.

**Silver Nitrate**
See SILVER NITRATE plus Calcium Carbide.

**Sodium Peroxide**
See SODIUM PEROXIDE plus Calcium Carbide.


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**Stannous Chloride**
See STANNOUS CHLORIDE plus Calcium Carbide.

**Sulfur**
See SULFUR plus Calcium Carbide.

**Water**
The reaction between calcium carbide and water can produce enough heat to ignite the acetylene that is formed.
G. W. Jones, G. S. Scott, R. E. Kennedy & W. J. Huff, *BM Report Invest.* **3755** (1944).
*Von Schwartz,* p. 142 (1918).

## CALCIUM CARBONATE $CaCO_3$

**Fluorine**
See FLUORINE plus Carbonates. See also FLUORINE plus Common Materials and Oxygen.

**Magnesium and Hydrogen**
See MAGNESIUM plus Hydrogen and Calcium Carbonate.

## CALCIUM CHLORATE $Ca(ClO_3)_2$

**Aluminum**
See ALUMINUM plus Bromates.

**Arsenic**
See ARSENIC plus Bromates.

**Carbon**
See CARBON plus Bromates.

**Charcoal**
See CHLORATES plus Organic Matter.

**Copper**
See COPPER plus Bromates.

**Manganese Dioxide**
See CHLORATES plus Manganese Dioxide.

**Metal Sulfides**
See METAL SULFIDES plus Bromates.

**Organic Acids (Dibasic)**
See CHLORATES plus Organic Acids.

**Organic Matter**
See CHLORATES plus Organic Matter.

**Phosphorus**
See PHOSPHORUS plus Bromates.

**Sulfur**
See SULFUR plus Bromates.

## CALCIUM CHLORIDE $CaCl_2$

**Boric Oxide and Calcium Oxide**
See BORIC OXIDE plus Calcium Oxide and Calcium Chloride.

**Bromine Trifluoride**
See BROMINE TRIFLUORIDE plus Barium Chloride.

**2-Furan**
See 2-FURAN PERCARBOXYLIC ACID

**Percarboxylic Acid**
(self-reactive).

## CALCIUM CHLORITE $Ca(OCl)_2$

**Chlorine**
See CHLORINE plus Calcium Chlorite.

## CALCIUM HEXAMMONIATE $Ca(NH_3)_6$

**Air**
Hexammino calcium is spontaneously flammable in air.
*Ellern* (1961).

## CALCIUM HYDRIDE $CaH_2$

**Air**
Calcium hydride burns fiercely in air when heated.
*Lab. Govt. Chemist* (1965). NSC *Nat. Saf. News* **77** (2): 37–40 (1958).

**Bromates**
See BROMATES plus Calcium Hydride.

**Chlorates**
See BROMATES plus Calcium Hydride.

**Perchlorates**
See BROMATES plus Calcium Hydride.

**Silver Fluoride**
See SILVER FLUORIDE plus Calcium Hydride.

## CALCIUM HYDROXIDE $Ca(OH)_2$

**Maleic Anhydride**
See SODIUM HYDROXIDE plus Maleic Anhydride.

**Nitroethane**
The nitroparaffins, in the presence of water, form salts with inorganic bases. The dry salts are explosive.
*Chem. and Eng. News* **30:** 2344 (1952).

**Nitromethane**
See CALCIUM HYDROXIDE plus Nitroethane.

**Nitroparaffins**
See CALCIUM HYDROXIDE plus Nitroethane.

**Nitropropane**
See CALCIUM HYDROXIDE plus Nitroethane.

**Phosphorus**
See PHOSPHORUS plus Alkaline Hydroxides.

## CALCIUM HYPOCHLORITE $Ca(OCl)_2$

**(See also HYPOCHLORITES)**

**Amines**
Primary amines and calcium hypochlorite or sodium hypochlorite react to form normal chloroamines, which are explosive.
*Kirk and Othmer* **1:** 709 (1947).

**Anthracene**
Anthracene heats on contact with calcium hypochlorite.
*Douglas and Thompson* (1949).

**Carbon**
See CALCIUM HYPOCHLORITE plus Charcoal.

**Carbon Tetrachloride**
A severe explosion occurred when a carbon tetrachloride fire extinguisher was used to extinguish a fire in an open container of calcium hypochlorite.
*NSC Newsletter, Chem. Sec.* (May 1972).



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**Charcoal**
A mixture of equal parts of bleaching powder and finely divided charcoal exploded when heated in a closed vessel.
*Halane — Prelim. Info. Sheet* (1953). *Mellor* **2:** 254–62 (1946–1947).

**Ethyl Alcohol**
A little calcium hypochlorite added to ethyl alcohol or glycerol will result in a violent explosion after a short time.
*Roblee* (1966).

**Glycerol**
When mixed with calcium hypochlorite, glycerol may ignite spontaneously.
H. Fawcett, *Ind. Eng. Chem.* **51:** 89A-90A (1959).
See also CALCIUM HYPOCHLORITE plus Ethyl Alcohol.

**Grease or Oil**
A metal scoop kept in a drum of calcium hypochlorite was contaminated with grease or oil. Reaction with the contaminant initiated the violent decomposition of the hypochlorite.
*MCA Case History* **663** (1960).

**Hydrochloric Acid**
Reaction of these two chemicals releases copious quantities of chlorine gas.
*Fawcett* (1969).

**Iron Oxide**
This material has been the cause of many serious accidents caused by explosions in the containers. Oxygen is evolved by reaction between the hypochlorite and oxide catalysts.
A. H. Gill, *Ind. Eng. Chem.* **16:** 577 (1924).

**Manganese Oxide**
See CALCIUM HYPOCHLORITE plus Iron Oxide.

**Mercaptans**
Calcium hypochlorite and mercaptans will react violently.
*Barrett* (1973).

**Methyl Carbitol**
Fire occurred when a bag of calcium hypochlorite was inadvertently placed on a methyl carbitol spill on the floor.
*Wischmeyer* (1965).

**Nitromethane**
Nitromethane, either alone or in a mixture with methanol and castor oil (model airplane fuel) has a delayed but violent reaction with powdered calcium hypochlorite, especially when confined, as in a plastic bag.
H. Fawcett, *Hazards Home Chem.* (1963).

**Organic Matter**
Calcium hypochlorite contaminated with one per cent of various common organic materials reacted when heated. The reaction varied from mild flame at 350°F. with wood, to violent explosion at 275°F. with oil.
*Halane — Prelim. Info. Sheet.*

**Organic Sulfides**
Dry calcium hypochlorite when mixed with organic sulfides causes a violent reaction with the possibility of a flash fire.
*Stephenson* (1973).

**Phenol**
This is an exothermic reaction producing toxic fumes, which may ignite.
H. Fawcett, *Ind. Eng. Chem.* **51:** 89A-90A (1959).

**1-Propanethiol**
An explosion occurred when 10 grams of calcium hypochlorite was dumped into a beaker containing 5 milliliters of 1-propanethiol. Identical results were obtained with ethanediol and isobutanethiol.
*R. E. Barrett* (1973).

**Propyl Mercaptan**
See CALCIUM HYPOCHLORITE plus Mercaptans.

**Sulfur**
See SULFUR plus Calcium Hypochlorite.

**Turpentine**
Calcium hypochlorite was placed in a turpentine can thought to be empty. A few minutes later reaction between the residual turpentine and the calcium hypochlorite resulted in an explosion.
*Benson* (1967).

## CALCIUM HYPOPHOSPHITE $Ca(H_2PO_2)_2$

**Air**
Calcium hypophosphite decomposes when heated, forming phosphine, a spontaneously flammable gas in air.
*Mellor* **8:** 881 (1946–1947).

**Nitric Acid**
The salt ignites when nitric acid is poured onto it.
*Mellor* **8:** 883 (1946–1947).

**Potassium Chlorate**
A mixture of calcium hypophosphite and potassium chlorate exploded when being ground with quartz in a mortar. The mixture of calcium hypophosphite and potassium chlorate can be caused to explode by shock, heat, spark or friction.
*Mellor* **8:** 881 (1946–1947).

## CALCIUM IODATE $Ca(IO_3)_2$

**Aluminum**
See ALUMINUM plus Bromates.

**Arsenic**
See ARSENIC plus Bromates.

**Carbon**
See CARBON plus Bromates.

**Copper**
See COPPER plus Bromates.

**Metal Sulfides**
See METAL SULFIDES plus Bromates.

**Organic Matter**
See BROMATES plus Organic Matter.

**Phosphorus**
See PHOSPHORUS plus Bromates.

**Sulfur**
See SULFUR plus Bromates.

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## CALCIUM-MANGANESE-SILICON

**Acids**
Calcium-manganese-silicon combinations evolve spontaneously flammable gas when in contact with acids.
*Lab. Govt. Chemist* (1965).

## CALCIUM NITRIDE $Ca_3N_2$

**Air**
Calcium nitride is spontaneously flammable in air.
*Von Schwartz,* p. 322 (1918).

**Bromine**
See BROMINE plus Calcium Nitride.

**Chlorine**
See CHLORINE plus Calcium Nitride.

## CALCIUM OXIDE (QUICKLIME) CaO

**Boric Oxide and Calcium Chloride**
See BORIC OXIDE plus Calcium Oxide and Calcium Chloride.

**Boron Trifluoride**
The reaction of calcium oxide and boron trifluoride forms a fused mass after warming.
*Mellor* **5:** 123 (1946–1947).

**Chlorine Trifluoride**
See CHLORINE TRIFLUORIDE plus Aluminum Oxide.

**Fluorine**
See FLUORINE plus Calcium Oxide.

**Hydrofluoric Acid**
Liquid hydrofluoric acid and calcium oxide react very violently.
*Mellor* **2, Supp. 1:** 129 (1956).

**Phosphorus Pentoxide**
Calcium oxide or sodium hydroxide reacts with phosphorus pentoxide extremely violently when initiated by local heating.
*Mellor* **8, Supp. 3:** 406 (1971).

**Water**
Addition of water to quicklime has generated temperatures as high as 800°C. (1,470°F.). Some reports describe the reaction as violent. Ignition of sulfur, gunpowder, wood, and straw by the heat of the quicklime-water reaction has been reported.
*Mellor* **3:** 673 (1946–1947). *Von Schwartz,* p. 325 (1918).

## CALCIUM PERCHROMATE $Ca_3(CrOO_3)_2$

**(self-reactive)**
Calcium perchromate is a buff-colored powder that explodes at 100°C.
*Mellor* **11:** 359 (1946–1947).

## CALCIUM PEROXIDE $CaO_2$

**Polysulfide Polymers**
Dry calcium peroxide floating on liquid polysulfide polymers containing mercaptan radicals caused flashing in small scale tests and ignition in plant scale processes.
*R. Davis* (1968).

## CALCIUM PHOSPHIDE $Ca_3P_2$

**Chlorine**
See CHLORINE plus Calcium Phosphide.

**Chlorine Monoxide**
See CHLORINE MONOXIDE plus Calcium Phosphide.

**Hydrochloric Acid**
Calcium phosphide and hydrochloric acid undergo a very energetic reaction.
*Mellor* **8:** 841 (1946–1947).

**Oxygen**
See SULFUR plus Calcium Phosphide.

**Sulfur**
See SULFUR plus Calcium Phosphide.

**Water**
The reaction forms phosphine which is a spontaneously flammable gas (in moist air).
*Von Schwartz,* p. 327 (1918). *Lab. Govt. Chemist* (1965). *Douda* (1966).
*Mellor* **8:** 841 (1946–1947).

## CALCIUM SILICIDE $CaSi_2$

**Acids**
Calcium silicide plus acids forms the gas, silicon hydride, which may ignite spontaneously in air.
*Lab. Govt. Chemist* (1965).

**Fluorine**
See FLUORINE plus Calcium Silicide.

## CALCIUM-SILICON

**Acids**
Calcium-silicon combinations evolve spontaneously flammable gas when in contact with acids.
*Lab. Govt. Chemist* (1965).

## CALCIUM SULFATE $CaSO_4$

**Aluminum**
See ALUMINUM plus Sulfates.

## CALCIUM SULFIDE CaS

**Lead Dioxide**
See BARIUM SULFIDE plus Lead Dioxide.

**Potassium Chlorate**
See BARIUM SULFIDE plus Lead Dioxide.

**Potassium Nitrate**
See BARIUM SULFIDE plus Lead Dioxide.

## CAMPHOR $C_{10}H_{16}O$

**Chromic Anhydride**
See CHROMIC ANHYDRIDE plus Naphthalene.

## CARBIDES

**(See also specific carbides as primary reactants or under other reactants)**

**Lithium**
See LITHIUM plus Carbides.

**Oxidizing Agents**
Mixtures of carbides and oxidizing agents are explosive.
*Mellor* **5:** 848 (1946–1947).



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**Sulfuric Acid**
See SULFURIC ACID plus Carbides.

**CARBOHYDRATES**

**Boron Triiodide**
See BORON TRIIODIDE plus Ethers.

**CARBON C**

**Ammonium Nitrate**
Explosions may occur when a mixture of these materials is heated.
*Mellor* **5:** 822 (1946–1947).

**Ammonium Perchlorate**
Ammonium perchlorate mixed with carbon (sugar charcoal) undergoes exothermic decomposition below 240°C. Above 240°C, the reaction produces mild explosions.
*Trans. Faraday Soc.* **56:** 581–90 (1960).

**Barium Bromate**
See CARBON plus Bromates.

**Barium Chlorate**
See CARBON plus Bromates.

**Barium Iodate**
See CARBON plus Bromates.

**Bromates**
A combination of finely divided carbon with finely divided bromates (also chlorates or iodates) of barium, calcium, magnesium, potassium, sodium, or zinc will explode with heat, percussion, and sometimes light friction.
*Mellor* **2:** 310 (1946–1947).

**Calcium Bromate**
See CARBON plus Bromates.

**Calcium Chlorate**
See CARBON plus Bromates.

**Calcium Hypochlorite**
See CALCIUM HYPOCHLORITE plus Charcoal.

**Calcium Iodate**
See CARBON plus Bromates.

**Chlorates**
See CARBON plus Bromates.

**Chlorine**
See CHLORINE plus Carbon (Activated).

**Chlorine and Chromyl Chloride**
See CHLORINE plus Chromyl Chloride and Carbon.

**Chlorine Monoxide**
There is an immediate explosion when charcoal is added to chlorine monoxide.
*Mellor* **5:** 824 (1946–1947).

**Fluorine**
See FLUORINE plus Carbon.

**2-Furan Percarboxylic Acid**
See 2-FURAN PERCARBOXYLIC ACID (self-reactive).

**Iodates**
See CARBON plus Bromates.

**Iodine Pentoxide**
Iodine pentoxide reacts explosively when warmed with carbon, sulfur, sugar, resin, or powdered combustible elements.
*Mellor* **2:** 295 (1946–1947).

**Lead Nitrate**
Lead nitrate reacts with brilliant sparks when projected on red-hot carbon.
*Mellor* **7:** 863 (1946–1947).

**Magnesium Bromate**
See CARBON plus Bromates.

**Magnesium Chlorate**
See CARBON plus Bromates.

**Magnesium Iodate**
See CARBON plus Bromates.

**Mercurous Nitrate**
At high temperature, a mixture of mercurous nitrate and carbon decomposes explosively.
*Mellor* **4:** 987 (1946–1947).

**Nitric Acid**
Pulverized carbon reacts violently with nitric acid.
*Pascal* **10:** 504 (1931–1934).

**Oils and Air**
Fatty oils are spontaneously flammable when distributed in activated carbon. The carbon enormously increases the surface of oil exposed to the air.
C. W. Bahme, *NFPA Quarterly* **45:** 341 (1952).
*Von Schwartz,* p. 326 (1918).

**Potassium and Air**
See POTASSIUM plus Carbon and Air.

**Potassium Bromate**
See CARBON plus Bromates.

**Potassium Chlorate**
See CARBON plus Bromates.

**Potassium Iodate**
See CARBON plus Bromates.

**Sodium Bromate**
See CARBON plus Bromates.

**Sodium Chlorate**
See CARBON plus Bromates.

**Sodium Iodate**
See CARBON plus Bromates.

**Sodium Sulfide**
Mixtures of sodium sulfide and carbon are susceptible to spontaneous heating.
C. A. Browne, *USDA Tech. Bull.* **141** (1929).
J. Creevy, *Chem. Age* **44:** 257 (1941).

**Zinc Bromate**
See CARBON plus Bromates.

**Zinc Chlorate**
See CARBON plus Bromates.

**Zinc Iodate**
See CARBON plus Bromates.

**Zinc Nitrate**
Zinc nitrate explodes when sprinkled on hot carbon.
*Mellor* **4:** 655 (1946–1947).


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## CARBONATES

**(See also specific carbonates under other reactants)**

**Aluminum**
See ALUMINUM plus Sodium Carbonate.

**Fluorine**
See FLUORINE plus Carbonates.

**Magnesium**
See MAGNESIUM plus Carbonates.

**Silicon**
See SILICON plus Alkali Carbonates.

## CARBON DIOXIDE $CO_2$

**Aluminum and Sodium Peroxide**
See ALUMINUM plus Sodium Peroxide and Carbon Dioxide.

**Cesium Monoxide**
See CESIUM MONOXIDE plus Carbon Dioxide.

**Diethyl Magnesium**
See DIETHYL MAGNESIUM plus Air.

**Lithium**
See LITHIUM plus Oxygen.
See LITHIUM plus Water.

**Lithium Acetylene Carbide Diammino**
See LITHIUM ACETYLENE CARBIDE DIAMMINO plus Carbon Dioxide.

**Magnesium and Sodium Peroxide**
See MAGNESIUM plus Sodium Peroxide and Carbon Dioxide.

**Potassium**
See POTASSIUM plus Carbon Dioxide.

**Potassium Acetylene Carbide**
See POTASSIUM ACETYLENE CARBIDE plus Carbon Dioxide.

**Sodium**
See SODIUM plus Carbon Dioxide.

**Sodium Carbide**
See SODIUM CARBIDE plus Carbon Dioxide.

**Sodium-Potassium Alloy**
See SODIUM-POTASSIUM ALLOY plus Carbon Dioxide.

**Titanium**
See TITANIUM plus Carbon Dioxide.

## CARBON DISULFIDE $CS_2$

**Aluminum**
See ALUMINUM plus Carbon Disulfide.

**Azides**
Carbon disulfide plus any of the azides produces violently explosive, extremely sensitive salts.
*Mellor* **8:** 338 (1946–1947).

**Cesium Azide**
See CARBON DISULFIDE plus Azides.

**Chlorine**
See CHLORINE plus Carbon Disulfide.

**Chlorine Monoxide**
See CHLORINE MONOXIDE plus Carbon Disulfide.

**Ethylene Diamine**
Mixing carbon disulfide and ethylene diamine in a closed container caused the temperature and pressure to increase.
*Flynn and Rossow* (1970). See Note under complete reference.

**Ethyleneimine**
Mixing carbon disulfide and ethyleneimine in a closed container caused the temperature and pressure to increase.
*Flynn and Rossow* (1970). See Note under complete reference.

**Fluorine**
See FLUORINE plus Carbon Disulfide.

**Lead Azide**
See CARBON DISULFIDE plus Azides.

**Lithium Azide**
See CARBON DISULFIDE plus Azides.

**Nitric Oxide**
See NITRIC OXIDE plus Carbon Disulfide.

**Nitrogen Dioxide**
See NITROGEN TETROXIDE plus Carbon Disulfide.

**Permanganates and Sulfuric Acid**
See PERMANGANATES plus Sulfuric Acid and Benzene.

**Potassium**
See POTASSIUM plus Carbon Disulfide.

**Potassium Azide**
See CARBON DISULFIDE plus Azides.

**Rubidium Azide**
See CARBON DISULFIDE plus Azides.

**Sodium Azide**
See CARBON DISULFIDE plus Azides.

**Zinc**
See ZINC plus Carbon Disulfide.

## CARBON MONOXIDE CO

**Bromine Trifluoride**
See BROMINE TRIFLUORIDE plus Carbon Monoxide.

**Cesium Monoxide**
See CESIUM MONOXIDE plus Carbon Dioxide.

**Chlorine Trifluoride**
See CHLORINE TRIFLUORIDE plus Ammonia.

**Iodine Heptafluoride**
See IODINE HEPTAFLUORIDE plus Carbon Monoxide.

**Lithium and Water**
See LITHIUM plus Carbon Monoxide and Water.

**Nitrogen Trifluoride**
See HYDROGEN plus Nitrogen Trifluoride.

**Oxygen**
See OXYGEN (LIQUID) plus Carbon Monoxide.

**Oxygen Difluoride**
See HYDROGEN plus Oxygen Difluoride.



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**Potassium and Oxygen**
See POTASSIUM plus Carbon Monoxide and Oxygen.

**Silver Oxide**
See SILVER OXIDE plus Carbon Monoxide.

**Sodium and Ammonia**
See SODIUM plus Carbon Monoxide and Ammonia.

**CARBON TETRABROMIDE** $CBr_4$

**Lithium**
See LITHIUM plus Bromoform.

**CARBON TETRACHLORIDE** $CCl_4$

**Allyl Alcohol**
See ALLYL ALCOHOL, plus Carbon Tetrachloride.

**Aluminum**
See ALUMINUM plus Carbon Tetrachloride.

**Aluminum Triethyl Sesquichlorides**
See ALUMINUM TRIETHYL plus Carbon Tetrachloride.

**Barium**
See BARIUM plus Carbon Tetrachloride.

**Benzoyl Peroxide and Ethylene**
See BENZOYL PEROXIDE plus Carbon Tetrachloride and Ethylene.

**Beryllium**
See BERYLLIUM plus Carbon Tetrachloride.

**Bromine Trifluoride**
See BROMINE TRIFLUORIDE plus Carbon Tetrachloride.

**Calcium Hypochlorite**
See CALCIUM HYPOCHLORITE plus Carbon Tetrachloride.

**Diborane**
A violent explosion occurred when carbon tetrachloride was used on a borane fire.
*Fawcett* (1973).

**Dimethyl Formamide**
See DIMETHYL FORMAMIDE plus Carbon Tetrachloride.

**Disilane**
See DISILANE plus Carbon Tetrachloride.

**Ethylene**
Ethylene and carbon tetrachloride can react explosively under high pressures in the presence of organic peroxide catalysts.
R. O. Bolt, *Chem. and Eng. News* **25:** 1866 (1947).
R. M. Joyce, *Chem. and Eng. News* **25:** 1866–7 (1947).

**Fluorine**
See FLUORINE plus Carbon Tetrachloride.

**Lithium**
See LITHIUM plus Trichlorotrifluoroethane.
See LITHIUM plus Carbon Tetrachloride.

**Magnesium**
See ALUMINUM plus Chloroform.

**Oxygen (Liquid)**
See OXYGEN (LIQUID) plus Chlorinated Hydrocarbons.

**Plutonium**
See PLUTONIUM plus Carbon Tetrachloride.

**Potassium**
See POTASSIUM plus Carbon Tetrachloride.
See POTASSIUM plus Boron Tribromide.

**Potassium Tert.-Butoxide**
See ACETONE plus Potassium Tert.-Butoxide.

**Silver Perchlorate and Hydrochloric Acid**
See SILVER PERCHLORATE plus Carbon Tetrachloride and Hydrochloric Acid.

**Sodium**
See SODIUM plus Carbon Tetrachloride.
See SODIUM plus Cobaltous Bromide.

**Sodium-Potassium Alloy**
See SODIUM-POTASSIUM ALLOY plus Carbon Tetrachloride.

**Tetrasilane**
See TETRASILANE plus Carbon Tetrachloride.

**Trisilane**
See TRISILANE plus Carbon Tetrachloride.

**Uranium**
See URANIUM plus Carbon Tetrachloride.

**Wax**
An explosion occurred when a stream of carbon tetrachloride (fire extinguisher) was directed on burning wax.
*Chem. and Eng. News* **25:** 1866, 2852 (1947).
*Chem. and Eng. News* **26:** 957 (1948).

**Zirconium**
See ZIRCONIUM plus Carbon Tetrachloride.

**CARBON TETRAIODIDE** $CI_4$

**Bromine Trifluoride**
See BROMINE TRIFLUORIDE plus Carbon Tetraiodide.

**CELLULOSE** $(C_6H_{12}O_5)_x$

**Bromine Pentafluoride**
See BROMINE PENTAFLUORIDE plus Acetic Acid.

**Fluorine**
See FLUORINE plus Cellulose.

**Hydrogen Peroxide**
See HYDROGEN PEROXIDE plus Cellulose.

**Sodium Hypochlorite**
See SODIUM HYPOCHLORITE plus Oxalic Acid.

**Sodium Nitrite**
See SODIUM NITRITE plus Cellulose.

**CERIUM** Ce

**Air**
See RARE EARTH METALS plus Air.

**Halogens**
See RARE EARTH METALS plus Halogens.

**Phosphorus**
Cerium or lanthanum and phosphorus react violently at 400°–500°C.
*Mellor* **8, Supp. 3:** 347, 252 (1971).

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**CERIUM HYDRIDE** $CeH_3$

**Air**
Cerium hydride is spontaneously flammable in air.
*Douda* (1966).

**CERIUM NITRIDE** CeN

**Acids**
Cerium nitride sometimes reacts violently with dilute acids.
*Mellor* **8:** 121 (1946–1947).

**Air**
With moist air, cerium nitride undergoes spontaneous, incandescent oxidation. If a few drops of water are added to the cerium nitride, the heat developed is adequate to ignite the ammonia and hydrogen evolved.
*Mellor* **8:** 121 (1946–1947).

**Water**
The reaction of cerium nitride and water can produce enough heat to ignite the hydrogen and ammonia being evolved.
*Mellor* **8:** 121 (1946–1947).

**CERIUM TETRAHYDROALUMINATE** $Ce(AlH_4)_3$

**Air**
Cerium aluminohydride is spontaneously flammable in air.
*Chem. Abst.* **49:** 766e (1955). J. Aubrey and G. Monnier, *Comp. Rend.* **238:** 2534–2535 (1954).

**CEROUS PHOSPHIDE** CeP

**Water**
The reaction of cerous phosphide, lanthanum phosphide, or neodymium phosphide and water liberates spontaneously flammable phosphine.
*Mellor* **8, Supp. 3:** 347, 342, 348 (1971).

**CESIUM** Cs

**Air**
Cesium is spontaneously flammable in air at room temperature, if the surface of the cesium is clean.
*Mellor* **2:** 468 (1946–1947).

**Chlorine**
Chlorine vapors and cesium, lithium, or rubidium react with luminous flame.
*Mellor* **2, Supp. 1:** 380 (1956).

**Oxygen**
Cesium burns spontaneously in dry oxygen.
*Mellor* **2:** 468 (1946–1947).

**Phosphorus**
See PHOSPHORUS plus Cesium.

**Water**
At 20°C. the heat of reaction is adequate to ignite the hydrogen liberated in the reaction between water and cesium.
*Mellor* **2:** 469 (1946–1947).

**CESIUM ACETYLIDE** $CsC_2H$

**Arsenic**
See ARSENIC plus Cesium Acetylene Carbide.

**Bromine**
See BROMINE plus Cesium Acetylene Carbide.

**Chlorine**
See CHLORINE plus Cesium Acetylene Carbide.

**Cupric Oxide**
Cesium acetylene carbide explodes on contact with lead dioxide or cupric oxide at 350°C.
*Mellor* **5:** 849 (1946–1947).

**Fluorine**
See CHLORINE plus Cesium Acetylene Carbide.
See FLUORINE plus Cesium Acetylene Carbide.

**Hydrogen Chloride**
Cesium acetylene carbide burns in hydrogen chloride gas.
*Mellor* **5:** 849 (1946–1947).

**Iodine**
See IODINE plus Cesium Acetylene Carbide.

**Lead Dioxide**
See CESIUM ACETYLENE CARBIDE plus Cupric Oxide.

**Nitrogen Dioxide**
Cesium acetylene carbide ignites at about 100°C. in nitrogen dioxide.
*Mellor* **5:** 848–50 (1946–1947).

**Phosphorus**
See PHOSPHORUS plus Cesium Acetylene Carbide.

**Sulfur Dioxide**
Cesium acetylene carbide reacts with sulfur dioxide at ordinary temperatures, with incandescence.
*Mellor* **5:** 848–50 (1946–1947).

**Sulfuric Acid**
Cesium acetylene carbide burns with sulfuric acid.
*Mellor* **5:** 849 (1946–1947).

**CESIUM AMIDE** $CsNH_2$

**Water**
The reaction between cesium amide and water in the presence of air proceeds with incandescence.
*Mellor* **8:** 256 (1946–1947).

**CESIUM AZIDE** $CsN_3$

**(self-reactive)**
Cesium azide decomposes at 326°C.
*Mellor* **8, Supp. 2:** 43 (1967).

**Carbon Disulfide**
See CARBON DISULFIDE plus Azides.

**CESIUM CARBIDE** $Cs_2C_2$

**Boron**
See SILICON plus Cesium Carbide.

**Ferric Oxide**
Ferric oxide is reduced with incandescence when gently heated with cesium carbide.
*Mellor* **5:** 849 (1946–1947).

**Hydrochloric Acid**
Cesium carbide ignites in contact with hydrochloric acid unless the acid is dilute.
*Mellor* **5:** 848 (1946–1947).

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**Iodine**
See IODINE plus Cesium Carbide.

**Nitric Acid**
A mixture of nitric acid and cesium carbide will explode.
*Mellor* **5:** 848 (1946–1947).

**Silicon**
See SILICON plus Cesium Carbide.

**CESIUM CHLORIDE** CsCl

**Bromine Trifluoride**
See BROMINE TRIFLUORIDE plus Barium Chloride.

**CESIUM FLUORIDE NITROSYL FLUORIDE COMPLEX** $CsF \cdot HNF_2$

**(self-reactive)**
This complex is an unstable compound at room temperature.
*Lawless and Smith,* pp. 39, 76 (1968).

**CESIUM HYDRIDE** CsH

**Acetylene**
In the presence of moisture, cesium hydride reacts vigorously, even at –60°C. When dry, no reaction occurs below 42°C.
*Mellor* **2:** 483 (1946–1947).

**Oxygen**
See OXYGEN plus Cesium Hydride.

**CESIUM MONOXIDE** $Cs_2O$

**Bromine**
See BROMINE plus Cesium Monoxide.

**Carbon Dioxide**
When heated, cesium monoxide burns in carbon monoxide or carbon dioxide.
*Mellor* **2:** 487 (1946–1947).

**Carbon Monoxide**
See CESIUM MONOXIDE plus Carbon Dioxide.

**Chlorine**
See BROMINE plus Cesium Monoxide.

**Fluorine**
See BROMINE plus Cesium Monoxide.

**Iodine**
See BROMINE plus Cesium Monoxide.

**Sulfur Dioxide**
Sulfur dioxide bleaches cesium monoxide at ordinary temperatures, and when heated the reaction is attended by incandescence.
*Mellor* **2:** 487 (1946–1947).

**Water**
Cesium monoxide is spontaneously flammable in air.
*Brauer* (1965).

**CESIUM NITRIDE** $Cs_3N$

**Air**
Cesium nitride burns in air and is readily attacked by chlorine, phosphorus, or sulfur.
*Mellor* **8:** 99, 101 (1946–1947).

**Chlorine**
See CESIUM NITRIDE plus Air.

**Phosphorus**
See CESIUM NITRIDE plus Air.

**Sulfur**
See CESIUM NITRIDE plus Air.

**CESIUM PERFLUOROPROPOXIDE** $CsOC_3F_7$

**Fluorine**
See FLUORINE plus Cesium Perfluoropropoxide.

**CESIUM PHOSPHIDE** $Cs_3P$

**Water**
Cesium phosphide reacts with water or moist air instantaneously to yield spontaneously flammable phosphine.
*Van Wazer* (1958).

**CESIUM SILICIDE** $Cs_2Si_2$

**Water**
The silicides of cesium, potassium, rubidium, and sodium ignite explosively in contact with water.
*Ellern,* p. 29 (1968). *Brauer* (1965).

**CHARCOAL** C

**(See also CARBON)**

**Air**
Charcoal is spontaneously flammable when freshly calcined.
*Von Schwartz,* p. 323 (1918).

**Air (Liquid)**
Explosions may occur when liquid air contacts organic matter. A cracked tube containing activated charcoal, when immersed in liquid air, caused a violent explosion.
J. Taylor, *J. Sci. Instr.* **5:** 24 (1928).

**Barium Chlorate**
See CHLORATES plus Organic Matter.

**Bromine Pentafluoride**
See ARSENIC plus Bromine Pentafluoride.

**Calcium Chlorate**
See CHLORATES plus Organic Matter.

**Calcium Hypochlorite**
See CALCIUM HYPOCHLORITE plus Charcoal.

**Chlorine Monoxide**
See CHLORINE MONOXIDE plus Charcoal.

**Chlorine Trifluoride**
See CHLORINE TRIFLUORIDE plus Charcoal.

**Fluorine**
See FLUORINE plus Common Materials and Oxygen.

**Hydrogen Peroxide**
See HYDROGEN PEROXIDE plus Charcoal.

**Magnesium Chlorate**
See CHLORATES plus Organic Matter.

**Oxygen and Wood**
See OXYGEN (LIQUID) plus Wood and Charcoal.

**Perchlorates**
See PERCHLORATES plus Charcoal.



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**Perchloric Acid**
See PERCHLORIC ACID plus Charcoal.

**Peroxides**
See SODIUM PEROXIDE plus Aniline.

**Phosphorus and Air**
See PHOSPHORUS plus Charcoal and Air.

**Potassium**
See POTASSIUM plus Charcoal.

**Potassium Chlorate**
See CHLORATES plus Organic Matter.

**Potassium Nitrate**
See POTASSIUM NITRATE plus Ammonium Chloride.

**Potassium Perchlorate**
See PERCHLORATES plus Charcoal.

**Ruthenium Tetroxide**
See RUTHENIUM TETROXIDE plus Charcoal.

**Silver Nitrate**
See SILVER NITRATE plus Charcoal.

**Sodium Chlorate**
See CHLORATES plus Organic Matter.

**Sodium Peroxide**
See SODIUM PEROXIDE plus Aniline.

**Sodium Peroxide and Silver Chloride**
See SODIUM PEROXIDE plus Silver Chloride and Charcoal.

**Sulfur**
See SULFUR plus Charcoal.

**Sulfur and Sodium Nitrate**
See SULFUR plus Sodium Nitrate and Charcoal.

**Water**
An explosion was reported when water was directed on charred (still smoldering) sunflower screenings. The probable cause is the so-called "water gas reaction." The reaction is the partial oxidation-reduction reaction between carbon and water to form carbon monoxide and hydrogen and proceeds only when the carbon phase is at temperatures of at least 700–800°C.

**Zinc Chlorate**
See CHLORATES plus Organic Matter.
See ZINC CHLORATE plus Charcoal.

## CHLORATES

**(See also specific chlorates as primary entries and under other reactants)**

**Acids**
All chlorates, when brought in contact with sulfuric acid or certain other strong acids, may give off chlorine dioxide, an explosive gas (See CHLORINE DIOXIDE, self-reactive). With concentrated sulfuric acid, a violent explosion is usual.
*Latimer and Hildebrand* (1940). *Von Schwartz,* p. 323 (1918).
Also see CHLORATES plus Organic Acids.

**Acids and Metals (powdered)**
See CHLORATES plus Metals (powdered).

**Aluminum**
See ALUMINUM plus Bromates.

**Antimony Sulfide**
Antimony sulfide reacts with incandescence with chlorates of cadmium, magnesium, or zinc.
*Mellor* **Supp. II, Part I:** 584 (1956).
A mixture of chlorates plus antimony sulfide, cyanides or thiocyanates explodes. The reaction may be caused by heat, shock, or friction.
*Von Schwartz,* p. 323 (1918). *Pieters,* p. 30 (1957).

**Arsenic**
See ARSENIC plus Bromates.

**Arsenic Sulfide**
Arsenic sulfide reacts with incandescence with chlorates of cadmium, magnesium, or zinc.
*Mellor* **Supp. II, Part I:** 584 (1956).

**Calcium Hydride**
See BROMATES plus Calcium Hydride.

**Carbon**
See CARBON plus Bromates.

**Charcoal**
See CHLORATES plus Organic Matter.

**Copper**
See COPPER plus Bromates.

**Copper Sulfide**
See COPPER SULFIDE plus Cadmium Chlorate.

**Cyanides**
See CHLORATES plus Antimony Sulfide.
See CYANIDES plus Chlorates. See POTASSIUM CYANIDE plus Sodium Chlorate.

**Manganese Dioxide**
A mixture of manganese dioxide plus chlorates of barium, calcium, magnesium, potassium, sodium, or zinc may liberate oxygen and heat explosively. The reaction may be originated by heat, shock, friction, age, or static electricity.
*Chem. and Eng. News* **30:** 3210. *Von Schwartz,* p. 323 (1918).

**Mercury Tetratriphosphide**
See MERCURY TETRATRIPHOSPHIDE plus Air.

**Metals (powdered)**
Some mixtures of chlorates and bromates with combustible substances, including powdered metals, are likely to ignite by friction or percussion. Strong acids have a very violent action on these substances and many mixtures of chlorates and combustible substances are set on fire if acted on by strong sulfuric acid.
*Lab. Govt. Chemist* (1965).

**Metal Sulfides**
See METAL SULFIDES plus Bromates. See COPPER SULFIDE plus Cadmium Chlorate.
See CHLORATES plus Antimony Sulfide.

**Organic Acids (Dibasic)**
When a mixture of chlorates and organic acids is heated above room temperature, explosive chlorine dioxide is evolved.
*U.S. Pat.* 2,338,268 (1944).

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**Organic Matter**
A mixture of organic matter plus barium chlorate, calcium chlorate, magnesium chlorate, potassium chlorate, sodium chlorate, or zinc chlorate may liberate oxygen and heat explosively. A similar reaction occurs when manganese dioxide, sulfur, or charcoal is combined with these chlorates.
*Chem. and Eng. News* **30:** 3210. *Von Schwartz,* p. 323 (1918).

**Phosphonium Iodide**
See PHOSPHONIUM IODIDE plus Bromates.

**Phosphorus**
See PHOSPHORUS plus Bromates.
See PHOSPHORUS plus Chlorates.

**Potassium Cyanide**
A mixture of potassium cyanide and chlorates reacts explosively.
*Bahme,* p. 30 (1961).

**Selenium**
See SELENIUM plus Chlorates.

**Sodium Hypophosphite**
Mixtures of sodium hypophosphite and chlorates or nitrates will explode if moistened, then dried slowly over flame.
*Chem. and Eng. News* **25:** 3176–77 (1947).

**Strontium Hydride**
See BROMATES plus Strontium Hydride.

**Sulfur**
See SULFUR plus Chlorates. See CHLORATES plus Organic Matter.

**Sulfur and Copper**
See SULFUR plus Chlorates and Copper.

**Sulfur Dioxide**
Dry sulfur dioxide reacts on chlorates with evolution of chlorine peroxide which will flash at 60°C. and can explode.
*Mellor* **10:** 217 (1946–1947).

**Sulfuric Acid**
See CHLORATES plus Acids. See also SULFURIC ACID plus Carbides. See SODIUM CHLORATE plus Sulfuric Acid.
The reaction of chlorates and sulfuric acid (to form chlorine dioxide) may cause explosions.
*Mellor* **2, Supp. 1:** 521 (1956).

**Sulfuric Acid and Metals**
See CHLORATES plus Metals (powdered).

**Thiocyanates**
See THIOCYANATES plus CHLORATES.
See CHLORATES plus Antimony Sulfide.

**Zinc**
See ZINC plus Chlorates.

## CHLORIC ACID $HClO_3$

**(self-reactive)**
Concentrations of chloric acid above 40% decompose.
*Mellor* **2, Supp. 1:** 576 (1956).

**Ammonia**
See ANTIMONY plus Chloric Acid.

**Antimony**
See ANTIMONY plus Chloric Acid.

**Antimony Sulfide**
See ANTIMONY SULFIDE plus Chloric acid.

**Arsenic Sulfide**
See ARSENIC SULFIDE plus Chloric Acid.

**Bismuth**
See ANTIMONY plus Chloric Acid.

**Copper Sulfide**
See COPPER SULFIDE plus Cadmium Chlorate.

**Organic Matter**
Chloric acid decomposes many organic substances with spontaneous ignition.
*Mellor* **2:** 310 (1946–1947).
See ANTIMONY plus Chloric Acid.

**Phosphonium Iodide**
See PHOSPHONIUM IODIDE plus Bromic Acid.

**Stannic Sulfide**
See STANNIC SULFIDE plus Chloric Acid.

**Stannous Sulfide**
See STANNOUS SULFIDE plus Chloric Acid.

## CHLORINATED HYDROCARBONS

**Aluminum**
See ALUMINUM plus Chlorinated Hydrocarbons.

**Oxygen (liquid)**
See OXYGEN (LIQUID) plus Chlorinated Hydrocarbons.

**Potassium**
See POTASSIUM plus Chlorinated Hydrocarbons.

**Sodium**
See SODIUM plus Chlorinated Hydrocarbons.

## CHLORINATED POLYETHYLENE

**Fluorine**
See FLUORINE plus Solid Nonmetals and Oxygen.

## CHLORINE $Cl_2$

**Acetaldehyde**
See BROMINE plus Acetaldehyde.

**Acetylene**
Acetylene can react explosively with chlorine.
*Von Schwartz,* p. 142 (1918).

**Alcohols**
See ALCOHOLS plus Hypochlorous Acid.

**Alkylisothiourea Salts**
On long contact or with excess chlorine, explosions occur due to the formation of unstable nitrogen trichloride.
*J. Am. Chem. Soc.* **63:** 3520 (1941).

**Alkylphosphines**
Unless precautions are taken, the reaction of chlorine with alkylphosphines or dialkylphosphines is a vigorous decomposing reaction.
*Mellor* **8, Supp. 3:** 900 (1971).

**Aluminum**
See ALUMINUM plus Chlorine.


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**Ammonia**
Ammonia plus chlorine (with heat) explodes due to the formation of extremely sensitive nitrogen trichloride. Excess chlorine (without heat) reacts similarly.
*Mellor* **2:** 95 (1946–1947). *Mathieson Chlorine* (1948). *Mellor* **8, Supp. 2:** 330 (1964).

**Antimony**
See ANTIMONY plus Chlorine.

**Arsenic**
See ARSENIC plus Chlorine.

**Arsenic Disulfide**
Arsenic disulfide ignites in a rapid stream of chlorine.
*Mellor* **9:** 270 (1946–1947).

**Arsine**
When chlorine is bubbled into arsine, each bubble produces a flame.
*Mellor* **9:** 55 (1946–1947).
*Mellor* **2, Supp. 1:** 379 (1956).

**Barium Phosphide**
The phosphide ignites in chlorine at 90°C.
*Mellor* **8, Supp. 3:** 842 (1971).

**Benzene**
An explosion of benzene vapors and chlorine (inadvertently mixed) was initiated by light.
*Report, Amer. Potash and Chemical Co.*

**Bismuth**
See BISMUTH plus Chlorine.

**Boron**
See BORON plus Chlorine.

**Boron Phosphodiiodide**
Powdered magnesium and boron phosphodiiodide react with incandescence.
*Mellor* **8:** 845 (1946–1947).

**Boron Trisulfide**
Boron trisulfide ignites in chlorine, even if cold.
*Mellor* **5:** 144 (1946–1947).

**Brass**
Brass burns spontaneously in gaseous chlorine.
*Mellor* **2:** 95, 292; **9:** 626 (1946–1947).

**Bromine Pentafluoride**
Mixture of chlorine and bromine pentafluoride explodes on heating.
*Mellor* **2, Supp. 1:** 173 (1956).

**Calcium**
See CALCIUM plus Chlorine.

**Calcium Carbide and Potassium Hydroxide**
See DICHLOROACETYLENE plus Air.

**Calcium Chlorite**
The reaction of chlorine and a dilute solution of calcium chlorite evolves explosive chlorine dioxide.
*Mellor* **2, Supp. 1:** 382 (1956).
See also CHLORINE DIOXIDE (self-reactive).

**Calcium Nitride**
Calcium nitride reacts in the cold with chlorine, with incandescence.
*Mellor* **8:** 99 (1946–1947).

**Calcium Phosphide**
Mixtures of chlorine and calcium phosphide react readily at about 100°C.
*Mellor* **8:** 841 (1946–1947).

**Carbon (Activated)**
The mixture spontaneously ignites in the dry state.
*Bahme,* p. 28 (1961).

**Carbon Disulfide**
When liquid chlorine was added to carbon disulfide in an iron cylinder, the iron catalyzed an explosive reaction.
*MCA Case History* **971** (1964).

**Cesium**
See CESIUM plus Chlorine.

**Cesium Acetylene Carbide**
Cesium acetylene carbide burns in cold chlorine or fluorine.
*Mellor* **5:** 849 (1946–1947).

**Cesium Monoxide**
See BROMINE plus Cesium Monoxide.

**Cesium Nitride**
See CESIUM NITRIDE plus Air.

**Chromyl Chloride and Carbon**
The reaction of a mixture of chlorine and chromyl chloride with red-hot carbon sometimes causes a violent reaction or explosion.
*Mellor* **11:** 395 (1946–1947).

**Copper**
See COPPER plus Chlorine.

**Copper Hydride**
See BROMINE plus Copper Hydride.

**Cuprous Acetylide**
See BROMINE plus Cuprous Acetylide.

**Dialkylphosphines**
See CHLORINE plus Alkylphosphines.

**Diborane**
Diborane explodes in contact with chlorine at ordinary temperatures.
*Mellor* **5:** 37 (1946–1947).

**Dibutyl Phthalate**
See CHLORINE plus Polypropylene.

**Diethyl Ether**
When ether is poured into chlorine gas an explosion results.
*Bernthsen* (1912).

**Diethyl Zinc**
Diethyl zinc is spontaneously flammable in air or chlorine.
*Handbook Chem. Phys.,* p. C-715 (1970–1971).

**Drawing Wax**
See CHLORINE plus Polypropylene

**Ethane**
Chlorine and ethane have produced explosions.
*Chem. Abst.* **31:** 85025 (1937). W. W. Lawrence and S. E. Cook, *Ind. Eng. Chem. Proc. Dev.* **9** (1): 47–49 (1970).

**Ethylene**
Ethylene reacts explosively with chlorine in sunlight or ultraviolet light.
*Haz. Chem. Data* (1966).



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The reaction of chlorine and ethylene is explosive at room temperature over yellow mercuric oxide, mercurous oxide, or silver oxide.
*Mellor* **2, Supp. 1:** 380 (1956).

**Ethyleneimine**
Ethyleneimine plus chlorine forms an explosive compound, 1-chloroethyleneimine.
*Ethyleneimine.*

**S-Ethyl Isothiourea Sulfate**
An explosion occurred during the chlorination of S-ethyl isothiourea sulfate and formamidine thiolacetic acid·HCl. Formation of spontaneously explosive nitrogen trichloride was the suggested cause.
*J. Am. Chem. Soc.* **63:** 3530–32 (1941).

**Ethyl Phosphine**
A mixture of ethyl phosphine and chlorine explodes.
*Von Schwartz,* pp. 324, 325 (1918).

**Fluorine**
Reaction of chlorine and fluorine is accompanied by flames. In the presence of a spark, a violent explosion occurs.
*Mellor* **2, Supp. 1:** 58 (1956).

**Formamidine Thiolacetic Acid·HCl**
See CHLORINE plus S-Ethyl Isothiourea Sulfate.

**Germanium**
See GERMANIUM plus Chlorine.

**Glycerol**
See CHLORINE plus Polypropylene.

**Hydrazine**
Hydrazine ignites in contact with chlorine.
*Mellor* **8:** 313 (1946–1947).

**Hydrocarbons**
In a chemical process, chlorine inadvertently contacted hydrocarbon vapors at about 60 psig. An explosion ruptured the pipeline.
*MCA Case History* **1035** (1964).
Chlorine reacts vigorously with most hydrocarbons, causing ignition with some, e.g., turpentine.
*Mathieson Chlorine. Mellor* **2, Supp. I:** 404.
During treatment of naphtha with an aqueous caustic-hypochlorite solution to remove objectionable odors, an explosion occurred in the mixer. Just before the detonation, liquid chlorine had been added to strengthen the hypochlorite solution. The explosion is attributed to the highly exothermic liquid phase reaction of chlorine and saturated hydrocarbons.
*Chem. Eng. Progs.* **58(6):** 71–74 (1962).
*Mellor* **2, Supp. 1:** 380 (1956).

**Hydrogen**
A mixture of hydrogen and chlorine is exploded by almost any form of energy (heat, sunlight, sparks, etc.). Explosive range: 5% to 95%.
*Mathieson Chlorine.*

**Hydrogen Peroxide and Potassium Hydroxide**
Red luminescence occurs during reaction of chlorine and hydrogen peroxide in strong potassium hydroxide solution.
*Mellor* **2, Supp. 1:** 378 (1956).

**Hydroxylamine**
Hydroxylamine is spontaneously flammable in chlorine.
*Mellor* **8:** 288 (1946–1947).

**Iodine**
The reaction of liquid chlorine and iodine is violent.
*Mellor* **2, Supp. 1:** 378 (1956).

**Iron**
See IRON plus Chlorine.

**Iron Carbide**
Iron carbide burns in chlorine below 100°C with incandescence and behaves similarly with bromine at about 100°C.
*Mellor* **5:** 858 (1946–1947).

**Linseed Oil**
See CHLORINE plus Polypropylene.

**Lithium**
See CESIUM plus Chlorine.

**Lithium Acetylene Carbide Diammino**
See LITHIUM ACETYLENE CARBIDE DIAMMINO plus Carbon Dioxide.

**Lithium Carbide**
See BROMINE plus Lithium Carbide.

**Lithium Silicide**
See FLUORINE plus Lithium Silicide.

**Magnesium**
See MAGNESIUM plus Chlorine.

**Magnesium Phosphide**
Magnesium phosphide burns brilliantly when heated in chlorine or bromine vapors.
*Mellor* **8:** 842 (1946–1947).

**Manganese**
See MANGANESE plus Chlorine.

**Manganese Ditritaphosphide**
This phosphide ignites when gently heated in chlorine.
*Mellor* **8:** 853 (1946–1947).

**Mercuric Oxide**
Chlorine reacts rapidly at room temperature with both mercuric oxide and silver oxide.
*Mellor* **2, Supp. 1:** 381 (1956).

**Mercuric Sulfide**
Mercuric sulfide burns in chlorine with incandescence.
*Mellor* **4:** 952 (1946–1947).

**Mercury**
See MERCURY plus Chlorine.

**Mercury Tetratriphosphide**
See MERCURY TETRATRIPHOSPHIDE plus Air.

**Methane**
The reaction of chlorine and methane is explosive at room temperature over yellow mercuric oxide.
*Mellor* **2, Supp. 1:** 380 (1956).

**Niobium (Columbium)**
See NIOBIUM plus Chlorine.
See NIOBIUM plus Fluorine.

**Nitrogen Triiodide**
See BROMINE plus Nitrogen Triiodide.


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**Oxomonosilane**
The polymer of oxomonosilane ignites in air or chlorine.
*Mellor* **6:** 234 (1946–1947).

**Oxygen Difluoride**
The reaction between chlorine and oxygen difluoride produces a reddish-brown solid that explodes at about minus 10°C.
*Mellor* **2, Supp. 1:** 182 (1956).
A mixture of chlorine and oxygen fluoride explodes on gentle warming. Puffs or more violent explosions occur if mixture is in copper tubing at 300°C.
*Mellor* **2, Supp. 1:** 192 (1956).

**Oxygen Difluoride and Copper**
See CHLORINE plus Oxygen Difluoride.

**Phosphine**
See BROMINE plus Phosphine.

**Phosphorus**
See PHOSPHORUS plus Chlorine.

**Phosphorus and Heptane**
See PHOSPHORUS plus Chlorine and Heptane.

**Phosphorus Isocyanate**
The reaction of phosphorus isocyanate and chlorine is vigorous, forming a yellow oil.
*Mellor* **8, Supp. 3:** 585 (1971).

**Phosphorus Oxide**
When phosphorus oxide is thrown into a jar of chlorine vapor, it ignites instantly. It reacts violently with liquid bromine and generally ignites.
*Mellor* **8:** 897 (1946–1947).

**Phosphorus Trioxide**
See BROMINE plus Phosphorus Trioxide.

**Polychlorinated Biphenyl**
Liquid chlorine reacts exothermically with polychlorinated biphenyl heat transfer liquid.
W. A. Statesir, *Chem. Eng. Progs.* **69** (4): 52–54 (1973).

**Polydimethylsiloxane**
See CHLORINE plus Polypropylene.

**Polypropylene**
Liquid chlorine reacts explosively with polypropylene, drawing wax, polydimethyl-siloxane, dibutyl phthalate, glycerol, and linseed oil.
W. A. Statesir, *Chem. Eng. Progs.* **69** (4): 52–54 (1973).

**Potassium**
See POTASSIUM plus Chlorine.

**Potassium Acetylene Carbide**
Potassium acetylene carbide ignites spontaneously in cold chlorine, forming hydrogen chloride plus carbon.
*Mellor* **5:** 849 (1946–1947) *Comp. Rend.* **127:** 916. *Comp. Rend.* **136:** 1220.

**Potassium Hydride**
Potassium hydride burns in fluorine or chlorine spontaneously.
*Mellor* **2:** 483 (1946–1947).

**Rubber**
Rubber will burn in liquid chlorine. During chlorination of rubber, an explosion occurred causing pressure of over 1,100 psi.
*Chem. and Eng. News* **26:** 3369.

**Rubidium**
See CESIUM plus Chlorine.

**Rubidium Acetylene Carbide**
See BROMINE plus Rubidium Acetylene Carbide.

**Silicon**
See SILICON plus Chlorine.

**Silicon Hydride**
Silicon hydride ignites in a chlorine atmosphere.
*Mellor* **6:** 219 (1946–1947).

**Silver Oxide**
See CHLORINE plus Mercuric Oxide.

**Sodium**
See SODIUM plus Chlorine.

**Sodium Acetylene Carbide**
See BROMINE plus Sodium Acetylene Carbide.

**Sodium Carbide**
See SODIUM CARBIDE plus Carbon Dioxide.
This carbide burns in chlorine gas.
*Mellor* **5:** 848 (1946–1947).

**Sodium Hydride**
Sodium hydride is spontaneously flammable in fluorine. With chlorine, moisture must also be present.
*Mellor* **2:** 483 (1946–1947).

**Stannous Fluoride**
The reaction of chlorine and stannous fluoride occurs with flaming.
*Mellor* **2, Supp. 1:** 382 (1956).

**Stibine**
See STIBINE plus Ammonia.

**Strontium Phosphide**
Mixtures of these materials ignite at about 30°C.
*Mellor* **8:** 841 (1946–1947).

**Sulfamic Acid**
An explosion occurred when chlorine was being passed at room temperature into a reaction mixture which included sulfamic acid and water. It is suspected that nitrogen trichloride, a very sensitive explosive, was formed.
*Short* (1966).

**Tellurium**
Warm chlorine attacks tellurium with incandescence.
*Mellor* **11:** 26, 40 (1946–1947).

**Tetramethyl Diarsine**
Tetramethyl diarsine is spontaneously flammable in chlorine.
*ACS* **15** (1923).

**Thorium**
See THORIUM plus Chlorine.

**Tin**
See TIN plus Chlorine.

**Tungsten Dioxide**
When tungsten dioxide is heated in chlorine the reaction occurs with incandescence.
*Mellor* **11:** 851 (1946–1947).

**Turpentine**
See CHLORINE plus Hydrocarbons.



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**Uranium**
Uranium ignites spontaneously if chlorine is heated to 150°C.
*Mellor* **12:** 31, 32 (1946–1947).

**Uranium Dicarbide**
See BROMINE plus Uranium Dicarbide.

**Vanadium**
Powdered vanadium explodes with chlorine, even at 0°C.
*Mellor* **Supp. II, Part I:** 715 (1956).

**Zinc**
See ZINC plus Chlorine.

**Zirconium Dicarbide**
See BROMINE plus Zirconium Dicarbide.

## CHLORINE AZIDE $N_3Cl$

**(self-reactive)**
Chlorine azide is spontaneously explosive.
*Mellor* **8:** 336 (1946–1947).
*Mellor* **8, Supp. 2:** 50 (1967).

**Butadiene-1, 3**
Chlorine dioxide mixed with butadiene, ethane, ethylene, methane or propane always explodes spontaneously.
J. K. K. Ip and P. Gray, *Comb. & Flame* **19:** 117–129 (1972).

**Ethane**
See CHLORINE DIOXIDE plus Butadiene.

**Ethylene**
See CHLORINE DIOXIDE plus Butadiene.

**Methane**
See CHLORINE DIOXIDE plus Butadiene.

**Propane**
See CHLORINE DIOXIDE plus Butadiene.

## CHLORINE FLUOROXIDE ClOF

**(self-reactive)**
Chlorine fluoroxide is explosively unstable.
*Mellor* **2, Supp. 1:** 182 (1956).

## CHLORINE MONOFLUORIDE ClF

**Organic Matter**
See BROMINE MONOFLUORIDE plus Water.

**Water**
See BROMINE MONOFLUORIDE plus Water.

## CHLORINE DIOXIDE $ClO_2$

**(self-reactive)**
With over 10% chlorine dioxide in air at pressures from 0.1 to 1.0 atmosphere, chlorine dioxide is violently explosive. Explosion may be initiated by almost any form of energy such as sunlight, heat, or sparks.
*Chem. and Eng. News* **29:** 5030 (1951).

**Difluoroamine**
The gas phase reaction of chlorine dioxide and difluoroamine is explosive.
*Lawless and Smith,* p. 171 (1968).

**Fluorine**
See FLUORINE plus Chlorine Dioxide.

**Mercury**
See MERCURY plus Chlorine Dioxide.

**Organic Matter**
Organic material in contact with chlorine dioxide can be exploded by shock or sparks.
R. F. Stedman, *Chem. and Eng. News* **29:** 5030 (1951).

**Phosphorus**
See PHOSPHORUS plus Chlorine Dioxide.

**Potassium Hydroxide**
See POTASSIUM HYDROXIDE plus Chlorine Dioxide.

**Sugar**
See SULFUR plus Chlorine Dioxide.

**Sulfur**
See SULFUR plus Chlorine Dioxide.

## CHLORINE FLUORIDE ClF

**Tellurium**
See TELLURIUM plus Chlorine Fluoride.

## CHLORINE MONOXIDE $Cl_2O$

**(self-reactive)**
Chlorine monoxide is highly explosive if heated rapidly or overheated locally.
*Mellor* **2, Supp. 1:** 517 (1956).

**Ammonia**
A mixture of chlorine monoxide and ammonia explodes.
*Mellor* **2:** 241, 242 (1946–1947).

**Antimony**
See POTASSIUM plus Chlorine Monoxide.

**Antimony Sulfide**
See CHLORINE MONOXIDE plus Calcium Phosphide.

**Arsenic**
See POTASSIUM plus Chlorine Monoxide.

**Barium Sulfide**
See CHLORINE MONOXIDE plus Calcium Phosphide.

**Calcium Phosphide**
Calcium phosphide causes chlorine monoxide to explode; chlorine monoxide also causes explosions with sulfides of barium, tin, antimony and mercury.
*Mellor* **2:** 242 (1946–1947).

**Carbon**
See CHLORINE MONOXIDE plus Charcoal.

**Carbon Disulfide**
Chlorine monoxide explodes in contact with carbon disulfide vapor.
*Mellor* **6:** 110 (1946–1947).

**Charcoal**
An immediate explosion occurs when charcoal is added to chlorine monoxide.
*Mellor* **5:** 822–30 (1946–1947).

**Hydrogen Sulfide**
A mixture of chlorine monoxide and hydrogen sulfide explodes.
*Mellor* **2:** 241–42 (1946–1947).

**Mercury Sulfide**
See CHLORINE MONOXIDE plus Calcium Phosphide.


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**Metal Sulfides**
See CHLORINE MONOXIDE plus Calcium Phosphide.

**Nitric Oxide**
A mixture of nitric oxide and chlorine monoxide can be explosive.
*Ann. Chim. et Phys.* (2) **57:** 225.

**Organic Matter**
Chlorine monoxide often explodes violently in contact with organic compounds.
*Mellor* **2, Supp. 1:** 520 (1956).
See POTASSIUM plus Chlorine Monoxide.

**Phosphine**
Chlorine monoxide explodes on contact with phosphine.
*Taylor* (1831).

**Phosphorus**
See CHLORINE MONOXIDE plus Calcium Phosphide.

**Sulfur**
See POTASSIUM plus Chlorine Monoxide.

**Tin Sulfides**
See CHLORINE MONOXIDE plus Calcium Phosphide.

**Turpentine**
See POTASSIUM plus Chlorine Monoxide.

## CHLORINE TRIFLUORIDE $ClF_3$

**Acetic Acid**
The reaction between chlorine trifluoride and acetic acid is very violent, sometimes explosive.
*Mellor* **2, Supp. 1:** 155 (1956).

**Aluminum**
See ALUMINUM plus Chlorine Trifluoride.

**Aluminum Oxide**
Chlorine trifluoride reacts violently, producing flame, with aluminum oxide, calcium oxide, chromium oxide, lead dioxide, magnesium oxide, manganese dioxide, molybdenum trioxide, tantalum pentoxide, tungsten trioxide, or vanadium pentoxide.
*Mellor* **2, Supp. 1:** 157 (1956).
See also CHLORINE TRIFLUORIDE plus Elements.

**Ammonia**
Chlorine trifluoride causes an explosive reaction with ammonia, carbon monoxide, hydrogen sulfide, sulfur dioxide, or hydrogen.
*Mellor* **2, Supp. 1:** 157 (1956).

**Antimony**
See ANTIMONY plus Chlorine Trifluoride.

**Arsenic**
See ANTIMONY plus Chlorine Trifluoride.

**Arsenic Trioxide**
Chlorine trifluoride produces a violent reaction without flame in presence of arsenic trioxide, bismuth trioxide, lanthanum oxide, phosphorus pentoxide, or stannic oxide.
*Mellor* **2, Supp. 1:** 157 (1956).
See also CHLORINE TRIFLUORIDE plus Elements.

**Benzene**
The reaction between chlorine trifluoride and benzene is very violent, sometimes explosive.
*Mellor* **2, Supp. 1:** 155 (1956).

**Bismuth Trioxide**
See CHLORINE TRIFLUORIDE plus Arsenic Trioxide.

**Calcium**
See CALCIUM plus Chlorine Trifluoride.

**Calcium Oxide**
See CHLORINE TRIFLUORIDE plus Aluminum Oxide.

**Carbon Monoxide**
See CHLORINE TRIFLUORIDE plus Ammonia.

**Charcoal**
Chlorine trifluoride causes charcoal, glass wool (rapidly etched with traces of moisture), or graphite to burst into flame.
*Mellor* **2, Supp. 1:** 157 (1956).

**Chlorotrifluoroethylene Polymer (Kel-F Oil) and Water**
While chlorine trifluoride was being passed through Kel-F Oil for disposal the inadvertent introduction of moisture set up the exothermic water-plus-chlorine trifluoride reaction. The heat evolved initiated a violent reaction with the Kel-F Oil.
*Chem. and Eng. News* **43** (20): 41 (1965).

**Chromic Anhydride**
Chlorine trifluoride and chromic anhydride react violently with evolution of brown fumes.
*Mellor* **2, Supp. 1:** 157 (1956).
*Mellor* **11:** 230 (1946–1947).

**Chromic Oxide**
Reaction between chlorine trifluoride and chromic oxide is accompanied by incandescence.
*Mellor* **11:** 181 (1946–1947).

**Chromium Oxide**
See also CHLORINE TRIFLUORIDE plus Aluminum Oxide.

**Copper**
See ALUMINUM plus Chlorine Trifluoride.

**Diethyl Ether**
The reaction between chlorine and diethyl ether is very violent, sometimes explosive.
*Mellor* **2, Supp. 1:** 155 (1956).

**Elements**
Most chemical elements are attacked explosively by chlorine trifluoride. Most oxides behave the same way. Glass wool catches fire in the vapor. One drop of the liquid sets fire to paper, cloth, or wood. The reaction is violent with water or ice.
*Sidgwick,* p. 1156 (1950). *Matheson Gas Data,* p. 108 (1961).

**Glass**
Glass wool catches fire readily in the vapor. Chlorine trifluoride flowing in glass tubing at excessive rates or pressures can cause the glass to burn.
*Sidgwick,* p. 1156 (1950). *Yunker* (1966).
See also CHLORINE TRIFLUORIDE plus Charcoal.

**Graphite**
See CHLORINE TRIFLUORIDE plus Charcoal.



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**Hydrogen**
See CHLORINE TRIFLUORIDE plus Ammonia.

**Hydrogen Sulfide**
See CHLORINE TRIFLUORIDE plus Ammonia.

**Iodine**
See CHLORINE TRIFLUORIDE plus Mercuric Iodide.

**Iridium**
See IRIDIUM plus Chlorine Trifluoride.

**Iron**
See IRON plus Chlorine Trifluoride.

**Lanthanum Oxide**
See CHLORINE TRIFLUORIDE plus Arsenic Trioxide.

**Lead**
See ALUMINUM plus Chlorine Trifluoride.

**Lead Dioxide**
See CHLORINE TRIFLUORIDE plus Aluminum Oxide.

**Magnesium**
See ALUMINUM plus Chlorine Trifluoride.

**Magnesium Oxide**
See CHLORINE TRIFLUORIDE plus Aluminum Oxide.

**Manganese Dioxide**
See MANGANESE DIOXIDE plus Chlorine Trifluoride.
See also CHLORINE TRIFLUORIDE plus Aluminum Oxide.

**Mercuric Iodide**
Combination of chlorine trifluoride and mercuric iodide, tungsten carbide, or iodine results in a reaction with flame.
*Mellor* **2, Supp. 1:** 157 (1956).

**Molybdenum**
See MOLYBDENUM plus Chlorine Trifluoride.

**Molybdenum Trioxide**
See MOLYBDENUM TRIOXIDE plus Chlorine Trifluoride.
See also CHLORINE TRIFLUORIDE plus Aluminum Oxide.

**Nitric Acid (Fuming)**
Combination of chlorine trifluoride and fuming nitric acid, potassium carbonate, potassium iodide, silver nitrate, 10% sodium hydroxide or sulfuric acid results in a violent reaction.
*Mellor* **2, Supp. 1:** 157 (1956).

**Nitroaromatic Compounds**
See NITROAROMATIC COMPOUNDS plus Chlorine Trifluoride.

**Organic Matter**
Chlorine trifluoride is compatible with other oxidizers such as $OF_2$ and $ClO_3F$, but reacts violently with organics.
See also CHLORINE TRIFLUORIDE plus Elements.
*Lawless and Smith,* p. 114 (1968).
*Mellor* **2, Supp. 1:** 155 (1956).
See also BROMINE MONOFLUORIDE plus Water.

**Osmium**
See ANTIMONY plus Chlorine Trifluoride.

**Oxides**
See CHLORINE TRIFLUORIDE plus Elements.

**Phosphorus**
See ANTIMONY plus Chlorine Trifluoride.

**Phosphorus Pentoxide**
See CHLORINE TRIFLUORIDE plus Arsenic Trioxide.

**Potassium**
See ANTIMONY plus Chlorine Trifluoride.

**Potassium Carbonate**
See CHLORINE TRIFLUORIDE plus Nitric Acid.

**Potassium Iodide**
See CHLORINE TRIFLUORIDE plus Nitric Acid.

**Rhodium**
See ANTIMONY plus Chlorine Trifluoride.

**Rubber**
When chlorine trifluoride is in contact with rubber a violent reaction occurs.
*Mellor* **2, Supp. 1:** 156 (1956).

**Selenium**
See ANTIMONY plus Chlorine Trifluoride.

**Silicon**
See ANTIMONY plus Chlorine Trifluoride.

**Silver**
See ALUMINUM plus Chlorine Trifluoride.

**Silver Nitrate**
See CHLORINE TRIFLUORIDE plus Nitric Acid.

**Sodium**
See CALCIUM plus Chlorine Trifluoride.

**Sodium Hydroxide**
See CHLORINE TRIFLUORIDE plus Nitric Acid.

**Stannic Oxide**
See CHLORINE TRIFLUORIDE plus Arsenic Trioxide.

**Sulfur**
See ANTIMONY plus Chlorine Trifluoride.

**Sulfur Dioxide**
See CHLORINE TRIFLUORIDE plus Ammonia.

**Sulfuric Acid**
See CHLORINE TRIFLUORIDE plus Nitric Acid.

**Tantalum Pentoxide**
See CHLORINE TRIFLUORIDE plus Aluminum Oxide.

**Tellurium**
See ANTIMONY plus Chlorine Trifluoride.

**Tin**
See ALUMINUM plus Chlorine Trifluoride.

**Tungsten**
See ANTIMONY plus Chlorine Trifluoride.

**Tungsten Carbide**
See CHLORINE TRIFLUORIDE plus Mercuric Iodide.

**Tungsten Trioxide**
See TUNGSTEN TRIOXIDE plus Chlorine Trifluoride.
See also CHLORINE TRIFLUORIDE plus Aluminum Oxide.

**Vanadium Pentoxide**
See CHLORINE TRIFLUORIDE plus Aluminum Oxide.


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**Water**
See CHLORINE TRIFLUORIDE plus Elements.
See also BROMINE MONOFLUORIDE plus Water.

**Zinc**
See ALUMINUM plus Chlorine Trifluoride.

## CHLORINE TRIOXIDE $ClO_3$

**(self-reactive)**
Explosions occurred during preparation of chlorine trioxide.
*Mellor* **2, Supp. 1:** 540 (1956).

**Ethyl Alcohol**
No really safe conditions exist under which ethyl alcohol and chlorine oxides can be handled.
*Mellor* **2, Supp. 1:** 540 (1956).

**Organic Matter**
Chlorine trioxide reacts violently, even explosively, with stopcock grease, wood, most forms of organic matter.
*Mellor* **2, Supp. 1:** 540 (1956).

**Phosphorus**
See PHOSPHORUS plus Chlorine Trioxide.

**Phosphorus Pentachloride**
When chlorine trioxide is passed over phosphorus pentachloride, there is often a vigorous explosion, explosive chlorine monoxide being formed.
*Bull. Acad. Belg.* (2) **38:** 503 (1814).

**Water**
Chlorine trioxide reacts vigorously and may explode with water.
*Mellor* **2, Supp. 1:** 540 (1956).

## CHLORITES

**(See also specific chlorites)**

**Ammonia**
This reaction produces ammonium chlorite, which is a shock-sensitive compound.
*Federoff* **3:** C-254 (1966).

**Organic Matter**
See CHLORITES plus Metals.

**Metals**
Finely divided metallic or organic substances, if mixed with chlorites, are highly flammable and may be ignited by friction.
*Lab. Govt. Chemist* (1965).

## CHLOROACETALDEHYDE OXIME $ClCH_2CH{=}NOH$

**(self-reactive)**
Separation of chloroacetaldehyde oxime from ether by distillation must not be carried out too far or a violent explosion will occur.
*MCA Guide for Safety,* Appendix 3 (1972).

## CHLOROACETONE $ClCH_2COCH_3$

**(self-reactive)**
Chloroacetone had turned black during storage for two years on a shelf in dull diffused light. A few days after the bottle of chloroacetone was moved, it exploded. The chloroacetone had polymerized to a black rubber-like substance.
*Ind. & Eng. Chem. News* **9:** 184 (1931).

## CHLOROACETYLENE $HC{\equiv}CCl$

**(self-reactive)**
See POTASSIUM HYDROXIDE plus 1,2-Dichloroethylene.

**Air**
See POTASSIUM HYDROXIDE plus 1,2-Dichloroethylene.

## m-CHLOROANILINE DIAZONIUM CHLORIDE $NH_2{\cdot}C_6H_4N(\equiv N)Cl$

**Sodium Bisulfide**
See SODIUM SULFIDE plus Diazonium Salts and Diazonium Chloride Salts.

**Sodium Polysulfide**
See SODIUM SULFIDE plus Diazonium Salts and Diazonium Chloride Salts.

**Sodium Sulfide**
See SODIUM SULFIDE plus Diazonium Salts and Diazonium Chloride Salts.

## CHLOROAZODIN $ClN{=}C(NH_2)N{=}NC(NH_2)NCl$

**(self-reactive)**
Chloroazodin decomposes explosively at about 155°C. The decomposition is accelerated by contact with metals.
*Merck Index,* p. 240 (1968).

## CHLOROBENZENE $C_6H_5Cl$

**Dimethyl Sulfoxide**
See DIMETHYL SULFOXIDE plus Acyl Halides.

**Silver Perchlorate**
See SILVER PERCHLORATE plus Acetic Acid.

## 5-CHLOROBENZOTRIAZOLE $\underline{NHN{=}N}C_6H_3Cl$

**(self-reactive)**
5-Chlorobenzotriazole spontaneously burst into flame while being packaged.
H. S. Hopps, *Chem. and Eng. News* **49** (30): 3 (1971).
*J. Chem. Eng. Data* **17:** 108 and 109 (1972).

## 3-CHLOROCYCLOPENTENE $(\text{-}CH{=}CHCHClCH_2CH_2\text{-})$

**(self-reactive)**
Thirty-five grams of 3-chlorocyclopentene exploded one day after it was made.
*Merck Safety Report* (April 1962).

## CHLORODIBORANE $ClBH(H_2)BH_2$

**Air**
This compound is spontaneously flammable in air.
*Mellor* **5:** 37 (1946–1947). *Douda* (1966).

## CHLORODIETHYLALUMINUM $(C_2H_5)_2AlCl$

**Benzene and Allyl Chloride**
See ALLYL CHLORIDE plus Benzene and Ethyl Aluminum Dichloride.



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**Toluene and Allyl Chloride**
See ALLYL CHLORIDE plus Benzene and Ethyl Aluminum Dichloride.

**Water**
Diethyl aluminum chloride reacts violently with water.
*Rose* (1961).

**CHLORODIETHYLBISMUTHINE** $(C_2H_5)_2BiCl$

**Air**
Diethyl bismuth chloride is spontaneously flammable in air.
*Coates,* p. 161 (1956).

**CHLORODIETHYLBORANE** $(C_2H_5)_2BCl$

**Air**
Diethyl boron chloride is spontaneously flammable in air.
*Buls, Bimonthly Rept. 5,* p. 3 (1953).

**2-CHLORO-1, 1-DIETHOXYETHANE** $(C_2H_5O)_2CHCH_2Cl$

**Sodium Amide**
See SODIUM AMIDE plus 1,1-Diethoxy-2-Chloroethane.

**CHLORODIISOBUTYLALUMINUM** $AlCl(C_4H_9)_2$

**Air**
Diisobutyl aluminum chloride ignites spontaneously in air.
J. E. Knap, R. E. Leach et al., *Ind. Eng. Chem.* **49** (5): 874–879 (1957).

**CHLORO (DIMETHYLAMINO) DIBORANE**
$(CH_3)_2NB_2H_4Cl$

**Air**
Dimethylamino chlorodiborane is spontaneously flammable in air.
A. B. Burg and C. L. Randolph, Jr., *J. Am. Chem. Soc.* **71:** 3451–3455 (1949).

**1-CHLORO-2, 4-DINITROBENZENE** $(O_2N)_2C_6H_3Cl$

**(self-reactive)**
An explosion may occur when the solvent symmetrical tetrachlorethane is almost removed in the chlorinolysis of 2, 4-dinitrophenyl disulfide.
*MCA Guide for Safety,* Appendix 3 (1972).
2, 4-Dinitrochlorobenzene has been known to detonate at about 300°F. It can be detonated by shock or heat under confinement that will permit high pressure build-up.
*Haz. Chem. Data,* p. 85 (1966).

**Hydrazine Hydrate**
See HYDRAZINE HYDRATE plus 2, 4-Dinitrochlorobenzene.
See also 2, 4-Dinitrochlorobenzene.

**x-CHLORO-2, 4-DINITROTOLUENE** $C_6H_3(NO_2)_2CH_2Cl$

**(self-reactive)**
2,4-Dinitrochlorotoluene has been known to detonate at about 300°F. It can be exploded by shock or heat under confinement that will permit high pressure build-up.
*Van Dolah* (1966).

**CHLORODIPROPYLBORANE** $(C_3H_7)_2BCl$

**Air**
Dipropylchloroborine is spontaneously flammable in air.
*Douda* (1966).

**2-CHLOROETHANOL** $ClCH_2CH_2OH$

**Chlorosulfonic Acid**
Mixing ethylene chlorohydrin and chlorosulfonic acid in a closed container caused the temperature and pressure to increase.
*Flynn and Rossow* (1970). See Note under complete reference.

**Ethylene Diamine**
Mixing ethylene chlorohydrin and ethylene diamine in a closed container caused the temperature and pressure to increase.
*Flynn and Rossow* (1970). See Note under complete reference.

**Sodium Hydroxide**
See SODIUM HYDROXIDE plus Chlorohydrin.

**2-CHLOROETHYLENIMINE** CHCl=C=NH

**(self-reactive)**
A distilled 50-gram quantity, after sitting in an amber bottle for three months, exploded suddenly. A black residue indicated it may have polymerized.
*Chem. and Eng. News* **42** (8): 41 (1964); *Chem. and Eng. News* **36** (43): 52 (1958).

**N-CHLOROETHYLENIMINE** $ClNCH_2CH_2$

**(self-reactive)**
*MCA Guide for Safety,* Appendix 3 (1972).

**CHLOROFLUOROHYDROCARBONS**

**Aluminum**
See ALUMINUM plus Chlorofluorohydrocarbons.

**CHLOROFORM** $Cl_3CH$

**Acetone**
See ACETONE plus Chloroform.

**Aluminum**
See ALUMINUM plus Chlorinated Hydrocarbons and ALUMINUM plus Chloroform.

**Disilane**
See DISILANE plus Carbon Tetrachloride.

**Lithium**
See LITHIUM plus Chloroform.

**Magnesium**
See MAGNESIUM plus Chloroform.

**Nitrogen Tetroxide**
See NITROGEN TETROXIDE plus 1,2-Dichloroethane.

**Perchloric Acid and Phosphorus Pentoxide**
See PHOSPHORUS PENTOXIDE plus Perchloric Acid and Chloroform.

**Potassium**
See POTASSIUM plus Chloroform.


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**Potassium Hydroxide and Methyl Alcohol**
See SODIUM HYDROXIDE plus Chloroform and Methyl Alcohol.

**Potassium Tert.-Butoxide**
See ACETONE plus Potassium Tert.-Butoxide.

**Sodium**
See SODIUM plus Chloroform.

**Sodium Hydroxide and Methyl Alcohol**
See SODIUM HYDROXIDE plus Chloroform and Methyl Alcohol.

**Sodium Methylate**
See SODIUM METHYLATE plus Chloroform.

**Sodium-Potassium Alloy**
See SODIUM-POTASSIUM ALLOY plus Carbon Tetrachloride.
See LITHIUM plus Chloroform.

**3-CHLORO-2-METHYLFURAN** $OCCH_3{=}CClCH{=}CH$

**(self-reactive)**
A small sample (20 milliliters) had been made, distilled and allowed to stand over the weekend. During the weekend it exploded.
*MCA Guide for Safety,* Appendix 3 (1972).

**Lithium Aluminum Hydride and Ethyl Acetate**
A mixture of chlorinated organic compounds consisting principally of 3-CHLORO-2-METHYLFURAN was subjected to reductive dechlorination with lithium aluminum hydride, after which ethyl acetate was added in small increments to decompose excess lithium aluminum hydride. After a few drops had been added, a violent explosion occurred.
*Chem. & Ind.* **14:** 432 (1957).

**4-CHLORO-2-NITROANILINE** $NO_2(Cl)C_6H_3NH_2$

**Nitric Acid**
In a large scale-up of the method for preparing 4-chloro-2,6-dinitroaniline by reacting nitric acid with 4-chloro-2-nitroaniline, an unexpected strong evolution of heat was experienced. The exotherm was found due to the simultaneous formation of two explosive products — the isomer 2-chloro-4,6-dinitroaniline and also 4-chloro-3,6-dinitrophenyldiazonium-2-oxide. The latter is very shock sensitive.
*MCA Case History* **1489** (1968).

**CHLORONITROTOLUENES**

**Sodium Hydroxide**
The feed stream into a tank of mixed chloronitrotoluenes became inadvertently contaminated with caustic. The runaway reaction within the tank ripped the tank open in spite of a 10-inch relief vent.
*MCA Case History* **907** (1963).

**p-CHLOROPHENYL ISOCYANATE** $ClC_6H_4NCO$

**(self-reactive)**
A violent explosion occurred in a laboratory during vacuum distillation of p-chlorophenyl isocyanate that had been prepared by the Curtius reaction of p-chlorobenzoylazide.
*Chem. & Ind.* **38:** 1625 (1965).

**CHLOROPICRIN** $Cl_3CNO_2$

**(self-reactive)**
Tank car volumes of this material may detonate under certain conditions. There is a critical volume above which sufficient shock may cause detonation.
*Chem. and Eng. News* **50** (38): 13 (1972).

**Propargyl Bromide**
See PROPARGYL BROMIDE plus Chloropicrin.

**3-CHLORO-1-PROPYNE** $CH{\equiv}CCH_2Cl$

**(self-reactive)**
See PROPARGYL BROMIDE. Liquid propargyl chloride is much less susceptible to this type ignition.
D. R. Forshey et al., *Fire Tech.* **5** (2):100–111 (1969).

**CHLOROSILANE** $ClSiH_3$
Silane and chlorosilanes can explode when mixed with various halocarbons and ignited.
*Plant Operations Progress,* Britton (1990).

**Ammonia**
With insufficient ammonia, chlorosilane forms trisilylammonia which is spontaneously flammable in air.
*Mellor* **8:** 262 (1946–1947).

**CHLOROSILANES** ClxSiHy
Chloropentamethyl disilane and related heavy chlorosilanes may be thermally unstable and some are shock sensitive.
*Chem. and Eng. News* (June 4, 1990), *Plant Operations Progress,* Britton (1990) - Silanes.

**Air**
The chlorosilicon hydrides are spontaneously flammable in air.
*Ellern,* p. 22 (1968).

**CHLOROSULFURIC ACID** $ClSO_2OH$

**Acetic Acid**
See ACETIC ACID plus Chlorosulfonic Acid.

**Acetic Anhydride**
See ACETIC ANHYDRIDE plus Chlorosulfonic Acid.

**Acetonitrile**
See ACETONITRILE plus Chlorosulfonic Acid.

**Acrolein**
See ACROLEIN plus Chlorosulfonic Acid.

**Acrylic Acid**
See ACRYLIC ACID plus Chlorosulfonic Acid.

**Acrylonitrile**
See ACRYLONITRILE plus Chlorosulfonic Acid.

**Allyl Alcohol**
See ALLYL ALCOHOL plus Chlorosulfonic Acid.

**Allyl Chloride**
See ALLYL CHLORIDE plus Chlorosulfonic Acid.

**2-Aminoethanol**
See 2-AMINOETHANOL plus Chlorosulfonic Acid.



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**Ammonium Hydroxide**
Mixing chlorosulfonic acid and 28% ammonia in a closed container caused the temperature and pressure to increase.
*Flynn and Rossow* (1970). See Note under complete reference.

**Aniline**
See ANILINE plus Chlorosulfonic Acid.

**n-Butyraldehyde**
See n-Butyraldehyde plus Chlorosulfonic Acid.

**Creosote Oil**
Mixing chlorosulfonic acid and creosote oil in a closed container caused the temperature and pressure to increase.
*Flynn and Rossow* (1970). See Note under complete reference.

**Cresol**
See CRESOL plus Chlorosulfonic Acid.

**Cumene**
See CUMENE plus Chlorosulfonic Acid.

**Dichloroethyl Ether**
See DICHLOROETHYL ETHER plus Chlorosulfonic Acid.

**Diethylene Glycol Monomethyl Ether**
See DIETHYLENE GLYCOL MONOMETHYL ETHER plus Chlorosulfonic Acid.

**Diisobutylene**
See DIISOBUTYLENE plus Chlorosulfonic Acid.

**Diisopropyl Ether**
See DIISOPROPYL ETHER plus Chlorosulfonic Acid.

**Epichlorohydrin**
See EPICHLOROHYDRIN plus Chlorosulfonic Acid.

**Ethyl Acetate**
See ETHYL ACETATE plus Chlorosulfonic Acid.

**Ethyl Acrylate**
See ETHYL ACRYLATE plus Chlorosulfonic Acid.

**Ethylene Chlorohydrin**
See ETHYLENE CHLOROHYDRIN plus Chlorosulfonic Acid.

**Ethylene Cyanohydrin**
See ETHYLENE CYANOHYDRIN plus Chlorosulfonic Acid.

**Ethylene Diamine**
See ETHYLENE DIAMINE plus Chlorosulfonic Acid.

**Ethylene Glycol**
See ETHYLENE GLYCOL plus Chlorosulfonic Acid.

**Ethylene Glycol Monoethyl Ether Acetate**
See ETHYLENE GLYCOL MONOETHYL ETHER ACETATE plus Chlorosulfonic Acid.

**Ethyleneimine**
See ETHYLENEIMINE plus Chlorosulfonic Acid.

**Glyoxal**
See GLYOXAL plus Chlorosulfonic acid.

**Heptane**
Stirred mixtures of chlorosulfonic acid (aka chlorosulfuric acid) and heptane or similar alkanes can cause a reaction liberating large volumes of hydrogen chloride, sulfur dioxide, and other gases.
*Chem. and Eng. News* (Dec. 11, 1989).

**Hydrochloric Acid**
Mixing chlorosulfonic acid and 36% hydrochloric acid in a closed container caused the temperature and pressure to increase.
*Flynn and Rossow* (1970). See Note under complete reference.

**Hydrofluoric Acid**
Mixing chlorosulfonic acid and 48.7% hydrofluoric acid in a closed container caused the temperature and pressure to increase.
*Flynn and Rossow* (1970). See Note under complete reference.

**Hydrogen Peroxide**
Permonosulfonic acid was being prepared by reacting chlorosulfonic acid and 90% hydrogen peroxide. A sample was stored overnight at 0°C, then removed to a test tube rack. In ten minutes it exploded.
*Chem. and Eng. News* **33:** 3336 (1955).
See also PERMONOSULFURIC ACID plus Acetone.

**Isoprene**
See ISOPRENE plus Chlorosulfonic Acid.

**Mesityl Oxide**
See MESITYL OXIDE plus Chlorosulfonic acid.

**Metallic Powders**
See CHLOROSULFONIC ACID plus Organic Matter.

**Methyl Ethyl Ketone**
See METHYL ETHYL KETONE plus Chlorosulfonic Acid.

**Nitric Acid**
Mixing chlorosulfonic acid and 70% nitric acid in a closed container caused the temperature and pressure to increase.
*Flynn and Rossow* (1970). See Note under complete reference.

**2-Nitropropane**
Mixing chlorosulfonic acid and 2-nitropropane in a closed container caused the temperature pressure to increase.
*Flynn and Rossow* (1970). See Note under complete reference.

**Organic Matter**
This material is dangerous in contact with combustible materials, nitrates, chlorates, metallic powders, carbides, picrates and fulminates. It develops great heat in contact with water.
*Chem. Safety Data Sheet* **SD-33** (1949).

**Phosphorus**
See PHOSPHORUS plus Chlorosulfonic Acid.

**Propiolactone (BETA-)**
See PROPIOLACTONE (BETA-) plus Chlorosulfonic Acid.

**Propylene Oxide**
See PROPYLENE OXIDE plus Chlorosulfonic Acid.

**Pyridine**
See PYRIDINE plus Chlorosulfonic Acid.

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**Sodium Hydroxide**
See SODIUM HYDROXIDE plus Chlorosulfonic Acid.

**Styrene Monomer**
See STYRENE MONOMER plus Chlorosulfonic Acid.

**Sulfolane**
See SULFOLANE plus Chlorosulfonic Acid.

**Sulfuric Acid**
Mixing chlorosulfonic acid and 96% sulfuric acid in a closed container caused the temperature and pressure to increase.
*Flynn and Rossow* (1970). See Note under complete reference.

**Vinyl Acetate**
See VINYL ACETATE plus Chlorosulfonic Acid.

**Vinylidene Chloride**
See VINYLIDENE CHLORIDE plus Chlorosulfonic Acid.

**Water**
See CHLOROSULFONIC ACID plus Organic Matter.

## CHLOROTHION $(CH_3O)_2P(S)OC_6H_3ClNO_2$

**(self-reactive)**
When a sample was heated in a small test tube it decomposed and in a few minutes the residue exploded.
J. B. McPherson and G. A. Johnson, *Agri. Food Chem.* **4** (1): 42 (1956).

## 4-CHLORO-o-TOLUIDINE DIAZONIUM CHLORIDE SALT $NH_2C_6H_3(Cl)CH_2N(\equiv N)Cl$

**Sodium Bisulfide**
See SODIUM SULFIDE plus Diazonium Salts and Diazonium Chloride Salts.

**Sodium Polysulfide**
See SODIUM SULFIDE plus Diazonium Salts and Diazonium Chloride Salts.

**Sodium Sulfide**
See SODIUM SULFIDE plus Diazonium Salts and Diazonium Chloride Salts.

## CHLOROTRIFLUOROETHYLENE $ClFC{=}CF_2$

**Bromine and Oxygen**
Addition of bromine to a mixture of chlorotrifluoroethylene and oxygen causes an explosion. One of the products of the reaction is chlorotrifluoroethylene peroxide, which explodes when heated.
R. N. Haszeldine and F. Nyman, *J. Chem. Soc.* **1959:** 1084–1090 (1959).

**Chlorine Trifluoride and Water**
See CHLORINE TRIFLUORIDE plus Chlorotrifluoroethylene Polymer and Water.

## CHLOROTRIFLUOROETHYLENE PEROXIDE $CF_2ClCOF$

**(self-reactive)**
Chlorotrifluoroethylene peroxide explodes when heated.
R. N. Haszeldine and F. Nyman, *J. Chem. Soc.* **1959:** 1084–90 (1959).

## CHLOROTRIFLUOROMETHANE $CClF_3$

**Aluminum**
See ALUMINUM plus Dichlorodifluoromethane.

## CHLOROTRIMETHYLSILANE $(CH_3)_3SiCl$

**Water**
Trimethyl chlorosilane reacts violently with water yielding heat and white acid fumes.
*Title* 46 (1970).

## CHROMATES

**Hydrazine**
Hydrazine is decomposed explosively by chromates and chromic anhydride.
*Mellor* **11:** 234 (1946–1947).

## CHROMIC ANHYDRIDE $CrO_3$ (CHROMIC ACID, CHROMIUM VI OXIDE, CHROMIUM TRIOXIDE)

**Acetic Acid**
Acetic acid or acetic anhydride can explode with chromic acid if not kept cold.
*Von Schwartz*, p. 321 (1918).

**Acetic Anhydride**
During the preparation of chromyl acetate by the direct reaction of chromic anhydride on acetic anhydride without the use of diluting solvents, a violent explosion occurred.
J. G. Dawber, *Chem. & Ind.* **23:** 973 (Part I, 1964).
See also CHROMIC ANHYDRIDE plus Acetic Acid.

**Acetic Anhydride and Acetic Acid**
Acetic anhydride was gradually being titrated into a mixture of chromic anhydride and acetic acid in a 20-gallon, glass-lined tank. After 1½ hours of this procedure, the contents of the reactor exploded.
*Doyle* (1966).

**Acetone**
An attempt to purify acetone by refluxing with chromic anhydride led to an explosion and fire when the acetone was first brought into contact with the chromic anhydride.
Robert Delhez, *Chem. & Ind.:* 931 (Sept. 8, 1956).

**Aluminum**
See ALUMINUM plus Chromic Anhydride.

**Ammonia**
Ammonia gas decomposes the dry trioxide with incandescence at ordinary temperatures.
*Mellor* **11:** 161 (1946–1947).
*Mellor* **11:** 233 (1946–1947).

**Anthracene**
Anthracene will burst into flame on contact with chromic acid.
*Douglas and Thompson* (1949).

**Arsenic**
See ARSENIC plus Chromium Trioxide.

**Benzene**
Benzene ignites in contact with powdered chromic anhydride.
*Mellor* **11:** 235 (1946–1947).

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**Camphor**
See CHROMIC ANHYDRIDE plus Naphthalene.

**Chlorine Trifluoride**
See CHLORINE TRIFLUORIDE plus Chromic Anhydride.

**Chromous Sulfide**
Ignition occurs when chromium trioxide comes in contact with a small proportion of chromium sulfide.
*Mellor* **11:** 430 (1946–1947).

**Diethyl Ether**
These compounds react violently at room temperature.
*Mellor* **11:** 235 (1946–1947).

**Dimethyl Formamide**
A violent reaction occurred when chromic anhydride was added rapidly or in large lumps to dimethyl formamide.
*Chem. and Eng. News* **48** (28): 4 (July 6, 1970).

**Ethyl Alcohol**
Chromic anhydride ignites ethyl alcohol.
*Durrant,* p. 990 (1962).

**Glycerol**
See CHROMIC ANHYDRIDE plus Naphthalene.

**Hydrocarbons**
Chromic anhydride ignites many hydrocarbons.
Campbell and Young, *Science* **104:** 353 (1946).

**Hydrogen Sulfide**
When hydrogen sulfide is passed over heated chromium trioxide, decomposition occurs with incandescence.
*Mellor* **11:** 232 (1946–1947).
See also CHROMIC ANHYDRIDE plus Naphthalene.

**Methyl Alcohol**
A laboratory preparation of hexa-aquochromic sulfate required the reduction of chromic anhydride by methyl alcohol. When the alcohol was contacted by the anhydride, an explosion and fire resulted.
*Delhez* (1967).

**Naphthalene**
Naphthalene, camphor, glycerol, or turpentine will react violently with chromic anhydride.
*Haz. Chem. Data,* p. 68 (1967).

**Organic Matter**
A container of 50 kilograms of chromic anhydride exploded when laid on the ground. The container may have been contaminated with an oxidizable substance.
*Chem. Abst.* **31:** 4010 (1937).

**Phosphorus**
See PHOSPHORUS plus Chromium Trioxide.

**Potassium**
See POTASSIUM plus Chromium Trioxide.

**Potassium Ferricyanide**
While these two compounds were being mixed, an explosion occurred when the dust was ignited by a spark.
*Mich. Occ. Health* **7:** No. 2, p. 2 (Winter 1962).

**Pyridine**
During the preparation of a chromium trioxide-pyridine complex, the proportion of the trioxide was increased. Since the trioxide dissolves in the pyridine by swelling, then rapidly dissolving with evolution of heat, the excessive amount of chromium trioxide produced overheating, which resulted in an explosion and fire.
*MCA Case History* **1284** (1967).

**Selenium**
See SELENIUM plus Chromium Trioxide.

**Sodium**
See SODIUM plus Chromium Trioxide.

**Sodium Amide**
See SODIUM AMIDE plus Chromic Anhydride.

**Sulfur**
See SULFUR plus Chromic Anhydride.

**Turpentine**
See CHROMIC ANHYDRIDE plus Naphthalene.

## CHROMIC-HEXAMMINE NITRATE $[Cr(NH_3)_6](NO_3)_3$

**(self-reactive)**
Hexammine chromium nitrate explodes at 265°C and is impact sensitive.
W. R. Tomlinson, Jr., and L. F. Audrieth,
*J. Chem. Edu.* **27:** 606–609 (1950).

## CHROMIUM Cr

**Ammonium Nitrate**
See AMMONIUM NITRATE plus Metals (powdered).

**Hydrogen Peroxide**
See IRON plus Hydrogen Peroxide.

**Lithium**
See LITHIUM plus Vanadium.

**Nitric Oxide**
Pyrophoric chromium unites with nitric oxide with incandescence.
*Mellor* **11:** 162 (1946–1947).

**Potassium Chlorate**
Chromium is attacked vigorously by fused potassium chlorate, producing vivid incandescence.
*Mellor* **11:** 163 (1946–1947).

**Sulfur Dioxide**
Pyrophoric chromium unites with sulfur dioxide with incandescence.
*Mellor* **11:** 161 (1946–1947).

## CHROMIUM-AMMINE NITRATES

**(self-reactive)**
Chromium-ammine nitrates may be impact-sensitive: $Cr(NH_3)_5NO_2(NO_3)_2$ detonates when heated.
*Mellor* **11:** 477 (1946–1947).

## CHROMIUM-AMMINE PERCHLORATES

**(self-reactive)**
Chromium-ammine perchlorates may be impact-sensitive.
*Mellor* **11:** 477 (1946–1947).

## CHROMIUM OXIDE $Cr_2O_3$ (CHROMIC OXIDE, CHROMIUM III OXIDE, CHROMIUM SESQUIOXIDE)

**Chlorine Trifluoride**
See CHLORINE TRIFLUORIDE plus Chromic Oxide.


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**Glycerol**
Contact between the two may produce an explosion.
*Merck Index,* 7th Ed., p. 489 (1960). *Pieters,* p. 30 (1957).

**Lithium**
See LITHIUM plus Chromic Oxide.

**Oxygen Difluoride**
See OXYGEN DIFLUORIDE plus Aluminum Chloride.

## CHROMIUM TETRACHLORIDE $CrCl_4$

**Potassium**
See POTASSIUM plus Aluminum Bromide.

**Sodium**
See SODIUM plus Chromium Tetrachloride.

## CHROMIUM TRIAMMINOTETROXIDE $Cr(NH_3)_3O_4$

**(self-reactive)**
Chromium triamminotetroxide detonates and becomes incandescent when heated.
*Mellor* **11:** (1946–1947).

## CHROMIUM TRICHLORIDE $CrCl_3$

**Lithium**
See LITHIUM plus Chromium Trichloride.

## CHROMIUM TRIFLUORIDE $CrF_3$

**Potassium**
See POTASSIUM plus Ammonium Bromide.

## CHROMOUS OXIDE CrO

**Air**
Chromous monoxide is spontaneously flammable in air.
*Ellern* (1968).

## CHROMOUS SULFIDE CrS

**Chromic Anhydride**
See CHROMIC ANHYDRIDE plus Chromous Sulfide.

**Fluorine**
See FLUORINE plus Chromous Sulfide.

## CHROMYL CHLORIDE $CrO_2Cl_2$

**Acetone**
Alcohol, ether and acetone react with chromyl chloride with incandescence. Turpentine is ignited by chromyl chloride.
*Mellor* **11:** 396 (1946–1947).

**Ammonia**
Chromyl chloride causes ammonia and ethyl alcohol to ignite.
*Durrant,* p. 991 (1962).

**Chlorine and Carbon**
See CHLORINE plus Chromyl Chloride and Carbon.

**Diethyl Ether**
See CHROMYL CHLORIDE plus Acetone.

**Ethyl Alcohol**
See CHROMYL CHLORIDE plus Ammonia.

**Fluorine**
See FLUORINE plus Chromyl Chloride.

**Phosphorus**
See PHOSPHORUS plus Chromyl Chloride.

**Phosphorus Trichloride**
Each drop of chromyl chloride added to well-cooled phosphorus trichloride produces a hissing noise, incandescence, and sometimes an explosion.
*Mellor* **11:** 395 (1946–1947).

**Sodium Azide**
See SODIUM AZIDE plus Chromyl Chloride.

**Sulfur**
See SULFUR plus Chromyl Chloride.

**Sulfur Monochloride**
If chromyl chloride vapor is passed through a narrow jet into the vapor of sulfur monochloride, vivid combustion occurs.
*Mellor* **11:** 394 (1946–1947).

**Turpentine**
See CHROMYL CHLORIDE plus Acetone.

## COBALT Co

**Acetylene**
Pyrophoric cobalt decomposes acetylene in the cold and the metal becomes incandescent.
*Mellor* **14:** 513 (1946–1947).

**Air**
Pyrophoric cobalt, a black powder, burns brilliantly when exposed to air.
*Mellor* **14:** 453 (1946–1947).

**Ammonium Nitrate**
See AMMONIUM NITRATE plus Metals (powdered).

## COBALT-HEXAMMINE CHLORATE $Co(NH_3)_6(ClO_3)_2$

**(self-reactive)**
This compound detonates when struck.
*Mellor* **2, Supp. 1:** 592 (1956).

## COBALT-HEXAMMINE CHLORITE $Co(NH_3)_6ClO_2 3H_2O$

**(self-reactive)**
Hexamminocobaltic chlorite contains an explosive combination of ions.
*Mellor* **2, Supp. 1:** 575 (1956).
Cobalt ammine azides explode violently on impact.
*Mellor* **8, Supp. 2:** 48 (1967).

## COBALT-HEXAMMINE PERCHLORATE $Co(NH_3)_6(ClO_4)_2$

**(self-reactive)**
This compound detonates when struck but is less sensitive than hexamminocobalt chlorate.
*Mellor* **2, Supp. 1:** 592 (1956).

## COBALT NITRIDE CoN

**Air**
Cobalt nitride is spontaneously flammable in air.
*Brauer* (1965).
*Mellor* **8, Supp. 1:** 238 (1964).



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**COBALT-PENTAMMINE AZIDE PERCHLORATE** $[Co(NH_3)_5N_3](ClO_4)_2$

**Phenyl Isocyanate and Nitrosyl Perchlorate**
See PHENYL ISOCYANATE plus Cobalt Pentammine Triazo Perchlorate and Nitrosyl Perchlorate.

**COBALT-PENTAMMINE HYPOPHOSPHITE PERCHLORATE** $[Co(NH_3)_5]H_2PO_2(ClO_4)_2$

**(self-reactive)**
When a chemist touched a platinum wire (temperature uncertain) into the freshly prepared chemical to make a flame test, the preparation exploded.
*Serious Acc. Series* **253** (1965).

**COBALTIC DIHYDROPHOSPHIDE** $Co(PH_2)_3$

**Air**
Cobalt triphosphine is spontaneously flammable in air.
J. Zehr, *Staub* **22** (11): 494–508 (1962).

**COBALTIC FLUORIDE** $CoF_3$

**Silicon**
See SILICON plus Colbatic Fluoride.

**COBALTIC-HEXAMMINE IODATE** $[Co(NH_3)_6](IO_3)_3$

**(self-reactive)**
Hexammine cobalt iodate explodes at 355°C and is impact sensitive.
W. R. Tomlinson, Jr. and L. F. Audrieth,
*J. Chem. Edu.* **27:** 606–609 (1950).

**COBALTIC-HEXAMMINE PERCHLORATE** $[Co(NH_3)_6](ClO_4)_3$

**(self-reactive)**
Hexammine cobalt perchlorate explodes at 360°C and is impact sensitive.
W. R. Tomlinson, Jr. and L. F. Audrieth,
*J. Chem. Edu.* **27:** 606–609 (1950).

**COBALTIC-PENTAMMINE AZIDE** $CoN_3(NH_3)_5(N_3)_2$

**(self-reactive)**
Cobalt ammine azide exploded violently on impact.
*Mellor* **8, Supp. 4:** 48 (1967).

**COBALTIC-PENTAMMINE CHLORITE** $Co(NH_3)_5Cl(ClO_2)_2$

**(self-reactive)**
Pentamminochlorocobaltic chlorite contains an explosive combination of ions.
*Mellor* **2, Supp. 1:** 575 (1956).

**COBALTOUS BROMIDE** $CoBr_2$

**Potassium**
See POTASSIUM plus Boron Tribromide.

**Sodium**
See SODIUM plus Cobaltous Bromide.

**COBALTOUS CHLORIDE** $CoCl_2$

**Potassium**
See POTASSIUM plus Boron Tribromide.

**Sodium**
See SODIUM plus Cobaltous Bromide.

**COBALTOUS CYANIDE** $Co(CN)_2$

**Magnesium**
See MAGNESIUM plus Cadmium Cyanide.

**COBALTOUS HYPOPHOSPHITE** $CO(PH_2O_2)_2$

**(self-reactive)**
Cobaltous hypophosphite liberates spontaneously flammable phosphine above 150°C.
*Mellor* **8:** 889 (1946–1947).

**COBALTOUS-PENTAMMINE CHLORO-PERCHLORATE** $[Co(NH_3)_5Cl]ClO_4$

**(self-reactive)**
Cobaltous-pentammine chloro-perchlorate explodes at 320°C and is impact sensitive.
*J. Chem. Educ.* **27:** 606–609 (1950).

**COBALTOUS-PENTAMMINE NITRITO-N NITRATE** $[Co(NH_3)_5NO_2]NO_3$

**(self-reactive)**
Nitropentammine cobalt nitrate explodes at 310°C and is impact sensitive.
W. R. Tomlinson, Jr. and L. F. Audrieth,
*J. Chem. Edu.* **27:** 606–609 (1950).

**COBALTOUS-TRIHYDRAZINE CHLORATE** $CO(N_2H_4)_3(ClO_3)_2$

**(self-reactive)**
This compound detonates when struck.
*Mellor* **2, Supp. 1:** 592 (1956).

**COKE**

**Fluorine**
See FLUORINE plus Common Materials and Oxygen.

**COPPER** Cu

**Acetylene**
Unstable acetylides form when acetylene is passed over copper that has been heated enough to form a tarnish of oxide coating. In the presence of wet acetylene and ammonia, copper and brasses down to 60 per cent copper react readily to form explosive acetylides.
Brameld, Clark and Seyfond, *J. Soc. Chem. Ind.* **66:** 346–53 (1947). G. Benson, *Comp. Gas Bull.* 1950–83. *Miller,* pp. 484–6 (1965). *Rutledge,* p. 84 (1968).

**Ammonium Nitrate**
See AMMONIUM NITRATE plus Metals (powdered).
*Mellor* **8, Supp. 1:** 546 (1964).

**Barium Bromate**
See COPPER plus Bromates.

**Barium Chlorate**
See COPPER plus Bromates.

**Barium Iodate**
See COPPER plus Bromates.

**Bromates**
A combination of finely divided copper with finely divided bromates (also chlorates or iodates) of barium, cal-


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cium, magnesium, potassium, sodium, or zinc will explode with heat, percussion, and sometimes light friction.
*Mellor* **2:** 310 (1946–1947).

**Calcium Bromate**
See COPPER plus Bromates.

**Calcium Chlorate**
See COPPER plus Bromates.

**Calcium Iodate**
See COPPER plus Bromates.

**Chlorates**
See COPPER plus Bromates.

**Chlorine**
Copper foil burns spontaneously in gaseous chlorine.
*Mellor* **2:** 92, 95 (1946–1947). *Mellor* **9:** 626 (1946–1947).
Copper reacts vigorously with chlorine at around 320°C.
*Mellor* **2, Supp. 1:** 380 (1956).

**Chlorine and Oxygen Difluoride**
See CHLORINE plus Oxygen Difluoride.

**Chlorine Trifluoride**
See ALUMINUM plus Chlorine Trifluoride.

**Ethylene Oxide**
Copper and other acetylide-forming metals should not be used in process equipment handling ethylene oxide because of the danger of the possible presence of acetylene. See COPPER plus Acetylene.
L. G. Hess and V. V. Tilton, *Ind. Eng. Chem.* **42:** 1251–8 (1950).

**Fluorine**
See FLUORINE plus Copper. See also FLUORINE plus Metals.

**Hydrazine Mononitrate**
See ZINC plus Hydrazine Mononitrate.

**Hydrazoic Acid**
Explosions resulted from corrosion of brass parts of a vacuum gage and water jet vacuum pump on prolonged contact with hydrozoic acid vapors.
*Chem. & Ind.* **10,** p. 444 (1973).

**Hydrochloric Acid**
A reaction occurred at a slow rate that released hydrogen which built up pressure in a closed system resulting in an explosion of a glass container.
*Chem. and Eng. News,* p. 4, (July 29, 1991); and p. 2, (Sept. 16, 1991).

**Hydrogen Peroxide**
See IRON plus Hydrogen Peroxide.

**Hydrogen Sulfide**
If a mixture of air and hydrogen sulfide is passed over powdered copper, the mixture may heat to redness.
*Mellor* **10:** 140 (1946–1947).

**Iodates**
See COPPER plus Bromates.

**Lead Azide**
Lead azide, when in contact with copper, zinc, or alloys containing copper or zinc, forms, over a period of time, the extremely sensitive copper and zinc azides which on slight disturbance can set off the main body of lead azide.
*Federoff* **1:** A532, A551 (1960).
*Mustaparta* (1966).

**Magnesium Bromate**
See COPPER plus Bromates.

**Magnesium Chlorate**
See COPPER plus Bromates.

**Magnesium Iodate**
See COPPER plus Bromates.

**Phosphorus**
The reacting mass formed by the mixture of phosphorus and copper, iron, nickel, or platinum can become incandescent when heated.
*Mellor* **8, Supp. 3:** 228 (1971).

**Potassium Bromate**
See COPPER plus Bromates.

**Potassium Chlorate**
See COPPER plus Bromates.

**Potassium Iodate**
See COPPER plus Bromates.

**Potassium Peroxide**
See POTASSIUM plus Potassium Peroxide and POTASSIUM plus Potassium Tetroxide.

**Sodium Azide**
See SODIUM AZIDE plus Copper.

**Sodium Bromate**
See COPPER plus Bromates.

**Sodium Chlorate**
See COPPER plus Bromates.

**Sodium Iodate**
See COPPER plus Bromates.

**Sodium Peroxide**
Sodium peroxide oxidizes copper with incandescence.
*Mellor* **2:** 490–93 (1946–1947).

**Sulfur and Chlorates**
See SULFUR plus Chlorates and Copper.

**Zinc Bromate**
See COPPER plus Bromates.

**Zinc Chlorate**
See COPPER plus Bromates.

**Zinc Iodate**
See COPPER plus Bromates.

## COPPER OXYCHLORIDE $Cu_2OCl_2$

**Potassium**
See POTASSIUM plus Boric Acid.

## COPPER SALTS

**Acetylene**
Many copper salts form dangerous acetylides. The copper acetylides formed in ammoniacal or caustic solutions



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with cupric salts and acetylene are more explosive than those derived from cuprous salts.
Brameld, Clark and Seyfond, *J. Soc. Chem. Ind.* **66:** 346–53 (1947). G. Benson, *Comp. Gas Bull.* 1950–83. *Miller,* pp. 484–6 (1965).

**Hydrazine**
Copper salts promote the decomposition of hydrazine.
*Chem. and Eng. News* **48** (48): 97 (Nov. 16, 1970). See also CUPRIC OXIDE plus Hydrazine.

**Nitromethane**
Nitromethane and salts of copper, silver, gold or mercury spontaneously form explosive materials.
*Chem. and Eng. News* **49** (23): 6 (1971).

## CREOSOTE OIL

**Chlorosulfonic Acid**
See CHLOROSULFURIC ACID plus Creosote Oil.

## CRESOL $CH_3C_6H_4OH$

**Chlorosulfonic Acid**
Mixing cresol and chlorosulfonic acid in a closed container caused the temperature and pressure to increase.
*Flynn and Rossow* (1970). See Note under complete reference.

**Nitric Acid**
Mixing cresol and 70% nitric acid in a closed container caused the temperature and pressure to increase.
*Flynn and Rossow* (1970). See Note under complete reference.

**Oleum**
Mixing cresol and oleum in a closed container caused the temperature and pressure to increase.
*Flynn and Rossow* (1970). See Note under complete reference.

## CROTONALDEHYDE $CH_3CH{=}CHCHO$

**Butadiene-1,3**
See BUTADIENE-1,3 plus Crotonaldehyde.

## CUMENE $C_6H_5CH(CH_3)_2$

**Chlorosulfonic Acid**
Mixing Cumene and chlorosulfonic acid in a closed container caused the temperature and pressure to increase.
*Flynn and Rossow* (1970). See Note under complete reference.

**Nitric Acid**
Mixing cumene and 70% nitric acid in a closed container caused the temperature and pressure to increase.
*Flynn and Rossow* (1970). See Note under complete reference.

**Oleum**
Mixing cumene and oleum in a closed container caused the temperature and pressure to increase.
*Flynn and Rossow* (1970). See Note under complete reference.

## CUMENE HYDROPEROXIDE $C_6H_5C(CH_3)_2OOH$

Contaminants may catalyze decomposition at lower temperatures.
*Chem. and Eng. News* (May 31, 1993).

**(self-reactive)**
At concentrations of 91 and 95%, cumene hydroperoxide decomposed violently at about 150°C.
A. Le Roux, *Mem. Poudres* **37:** 49–58 (1955).

**Sodium Iodide**
See SODIUM IODIDE plus Cumene Hydroperoxide.

## CUPRIC AZIDE $CU(N_3)_2$

**(self-reactive)**
Spontaneous explosions have been observed with this compound.
*Mellor* **8, Supp. 2:** 50 (1967).
See SODIUM AZIDE plus Copper.

## CUPRIC BROMIDE $CuBr_2$

**Potassium**
See POTASSIUM plus Aluminum Bromide.

## CUPRIC CHLORIDE $CuCl_2$

**Potassium**
See POTASSIUM plus Aluminum Bromide.

**Sodium**
See SODIUM plus Aluminum Bromide.

## CUPRIC CHLORITE $Cu(ClO_2)_2$

**(self-reactive)**
Cupric chlorite explodes violently on percussion. In the dry state it decomposes within 12 days.
*Mellor* **2, Supp. 1:** 574 (1956).

## CUPRIC-DIHYDRAZINE CHLORATE $Cu(H_2NNH_2)_2ClO_3$

**(self-reactive)**
This is an extremely explosive salt and will detonate on drying.
*Mellor* **8, Supp. 2:** 88 (1967).
*Mellor* **2, Supp. 1:** 592 (1956).

## CUPRIC HYPOPHOSPHITE $Cu(PH_2O_2)_2$

**(self-reactive)**
Cupric hypophosphite forms impact-sensitive ammunition-priming mixtures.
*Mellor* **8, Supp. 3:** 623 (1971).
Cupric hypophosphite explodes suddenly at about 90°C.
*Mellor* **8:** 883 (1946–1947).

## CUPRIC NITRATE $Cu(NO_3)_2$

**Paper**
On prolonged contact with cupric nitrate in the presence of moisture paper will ignite spontaneously.
*Ellern,* p. 46 (1968).

**Potassium Ferrocyanide**
A finely ground mixture of potassium ferrocyanide and cupric nitrate when dried at 220°C exploded within a few minutes.
*Chem. Abst.* **77:** 13431f (1972).

**Tin**
See TIN plus Cupric Nitrate.


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## CUPRIC NITRIDE $Cu_3N_2$

**Nitric Acid**
Concentrated nitric acid plus cupric nitride explodes with great violence.
*Mellor* **8:** 100 (1946–1947).

## CUPRIC OXIDE CuO

**Aluminum**
See ALUMINUM plus Copper Oxide.

**Boron**
See BORON plus Cupric Oxide.

**Cesium Acetylene Carbide**
See CESIUM ACETYLENE CARBIDE plus Cupric Oxide.

**Hydrazine**
Hydrazine reacts vigorously with cupric oxide.
*Mellor* **3:** 137 (1946–1947).

**Magnesium**
See MAGNESIUM plus Cupric Oxide.

**Phospham**
See PHOSPHAM plus Cupric Oxide.

**Potassium**
See POTASSIUM plus Cupric Oxide.

**Rubidium Acetylene Carbide**
See RUBIDIUM ACETYLENE CARBIDE plus Cupric Oxide.

**Sodium**
See SODIUM plus Cupric Oxide.

**Titanium**
See TITANIUM plus Cupric Oxide.

**Zirconium**
See ZIRCONIUM plus Cupric Oxide.

## CUPRIC PHOSPHIDE $Cu_3P_2$

**Potassium Chlorate**
When copper phosphide is mixed with oxidizing agents, such as potassium chlorate, it explodes on impact.
*Mellor* **8:** 839 (1946–1947).

**Potassium Nitrate**
When copper phosphide is mixed with potassium nitrate and heated, an explosion occurs.
*Mellor* **8:** 839 (1946–1947).

**Water**
On contact with water, copper phosphide yields phosphine, which is spontaneously flammable.
*Schwab* (1970).

## CUPRIC SALTS

**Sodium Hypobromite**
See SODIUM HYPOBROMITE plus Cupric Salts.

## CUPRIC SULFATE $CuSO_4$

**Hydroxylamine**
Anhydrous copper sulfate causes hydroxylamine to ignite and the hydrated salt is vigorously reduced.
*Mellor* **8:** 292 (1946–1947).

**Magnesium**
See MAGNESIUM plus Cupric Sulfate.

## CUPRIC SULFIDE CuS

**Cadmium Chlorate**
Copper sulfide explodes on contact with a concentrated solution of chloric acid or chlorates of cadmium, magnesium, or zinc.
*Mellor* **Supp. II, Part I:** 584 (1956).

**Chlorates**
See COPPER SULFIDE plus Cadmium Chlorate.

**Chloric Acid**
See COPPER SULFIDE plus Cadmium Chlorate.

**Hydrogen Peroxide**
See ANTIMONY TRISULFIDE plus Hydrogen Peroxide.

**Magnesium, Ammonium Nitrate, Potassium Chlorate and Water**
See MAGNESIUM plus Copper Sulfate (anhydrous), Ammonium Nitrate, Potassium Chlorate and Water.

**Magnesium Chlorate**
See COPPER SULFIDE plus Cadmium Chlorate.

**Zinc Chlorate**
See COPPER SULFIDE plus Cadmium Chlorate.

## CUPRIC-TETRAMMINE CHLORATE $Cu(NH_3)_4(ClO_3)_2$

**(self-reactive)**
This compound will detonate when struck.
*Mellor* **2, Supp. 1:** 592 (1956).

## CUPRIC-TETRAMMINE PERCHLORATE $Cu(NH_3)_4(ClO_4)_2$

**(self-reactive)**
This compound will detonate when struck but is less sensitive than tetramminocupric chlorate.
*Mellor* **2, Supp. 1:** 592 (1956).

## CUPROUS AZIDE $CuN_3$

**(self-reactive)**
Cuprous azide decomposes at 205°C. It is explosively unstable.
*Mellor* **8, Supp. 2:** 43 (1967).

## CUPROUS BROMIDE CuBr

**Potassium**
See POTASSIUM plus Aluminum Bromide.

## CUPROUS CARBIDE $Cu_2C_2$

**(self-reactive)**
Cuprous acetylide is explosive and can be detonated by percussion or when heated above 100°C.
*Mellor* **5:** 851, 852 (1946–1947). *Rutledge,* p. 84 (1968).

**Acetylene**
If warmed in air or oxygen for several hours, it explodes when brought in contact with acetylene.
*Mellor* **5:** 851, 852 (1946–1947).

**Bromine**
See BROMINE plus Cuprous Acetylide.

**Chlorine**
See BROMINE plus Cuprous Acetylide.

**Iodine**
See BROMINE plus Cuprous Acetylide.



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**Silver Nitrate**
Cuprous acetylide and silver nitrate give off an explosive mixture.
*Mellor* **5:** 853 (1946–1947). J. K. Luchs, *Photo. Sci. Eng.* **10** (6): 334–7 (1966).

**CUPROUS CHLORIDE** CuCl

**Potassium**
See POTASSIUM plus Aluminum Bromide.

**CUPROUS CYANIDE** CuCN

**Magnesium**
See MAGNESIUM plus Cadmium Cyanide.

**CUPROUS HYDRIDE** $Cu_2H_2$

**Air**
Dry copper hydride is spontaneously flammable in air.
*Von Schwartz*, p. 156 (1964).

**Bromine**
See BROMINE plus Copper Hydride.

**Chlorine**
See BROMINE plus Copper Hydride.

**Fluorine**
See BROMINE plus Copper Hydride.

**CUPROUS IODIDE** CuI

**Potassium**
See POTASSIUM plus Aluminum Bromide.

**CUPROUS NITRIDE** $Cu_3N$

**Nitric Acid**
See CUPRIC NITRIDE plus Nitric Acid.
See CUPROUS NITRIDE plus Sulfuric Acid.

**Sulfuric Acid**
The reaction of cuprous nitride and sulfuric or nitric acid is violent.
*Mellor* **8, Supp. 1:** 154 (1964).

**CUPROUS TETRAHYDROALUMINATE** $CuAlH_4$

**Air**
Copper aluminohydride is spontaneously flammable in air.
J. Aubrey and G. Monnier, *Comp. Rend.* **238:** 2534–2535 (1954).

**CYANIDES**

**(See also specific cyanides as primary entries or under other reactants)**

**Chlorates**
Violent explosion occurs if cyanide salt is melted with nitrite salt. The melt explodes if cyanide plus chlorate or nitrite is heated to 450°C.
*Von Schwartz*, pp. 299, 327 (1918).
Also see ANTIMONY SULFIDE plus Chlorates.

**Fluorine**
See FLUORINE plus Chlorides.

**Magnesium**
See MAGNESIUM plus Cadmium Cyanide.

**Nitrates**
See NITRATES plus Cyanides.

**Nitric Acid**
See NITRIC ACID plus Cyanides.

**Nitrites**
See CYANIDES plus Chlorates.
See NITRITES plus Potassium Cyanide.

**CYANOACETIC ACID** $NCCH_2COOH$

**Furfuryl Alcohol**
See FURFURYL ALCOHOL plus Cyanoacetic Acid.

**CYANOACETYL CHLORIDE** $NCCH_2COCl$

**(self-reactive)**
Cyanoacetyl chloride was prepared from cyanoacetic acid and phosphorus pentachloride. Following distillation of the volatile material, the crude cyanoacetyl chloride was placed in a hood in a stoppered, 1-liter flask. About 24 hours later the flask exploded.
*Wischmeyer* (1967).

**CYANODIMETHYLARSINE** $(CH_3)AsCN$

**Air**
Dimethylcyanoarsine is spontaneously flammable in air.
*Ripley* (1966).

**2-CYANOETHANOL** $HOCH_2CH_2CN$

**Sulfuric Acid**
Concentrated sulfuric acid reacts violently with both ethylene cyanohydrin and epichlorohydrin.
*Confidential information furnished to NFPA.*

**CYANOGEN** NCCN

**Fluorine**
See FLUORINE plus Cyanogen.

**Oxygen**
See OXYGEN (LIQUID) plus Cyanogen.

**CYANOGEN AZIDE** NCNNN

**(self-reactive)**
Cyanogen azide explodes when shocked mechanically or thermally.
*Chem. and Eng. News* **43** (52): 29, 30 (Dec. 27, 1965).

**CYANOGEN IODIDE** NCI

**Phosphorus**
See PHOSPHORUS plus Cyanogen Iodide.

**CYANURIC CHLORIDE** N=CClN=CClN=CCl

**Dimethyl Sulfoxide**
See DIMETHYL SULFOXIDE plus Acyl Halides.

**Water**
Cyanuric chloride acts autocatalytically with water at a temperature of about 30°C to produce cyanuric acid, hydrochloric acid and heat. An explosion occurred during an industrial process in which cyanuric chloride and water were mixed. The refrigeration had been turned off. Pressure built up in the reactor and blew gaskets, allow-


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ing flammable vapors to fill the building. The explosion occurred when the vapors were ignited.
*MCA Case History* **1869** (1972).

**CYCLOHEXANE** $C_6H_{12}$

**Nitrogen Dioxide**
Through an error, liquid nitrogen dioxide instead of gaseous was fed into a nitration column containing hot cyclohexane. An explosion resulted.
*MCA Case History* **128** (1962).

**CYCLOHEXANOL** $C_6H_{11}OH$

**Nitric Acid**
See NITRIC ACID plus Cyclohexanol.

**CYCLOHEXANONE** $CO(CH_2)_4CH_2$

**Nitric Acid**
See NITRIC ACID plus Cyclohexanone.

**CYCLOPENTADIENYLCHROMIUM DINITROSYL DIMER** $[C_5H_5(NO)_2Cr]_2$

**(self-reactive)**
A glass vial of the dimer in the sample compartment of a laser Raman spectrophotometer exploded on excitation by the helium-neon beam.
*Chem. & Ind.* No. **7:** 201 (1969). R. B. King and M. B. Bisnette, *Inorg. Chem.* **3:** 79 (1964).

**DECABORANE (14)** $B_{10}H_{14}$

**Oxygen**
See OXYGEN plus Decaborane.

**DEXTROSE** $C_6H_{12}O_6$

**Sodium Peroxide and Potassium Nitrate**
See SODIUM PEROXIDE plus Dextrose and Potassium Nitrate.

**DIACETYL PEROXIDE** $(CH_3CO)_2O_2$

**(self-reactive)**
Acetyl peroxide is unpredictable. Five grains of it being removed from an ice chest detonated violently.
*Chem. and Eng. News* **26:** 3197 (1948).
Pure diacetyl peroxide is a severe explosion hazard.
*Cond. Chem. Dict.* **10:** (1971).
See also HYDROGEN PEROXIDE plus Acetic Anhydride.

**Diethyl Ether**
Solid acetyl peroxide in contact with ether or any volatile solvent may explode violently. A 5-gram portion in ether detonated while being carried.
L. P. Kuhn, *Chem. and Eng. News* **26:** 3197 (1948); E. S. Shanley, *Chem. and Eng. News* **27:** 175 (1949).

**Organic Materials**
See ACETYL PEROXIDE plus Solvents.

**Solvents**
Acetyl peroxide is extremely shock-sensitive. When a solution of acetyl peroxide in any volatile solvent is evaporated, the concentration may become high enough for spontaneous explosions. Acetyl peroxide is a powerful oxidizing agent; it may cause ignition of organic materials on contact.
*Chem. and Eng. News* **26:** 3197 (1948). *Chem. and Eng. News* **27:** 175 (1949).

**DIALKYLPHOSPHINES**

**Chlorine**
See CHLORINE plus Alkylphosphines.

**DIALLYL METHYL CARBINOL** $(CH_2{=}CHCH_2)_2C(OH)CH_3$

**Ozone and Acetic Acid**
During the preparation of -hydroxy–methyl glutaric acid using 75 grams of diallyl methyl carbinol, the material had been ozonized and allowed to stand overnight. Glacial acetic acid had been added and the mixture was being concentrated under vacuum in a desiccator. After 1½ hours the mixture exploded. Previous preparations using 12.6 grams were successful.
*Chem. and Eng. News.* **51** (6): 29 (Feb. 5, 1973).

**DIALLYL PHOSPHITE** $(C_3H_5O)_2POH$

**(self-reactive)**
Diallyl phosphite is made from allyl alcohol and phosphorus trichloride. When the product is distilled in vacuo in a carbon dioxide stream, explosions usually occur after about two-thirds is distilled.
*Zh. Obshch. Khim.* **21:** 658–62 (1951).

**DIAMIDOPHOSPHOROUS ACID** $POH(NH_2)_2$

**Water**
This material dissolves in water with such violence that the mass becomes incandescent.
*Mellor* **8:** 704 (1946–1947).

**DI-o-AZIDOBENZOYL PEROXIDE** $[C_6H_4(N_3)CO]_2O_2$

**(self-reactive)**
A 2-gram sample of the crystalline material on a sintered glass funnel detonated "with extreme violence" when touched with a metal spatula. A build-up of static charge on the sintered glass may have initiated the decomposition.
*Chem. and Eng. News* **41** (48): 45; **41** (52): 5 (1963).

**1,3-DIAZIDOPROPENE** $N_3CH{=}CHCH_2N_3$

**(self-reactive)**
In the determination of the weight of a sample of 1,3-diazidopropene, a violent explosion occurred.
J. H. Bover and F. C. Canter, *Chem. Reviews* **54:** 32, 33 (1954).

**DIAZOCYCLOPENTADIENE** $NN{=}CCH{=}CHCH{=}CH$

**(self-reactive)**
Diazocyclopentadiene should be handled cautiously since during one preparation a violent explosion took place after distillation.
F. Ranairez and S. Levy, *J. Org. Chem.* **23:** 2036–7 (1958).

**DIAZOMALONIC ACID** $(HOCO)_2C{=}NN$

**(self-reactive)**
Six grams of impure diazomalonic acid was being distilled under 3 millimeters pressure in a 50 milliliter flask.

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After three minutes of heating, during which no product was obtained, the flask exploded.
*NSC Newsletter, Campus Safety* **3** (1973).

**DIAZOMETHANE** $NN{=}CH_2$

**(self-reactive)**
Diazomethane will undergo violent thermal decomposition. Above 200°C, the vapor may explode violently. Explosions at low temperatures can occur if traces of organic matter are present.
*J. Phys. Chem.* **35:** 1493 (1931).

**Organic Matter**
See DIAZOMETHANE (self-reactive).

**DIAZONIUM CHLORIDE SALTS**

**Sodium Sulfide**
See SODIUM SULFIDE plus Diazonium Salts and Diazonium Chloride Salts.

**DIAZONIUM PERCHLORATES**

**(self-reactive)**
Diazonium perchlorates are particularly hazardous, being exploded by the slightest shock when dry.
*Berichte* **39:** 3146–8 (1906). *German Pat.* 258,679 (Apr. 27, 1911). *ACS* **146:** 213.

**DIAZONIUM SALTS**

**Sodium Bisulfide**
See DIAZONIUM SALTS plus Thiophenates.

**Sodium Sulfide**
See SODIUM SULFIDE plus Diazonium Salts and Diazonium Chloride Salts.
See DIAZONIUM SALTS plus Thiophenates.

**Thiophenates**
This reaction is often quoted as a route to diaryl sulfides without mention of explosive hazards. Unstable p-chlorodiazobenzene thiophenyl ether has been prepared by this route. Two reactions of this type were attempted and in both cases explosive compounds were produced. Also, reported explosions from reactions of diazonium salts with xanthates, sodium bisulfide, and sodium sulfide are attributed to formation of diazo ethers or related compounds.
*BCISC* **40** (158): 17–18 (1969).

**Xanthates**
See DIAZONIUM SALTS plus Thiophenates.

**DIBENZOYL PEROXIDE** $(C_6H_5CO)_2O_2$

**N,N-Dimethylaniline**
Explosive decomposition occurred when finely ground benzoyl peroxide was allowed to react with N,N-dimethylaniline by breaking an ampoule containing 0.5 grams of dimethylaniline in an autoclave.
L. Horner and C. Betzel, *Chem. Ber.* **86:** 1071–72 (1953).

**Lithium Aluminum Hydride**
An attempted reduction of benzoyl peroxide with lithium aluminum hydride resulted in an explosion.
D. A. Sutton, *Chem. & Ind.* **1951:** 272 (1951).

**DIBENZYL CHLOROPHOSPHONATE**
$(C_6H_5CH_2O)_2POCl$

**(self-reactive)**
Dibenzylchlorophosphonate can decompose violently during vacuum distillation.
*Chem. and Eng. News* **28:** 3452 (Oct. 2, 1950).
*J. Chem. Soc.* 1106–10 (1948).

**DIBENZYL PHOSPHITE** $(C_6H_5CH_2O)_2PHO$

**(self-reactive)**
Dibenzyl phosphite can decompose violently during vacuum distillation.
*Chem. and Eng. News* **28:** 3452 (Oct. 2, 1950).
*J. Chem. Soc.* **385** (1945).

**DIBORANE** $BH_2(H_2)BH_2$

**Aluminum**
See ALUMINUM plus Diborane.

**Carbon Tetrachloride**
See CARBON TETRACHLORIDE plus Diborane.

**Chlorine**
See CHLORINE plus Diborane.

**Halogenated Hydrocarbons**
Diborane reacts violently with halogenated hydrocarbons (as in vaporizing liquid fire extinguishing agents).
*Haz. Chem. Data* (1966).

**Nitric Acid**
See NITRIC ACID plus Diborane.

**Nitrogen Trifluoride**
See NITROGEN TRIFLUORIDE plus Diborane.

**Oxygen**
See OXYGEN plus Diborane.

**Phosphorus Trifluoride**
See PHOSPHORUS TRIFLUORIDE plus Diborane.

**Water**
Diborane ignites spontaneously in moist air.
*Haz. Chem. Data* (1966). E. L. Poling and H. P. Simons, *Ind. Eng. Chem.* **50:** 1695–1698 (1958). P. L. Sampl and H. P. Simons, *Ind. Eng. Chem.* **50:** 1699–1702 (1958).

**2,6-DIBROMO-p-BENZOQUINONE-4-CHLORIMINE**
$O{=}C_6H_2Br_2{=}NCL$

**(self-reactive)**
While thin layer chromatograms were being dried with a hot-air dryer, a 25-gram bottle of 2,6-dibromo-p-benzoquinone-4-chlorimine, one to two feet away, exploded.
*Chem. & Ind.* **37:** 1551 (1967).

**DIBROMOBORYL-PHOSPHINE** $Br_2BPH_2$

**Air**
Dibromoborine phosphine is spontaneously flammable in air.
*Douda* (1966).

**2,6-DIBROMO-N-CHLOROBENZOQUINONIMINE**
$OC_6H_2(Br)_2NCl$

**(self-reactive)**
This chromatographic reagent can decompose violently under readily obtainable laboratory conditions. After a


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small quantity exploded on a laboratory reagent shelf, tests were made on one-half-gram quantities in a thermal stability bomb. When the temperature was raised gradually to 120°C, a violent exothermic reaction raised the pressure to 1,800 psi and burst the rupture diaphragm. A second sample held at 60°C decomposed similarly after 3 hours. Tests on the chlorocompound 2,6-DICHLOROQUINONECHLORIMIDE showed similar, but less severe instability.
*Chem. and Eng. News* **45** (50):54 (Dec. 11, 1967).
*Chem. & Ind.* **37:** 1551 (Sept. 1967).

**DIBROMOMALONONITRILE** $CBr_2(CN)_2$

**Sodium Azide**
See SODIUM AZIDE plus Dibromomalononitrile.

**DIBROMOTRIMETHYLALUMINUM** $(CH_3)_3AlBr_2$

**Air**
Trimethyl aluminum bromide is spontaneously flammable in air.
*Chem. Eng. Progs.* **63** (7): 126 (1967).

**DIBUTYL CHLOROBORANE** $(C_4H_9)_2BCl$

**Air**
Dibutyl boron chloride is spontaneously flammable in air.
*Buls, Bimonthly Rept.* **8,** p. 4 (1953).

**DIBUTYL ETHER** $C_4H_9OC_4H_9$

**Nitrogen Trichloride**
See NITROGEN TRICHLORIDE plus Di-n-Butyl Ether.

**DIBUTYLMAGNESIUM** $(C_4H_9)_2Mg$

**Air**
Dibutylmagnesium is spontaneously flammable in air.
*Douda* (1966).

**2,6-DI-t-BUTYL-4 NITROPHENOL**
$HOC_6H_3[C(CH_3)\ 2CH_3]_2$

**(self-reactive)**
This material exploded violently after being warmed for two to three minutes on a steam bath.
*ASESB Expl. Report* **24** (1961).

**2,6-DI-t-BUTYLPHENOL** $HOC_6H_3[C(CH_3)_2CH_3]_2$

**Nitric Acid**
See NITRIC ACID plus Di-t-Butylphenol.

**DIBUTYL PHTHALATE** $(C_4H_9OCO)_2C_6H_4$

**Chlorine**
See CHLORINE plus Polypropylene.

**DIBUTYL SULFOXIDE** $(C_4H_9)_2SO$

**Perchloric Acid**
See PERCHLORIC ACID plus Dibutyl Sulfoxide.

**DICHLORINE HEPTOXIDE** $Cl_2O_7$

**(self-reactive)**
Dichlorine heptoxide explodes violently under a blow or when heated rapidly.
*Mellor* **2, Supp. 1:** 542 (1956).

**DICHLOROACETYLENE** ClC≡CCl

**(self-reactive)**
During synthesis of dichloroacetylene, the dichloroacetylene accidentally condensed and collected in a water trap. When the chemist attempted to sample the material in the trap, a violent explosion occurred. Since dichloroacetylene is reported to be shock-sensitive, the touching of the sample could have initiated the detonation.
*MCA Case History* **1989** (1974).

**Air**
Dichloroacetylene ignites or explodes on contact with air.
*MCA Case History* **495** (1956); **1065** (1965).
When moist chlorine was passed over calcium carbide and potassium hydroxide, a solution of 58% dichloroacetylene was collected in ether. The solution burned spontaneously and filled the laboratory with phosgene. When the head was removed from a steel bomb used for one of the experiments, contact with air caused an explosion that drove the base of the bomb through the floor.
R. Reemschneider and K. Brendel, *Ann. Chem.* **640:** 5(1961). *Rutledge,* p. 138 (1968).

**DICHLOROBENZENE** $ClC_6H_4Cl$

**Aluminum**
See ALUMINUM plus Ethylene Dichloride, Propylene Dichloride, and Orthodichlorobenzene.

**DICHLORODIETHYLDIAMMINE COBALT PERCHLORATE** $[Co(Cl)_2(C_2H_5)_2(NH_2)_2]ClO_4$

**(self-reactive)**
Dichlorodiethyldiammine cobalt perchlorate explodes at 300°C and is impact sensitive.
W. R. Tomlinson, Jr., and L. F. Audrieth, *J. Chem. Edu.* **27:** 606–609 (1950).

**DICHLORODIFLUOROMETHANE** $CCl_2F_2$

**Aluminum**
See ALUMINUM plus Dichlorodifluoromethane.

**DICHLORODIMETHYLSILANE** $(CH_3)_2SiCl_2$

**Water**
Dimethyldichlorosilane reacts violently with water.
*Title* 46 (1970).

**DICHLORO(DISILYLAMINO)BORANE** $(SiH_3)_2NBCl_2$

**Air**
Disilylamino dichloroborane is spontaneously flammable in air.
*Douda* (1966).

**DICHLOROETHYLALUMINUM** $C_2H_5AlCl_2$

**Air**
Ethyl aluminum dichloride is spontaneously flammable in air.
*Douda* (1966).

**Benzene and Allyl Chloride**
See ALLYL CHLORIDE plus Benzene and Ethyl Aluminum Dichloride.

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**Toluene and Allyl Chloride**
See ALLYL CHLORIDE plus Benzene and Ethyl Aluminum Dichloride.

**Water**
Ethyl aluminum dichloride reacts violently with water.
*Rose* (1961).

**DICHLOROETHYLBORANE** $C_2H_5BCl_2$

**Air**
Ethyl boron dichloride is spontaneously flammable in air.
*Buls, Bimonthly Rept.* 5, p. 3 (1953).

**1,2-DICHLOROETHYLENE** ClCH=CHCl

**Nitrogen Tetroxide**
See NITROGEN TETROXIDE plus 1,2-Dichloroethane.

**Potassium Hydroxide**
See POTASSIUM HYDROXIDE plus 1,2-Dichloroethylene.

**Sodium**
See SODIUM plus 1,2-Dichloroethylene.

**Sodium Hydroxide**
See SODIUM plus 1,2-Dichloroethylene.

**DICHLOROFLUORAMINE** $Cl_2NF$

**(self-reactive)**
Dichlorofluoramine is explosive in the liquid state.
*Lawless and Smith,* p. 88 (1968).

**1,6-DICHLORO-2,4-HEXADIYNE** $(Cl{\cdot}CH_2C{\equiv}C\text{-})_2$

**(self-reactive)**
1, 6-dichloro-2, 4-hexadiyne is shock-sensitive.
P. E. Drieder and H. V. Isaacson,
*Chem. and Eng. News* **50** (12): 51 (1972).

**DICHLOROMETHANE** $ClCH_2Cl$

**Nitrogen Tetroxide**
See NITROGEN TETROXIDE plus 1,2-Dichloroethane.

**Oxygen (Liquid)**
See OXYGEN (LIQUID) plus Chlorinated Hydrocarbons.

**Potassium**
See POTASSIUM plus Chloroform.

**Sodium**
See POTASSIUM plus Chloroform.

**Sodium-Potassium Alloy**
See SODIUM-POTASSIUM ALLOY plus Carbon Tetrachloride.

**N,N-DICHLOROMETHYLAMINE** $CH_3NCl_2$

**Sodium Sulfide**
N,N-dichloromethylamine exploded violently on addition of sodium sulfide.
*Biul. Wojskowej Akad. Tech.* **8** (48): 75–9 (1959).

**1,2-DICHLOROPROPANE** $ClCH_2CHClCH_3$

**Aluminum**
See ALUMINUM plus Ethylene Dichloride, Propylene Dichloride and Orthodichlorobenzene.
See ALUMINUM plus Propylene Dichloride.

**DICHLOROSILANE** $H_2SiCl_2$
Dichlorosilane explodes immediately on contact with strong solid oxidants such as nitrate/nitrite mixtures.
*Plant Operations Progress,* Britton (1990).

**1,2-DICHLORO-1,1,2,2-TETRAFLUOROETHANE** $CClF_2CF_2Cl$

**Aluminum**
See ALUMINUM plus Dichlorodifluoromethane.

**DICYANDIAZIDE** $NCN{=}C(NNN)_2$

**(self-reactive)**
Dicyandiazide is a shock-sensitive compound.
*Chem. and Eng. News* **43** (52): 29, 30 (Dec. 27, 1965).

**2,2-DIETHOXYCYCLODISILOXANE** $(C_2H_5O)_2SiOSiH_2O$

**Air**
Diethoxycyclodisiloxane is spontaneously flammable in air.
*Kaufman* (1961).

**DIETHYLALUMINUM HYDRIDE** $(C_2H_5)_2AlH$

**Air**
Diethyl aluminum hydride ignites spontaneously in air.
*Fire Haz. Prop.* (1969).

**DIETHYLAMINE** $C_4H_{11}N$

**Cellulose Nitrate**
Cellulose nitrate of high surface area (dry or alcohol-wet guncotton or scrap) spontaneously ignited in contact with diethylamine used as curing agent for epoxide resins.
*ABCM Quarterly Safety Summary* (1956); *Bretherick* (1979).

**Dicyanofurazan**
Contact of dicyanofurazan, or its N-oxide, with diethylamine or mixtures of nitrogenous bases is instantaneously explosive.
Denson, D. B., *Chem. Abst.* (1973).

**DIETHYLARSINE** $(C_2H_5)_2AsH$

**Air**
Diethylarsine is spontaneously flammable in air.
*Douda* (1966).

**DIETHYL AZODICARBOXYLATE**
$C_2H_5OCON{=}NCOOC_2H_5$

**(self-reactive)**
A sample decomposed upon attempted distillation with sufficient violence to shatter the distillation apparatus.
*Org. Syntheses* **28,** p. 59 (1948).

**DIETHYLCADMIUM** $(C_2H_5)_2Cd$

**Air**
Diethylcadmium fumes explode in air.
*Brauer* (1965).


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**DIETHYL (3-DIETHYLAMINOPROPYL) ALUMINUM**
$(C_2H_5)_2Al(CH_2)_3N(C_2H_5)_2$

**Air**
Diethyl 3-diethylaminopropyl aluminum is spontaneously flammable in air.
*Douda* (1966).

**DIETHYL ETHER** $C_2H_5OC_2H_5$
Forms unstable peroxides upon prolonged contact with air which can concentrate and explode during distillation/evaporation.

**Acetyl Peroxide**
See ACETYL PEROXIDE plus Diethyl Ether.

**Air**
See also OXYGEN plus Diethyl Ether.

**Air (Liquid)**
A mixture of liquid air and diethyl ether exploded spontaneously.
*Z. Angew. Chem.* **40:** 1317. *MCA Case History* ***616*** (1960).

**Bromoazide**
See BROMOAZIDE plus Diethyl Ether.

**Chlorine**
See CHLORINE plus Diethyl Ether.

**Chlorine Trifluoride**
See CHLORINE TRIFLUORIDE plus Diethy Ether.

**Chromic Anhydride**
See CHROMIC ANHYDRIDE plus Diethyl Ether.

**Chromyl Chloride**
See CHROMYL CHLORIDE plus Acetone.

**Lithium Aluminum Hydride**
See LITHIUM ALUMINUM HYDRIDE plus Diethyl Ether.

**Nitrosyl Perchlorate**
See NITROSYL PERCHLORATE plus Diethyl Ether.

**Nitryl Perchlorate**
See NITRYL PERCHLORATE plus Benzene.

**Ozone**
See OZONE plus Diethyl Ether.

**Perchloric Acid**
See PERCHLORIC ACID plus Diethyl Ether.

**Permanganates and Sulfuric Acid**
See PERMANGANATES plus Sulfuric Acid and Benzene.

**Potassium Peroxide**
See SODIUM PEROXIDE plus Aniline.

**Sodium Peroxide**
See SODIUM PEROXIDE plus Aniline.

**Triethyl Aluminum and Air**
See TRIETHYL ALUMINUM plus Diethyl Ether and Air.

**Trimethyl Aluminum and Air**
See TRIMETHYL ALUMINUM plus Diethyl Ether and Air.

**DIETHYLMAGNESIUM** $(C_2H_5)_2Mg$

**Air**
Diethylmagnesium is spontaneously flammable in air; it explodes violently on contact with water and will glow and catch fire even in carbon dioxide. It must be handled in high vacuum, or under dry nitrogen or hydrogen.
*Merck Index,* p. 359 (1968).

**Carbon Dioxide**
See DIETHYL MAGNESIUM plus Air.

**Water**
See DIETHYL MAGNESIUM plus Air.

**DIETHYLPHOSPHINE** $(C_2H_5)_2PH$

**Air**
Diethylphosphine is spontaneously flammable in air.
*Von Schwartz,* p. 323 (1918).

**DIETHYL PEROXIDE** $C_2H_5OOC_2H_5$

**(self-reactive)**
See OXYGEN plus Ethers.

**DIETHYL PEROXYDICARBONATE** $[C_2H_5OCOO\text{-}]_2$

**(self-reactive)**
Diethyl peroxydicarbonate decomposes rapidly at room temperature, sometimes with an explosion. It becomes hazardous above 10°C. One must avoid allowing it to crystallize.
*Kirk and Othmer, Second Ed.* **14:** 801, 803 (1963).

**DIETHYL SULFATE** $(C_2H_5O)_2SO_2$

**Metals and Water**
The presence of moisture in a metal container of diethyl sulfate caused formation of sulfuric acid which reacted with the metal to release hydrogen which pressurized and exploded the container.
*Chem. Abst.* **28:** 2908 (1934).
*Angew. Chem. Intern. Ed. Engl.* **47:** 105 (1934).

**Potassium Tert.-Butoxide**
See ACETONE plus Potassium Tert.-Butoxide.

**DIETHYL TELLURIDE** $(C_2H_5)_2Te$

**Air**
Diethyl telluride is spontaneously flammable in air.
*Ellern,* pp. 24–25 (1968).

**1,2-DIETHYLTETRAIODODIALUMINUM**
$C_2H_5I_2Al_2I_2C_2H_5$

**Air**
1,2-Diethyl tetraiodo dialuminum is spontaneously flammable in air.
*Douda* (1966).

**DIETHYLZINC** $(C_2H_5)_2Zn$

**Air**
Diethyl zinc is spontaneously flammable in air.
*Douda* (1966). *Handbook Chem. Phys.,* p. C-715 (1970–1971).
*Mellor* **1:** 376 (1946–1947).
See also CHLORINE plus Diethyl Zinc.

**Chlorine**
See CHLORINE plus Diethyl Zinc.

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**Hydrazine**
See ZINC DIAMIDE plus Hydrazine.

**Water**
Diethyl zinc reacts violently with water.
*Brauer* (1965).

**2,4-DIETHYNYL-5-METHOXYTOLUENE**
$(CH{\equiv}C\text{-})_2C_6H_2(CH_3)OCH_3$

**(self-reactive)**
The polymer of this material explodes thermally.
*Chem. Abst.* **75:** 19831 (1971).

**2,4-DIETHYNYL-5-METHYLPHENOL**
$(CH{=}C\text{-})_2C_6H_2(OH)CH_3$

**(self-reactive)**
This compound is unstable in light and air.
*Chem. Abst.* **75:** 19831 (1971).

**DIFLUORAMINE** $NHF_2$

**(self-reactive)**
A small flask of gaseous difluoramine in a train of glass apparatus broke loose and exploded when it fell to the concrete floor. A nearby glass U-tube containing liquid difluoramine at minus 80°C exploded either from the shock of the first explosion or from the inrush of air after the apparatus broke.
*MCA Case History* **768** (1961).
Difluoramine has a tendency to explode when in the solid state or during the process of freezing or melting.
*Lawless and Smith,* pp. 70–71 (1968).

**Chlorine Dioxide**
See CHLORINE DIOXIDE plus Difluoramine.

**DIFLUORINE PEROXIDE** $O_2F_2$

**Organic Matter**
Even at minus 160°C or below a violent reaction or an explosion results when dioxygen difluoride reacts with any organic material and most inorganic materials containing hydrogen.
Solomon, Kacmarck, and McDonough, *J. Chem. Eng. Data* **13** (4): 529–531 (1968).

**Sulfur Trioxide**
The reaction of sulfur trioxide and oxygen difluoride is very vigorous and explosions occur if the reaction is carried out in the absence of a solvent.
Solomon, Kacmarck and McDonough, *J. Chem. Eng. Data* **13** (4): 529–531 (1968).

**DIFLUORODIAZENE** $N_2F_2$

**(self-reactive)**
Studies of the isomerization of difluorodiazine in a copper tube indicated that the cis form is much less stable than the trans.
*Lawless and Smith,* pp. 42, 43 (1968).

**DIGERMANE** $Ge_2H_6$

**Air**
Digermane ignites spontaneously in air.
*Ellern,* p. 22 (1968).

**DIHYDRAZINOZINC CHLORATE** $Zn(N_2H_4)_2(ClO_3)_2$

**(self-reactive)**
This compound detonates when struck.
*Mellor* **2, Supp. 1:** 592 (1956).
See ZINC-HYDRAZINE CHLORATE.

**1, 6-DIIODO-2,4-HEXADIYNE** $(I\text{-}CH_2C{\equiv}C\text{-})_2$

**(self-reactive)**
1, 6-diiodo-2,4-hexadiyne is shock-sensitive.
P. E. Drieder and H. V. Isaacson, *Chem. and Eng. News* **50** (12): 51 (1972).

**DIIODOMETHANE** $ICH_2I$

**Sodium-Potassium Alloy**
See SODIUM-POTASSIUM ALLOY plus Diiodomethane.

**DIISOAMYL ZINC** $((CH_3)_2CHC_2H_4)_2Zn$

**Air**
Isoamyl zinc is spontaneously flammable in air.
*Dangerous Chem. Code,* p. 343 (1951).

**DIISOBUTYLALUMINUM HYDRIDE** $(C_4H_9)_2AlH$

**Air**
Diisobutyl aluminum hydride is spontaneously flammable in air.
*Rose* (1961).

**DIISOBUTYLENE** $CH_2{=}C(CH_3)CH_2C(CH_3)_3$

**Chorosulfonic Acid**
Mixing diisobutylene and chlorosulfonic acid in a closed container caused the temperature and pressure to increase.
*Flynn and Rossow* (1970). See Note under complete reference.

**Oleum**
Mixing diisobutylene and oleum in a closed container caused the temperature and pressure to increase.
*Flynn and Rossow* (1970). See Note under complete reference.

**Sulfuric Acid**
Mixing diisobutylene and 96% sulfuric acid in a closed container caused the temperature and pressure to increase.
*Flynn and Rossow* (1970). See Note under complete reference.

**DIISOBUTYL ZINC** $((CH_3)_2CHCH_2)_2Zn$

**Air**
Isobutyl zinc is spontaneously flammable in air.
*Dangerous Chem. Code,* p. 343 (1951).

**DIISOPROPYLBERYLLIUM** $(C_3H_7)_2Be$

**Water**
Diisopropyl beryllium reacts explosively with water.
G. E. Coates and F. Glockling, *J. Chem. Soc.* **106:** 22 (1954).

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**DIISOPROPYL ETHER** $(CH_3)_2CHOCH(CH_3)_2$

**Air**

A flask of diisopropyl ether was being heated on a steam bath with gentle shaking when an explosion occurred. In a second instance, an explosion occurred after practically all the ether had been distilled.
*MCA Guide for Safety,* Appendix 3 (1972).
Diisopropyl ether and air form highly explosive peroxides.
*Wischmeyer* (1969).

**Air or Oxygen**

See OXYGEN plus Ethers.
See OXYGEN plus Isopropyl Ether.

**Chlorosulfonic Acid**

Mixing diisopropyl ether and chlorosulfonic acid in a closed container caused the temperature and pressure to increase.
*Flynn and Rossow* (1970). See Note under complete reference.

**Nitric Acid**

Mixing diisopropyl ether and 70% nitric acid in a closed container caused the temperature and pressure to increase.
*Flynn and Rossow* (1970). See Note under complete reference.

**DIISOPROPYL PEROXYDICARBONATE** $[(CH_3)_2CHOC(O)O\text{-}]_2$

**(self-reactive)**

Diisopropyl perdicarbonate decomposes rapidly at room temperature and sometimes explodes. It becomes hazardous above 10°C. It should not be allowed to crystallize.
*Kirk and Othmer, Second Ed.* **14:** 801, 803 (1963).

**Organic Matter**

Upon contact with diisopropyl peroxydicarbonate, combustible organic materials can ignite or explode.
*Haz. Chem. Data* p. 121 (1973).

**DIKETENE** $H_2C_3H_2CO_2$

Diketene residues awaiting incineration in a tank trailer decomposed violently on standing, and blew off the dome cover and ignited.
*Vervalin* (1973).

**Acids or Bases**

Presence of mineral, or Lewis acids, or bases including amines, will catalyze violent polymerization.
*Hazardous Chemicals Data,* NFPA 49 (1971).

**1,2-DIMETHOXYETHANE** $CH_2(OCH_3)CH_2(OCH_3)$

**Lithium Aluminum Hydride**

See LITHIUM ALUMINUM HYDRIDE plus 1,2-Dimethoxyethane.

**2,2-DIMETHOXYPROPANE** $CH_3C(OCH_3)_2CH_3$

**Manganese Perchlorate and Ethyl Alcohol**

See ETHYL ALCOHOL plus Manganese Perchlorate and 2,2-Dimethoxypropane.

**Nickel Perchlorate**

See NICKEL PERCHLORATE plus 2,2-Dimethoxypropane.

**DIMETHYLAMINE** $C_2H_7N$

**Maleic Anhydride**

Maleic anhydride decomposes exothermically, evolving carbon dioxide in the presence of dimethylamine.
Vogler, et al., *J. Chem. Eng. Data* (1963).

**N, N-DIMETHYLANILINE** $C_6H_5N(CH_3)_2$

**Benzoyl Peroxide**

See BENZOYL PEROXIDE plus N, N-Dimethylaniline.

**DIMETHYLARSINE** $(CH_3)_2AsH$

**Air**

Dimethylarsine is spontaneously flammable in air.
*Douda* (1966). *Handbook Chem. Phys.,* p. C-681 (1970–1971).

**DIMETHYL CARBONATE** $CH_3OCOOCH_3$

**Potassium Tert.-Butoxide**

See ACETONE plus Potassium Tert.-Butoxide.

**DIMETHYL ETHER** $CH_3OCH_3$

**Aluminum Hydride**

See ALUMINUM HYDRIDE plus Dimethyl Ether.

**Lithium Aluminum Hydride**

See LITHIUM ALUMINUM HYDRIDE plus Dimethyl Ether.

**DIMETHYL FORMAMIDE** $HCON(CH_3)_2$

**Bromine**

See BROMINE plus Dimethyl Formamide.

**Carbon Tetrachloride**

Dimethyl formamide and carbon tetrachloride react violently at temperatures above 65°C.
*Kittila,* p. 165 (1967).

**Chlorinated Hydrocarbons**

Some halogenated hydrocarbons reacted with dimethyl formamide in the presence of iron at moderate temperatures.
*Kittila,* p. 165 (1967).

**Chromic Anhydride**

See CHROMIC ANHYDRIDE plus Dimethyl Formamide.

**2,5-Dimethylpyrrole and Phosphorus Oxychloride**

See 2,5-DIMETHYLPYRROLE plus Phosphorus Oxychloride and Dimethyl Formamide.

**Hexachlorobenzene**

Dimethyl formamide and hexachlorobenzene react violently above 65°C.
*Kittila,* p. 165 (1967).

**Magnesium Nitrate**

This mixture undergoes spontaneous decomposition. Nitrates of sodium, lithium, lead, copper and silver do not react under similar conditions.
*Kittila,* p. 165 (1967).

**Methylene Diisocyanate**

Methylene diisocyanate polymerized violently on contact with dimethyl formamide.
*Kittila,* p. 122 (1967).



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**Organic Nitrates**
Dimethyl formamide undergoes spontaneous decomposition in the presence of organic nitrates.
*du Pont Prod. Inf. Bull., Dimethylformamide.*

**Phosphorus Trioxide**
Dimethyl formamide, dimethyl sulfoxide, dimethyl sulfite, or methanol and phosphorus trioxide react very violently, often charring.
*Mellor* **8, Supp. 3:** 382 (1971).

**Triethyl Aluminum**
Dimethyl formamide and triethyl aluminum form an explosive mixture when heated together.
*du Pont Prod. Inf. Bull., Dimethylformamide.*

## uns-DIMETHYLHYDRAZINE (UDMH) $(CH_3)_2NNH_2$

**Air**
Unsymmetrical dimethyl hydrazine, when spread on a large surface, may ignite spontaneously.
*Def. Res. and Eng.*, pp. 299–300 (1963).

**Hydrogen Peroxide**
Spontaneous ignition of UDMH can occur on contact with oxidants like hydrogen peroxide and fuming nitric acid.
*Haz. Chem. Data* (1966).

**Nitric Acid**
See NITRIC ACID plus Dimethylhydrazine.

**Nitric Acid (Fuming)**
See UNSYMMETRICAL DIMETHYL HYDRAZINE plus Hydrogen Peroxide.

**Nitric Acid, Nitrogen Tetroxide, and Sulfuric Acid**
Combinations of unsymmetrical dimethylhydrazine, aniline, or furfuryl alcohol as fuels with hydrogen peroxide or a mixture of nitric acid-nitrogen tetroxide-sulfuric acid as oxidizers ignite with little delay and are used as propellants.
*Chem. Abst.* **51:** 3961d (1957); **63:** 4067h (1965).
*Brennstoff-Chem.* **46** (4): 117–24 (1965).

**Nitric Oxide**
See NITRIC OXIDE plus Unsymmetrical Dimethylhydrazine.

## DIMETHYLMAGNESIUM $(CH_3)_2Mg$

**Air**
Dimethylmagnesium is spontaneously flammable in air.
*Coates,* p. 29 (1956).

## DIMETHYL MALONATE $CH_2(COOCH_3)_2$

**Methyl Azide**
See METHYL AZIDE plus Dimethyl Malonate.

## DIMETHYLMANGANESE $(CH_3)_2Mn$

**Air**
Dimethylmanganese is spontaneously flammable in air.
*Zeiss,* p. 432 (1960).

## 2,5-DIMETHYLPYRROLE $(CH_3)_2C_4H_3N$

**Phosphorus Oxychloride and Dimethyl Formamide**
A complex of phosphorus oxychloride and dimethyl formamide was formed, then 2,5-dimethylpyrrole was added slowly. Internal temperature was 15°C. When only a part of the 2,5-dimethylpyrrole had been added the chemist noted that a vortex was no longer being formed by the stirrer. When he agitated the flask, the mixture erupted.
*MCA Case History* **1460** (1968).

## DIMETHYL SULFATE $(CH_3)_2SO_4$

**Ammonium Hydroxide**
See AMMONIUM HYDROXIDE plus Dimethyl Sulfate.

**Sodium Azide**
See SODIUM AZIDE plus Dimethyl Sulfate.

## DIMETHYL SULFITE $SO_3(CH_3)_2$

**Phosphorus Trioxide**
See DIMETHYL FORMAMIDE plus Phosphorus Trioxide.

## DIMETHYL SULFOXIDE $(CH_3)_2SO$

**Acetyl Chloride**
See DIMETHYL SULFOXIDE plus Acyl Halides.

**Acyl Halides**
Dimethyl sulfoxide decomposes violently on contact with a wide range of acyl halides, aryl halides and related compounds. Examples are phenyl and tolyl chloride, acetyl chloride, benzenesulfonyl chloride, benzoyl chloride, cyanuric chloride, phosphorus chloride, phosphorus oxychloride, and thionyl chloride. Dimethyl sulfoxide should be used with caution in exploratory reactions.
*Chem. and Eng. News* **35** (9): 87 (1957). *BCISC* **39** (154): 15 (1968). *Chem. Ind.* **40:** 1706–1707 (1967).

**Benzenesulfonyl Chloride**
See DIMETHYL SULFOXIDE plus Acyl Halides.

**Benzoyl Chloride**
See DIMETHYL SULFOXIDE plus Acyl Halides.

**p-Bromobenzoyl Acetanilide**
See p-BROMOBENZOYL ACETANILIDE plus Dimethyl Sulfoxide.

**Cyanuric Chloride**
See DIMETHYL SULFOXIDE plus Acyl Halides.

**Iodine Pentafluoride**
The reaction of dimethyl sulfoxide and iodine pentafluoride can be controlled to give a number of products, but the unmoderated reaction is quite violent because of the predominant formation of gaseous fluoromethanes and sulfuroxyfluorides as the temperature increases.
E. M. Lawless, *Chem. and Eng. News* **47** (12): 8, 109 (1969).

**Magnesium Perchlorate**
In the preparation of anhydrous dimethyl sulfoxide by vacuum distillation from anhydrous magnesium perchlorate, an explosion occurred.
*MCA Case History* **1187** (1966). *Karasch* (1961). *Chem. and Eng. News* **43** (37): 62 (1965).

**Methyl Bromide**
See METHYL BROMIDE plus Dimethyl Sulfoxide.

**Perchloric Acid**
An explosion occurs when 70% perchloric acid contacts sulfoxides.
*MCA Case History* **1187** (1966). *Karasch* (1961).
See also SULFOXIDES plus Perchloric Acid.


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**Periodic Acid**

In periodic-dimethyl sulfoxide oxidizing systems, violent explosions can occur if the concentration of periodic acid is too strong. For example, in oxidizing glycopyranosides an explosion took place at a 1.5N concentration of the periodic acid.
R. J. Yu and C. T. Bishop, *Can. J. Chem.* **45:** 2195 (1967). *Chem. and Eng. News* **44** (15): 48 (1966). *J. Am. Chem. Soc.* **90** (7): 1924 (1968).

**Phenyl Chloride**

See DIMETHYL SULFOXIDE plus Acyl Halides.

**Phosphorus Oxychloride**

See DIMETHYL SULFOXIDE plus Acyl Halides.

**Phosphorus Trichloride**

See DIMETHYL SULFOXIDE plus Acyl Halides.

**Phosphorus Trioxide**

See DIMETHYL FORMAMIDE plus Phosphorus Trioxide.

**Potassium Permanganate**

A mixture of the two will flash instantaneously.
*Ellern,* p. 50 (1968).

**Silver Fluoride**

Dimethyl sulfoxide is violently reactive with fluorinating agents such as silver fluoride.
*Chem. and Eng. News* **47** (12): 8, 109 (1969).

**Sodium Hydride**

The reaction of these two reagents to prepare methyl sulfinyl carbanion can cause explosions.
*Chem. and Eng. News* **44** (14): 48 (1966); **44** (24): **7** (1966).

**Thionyl Chloride**

See DIMETHYL SULFOXIDE plus Acyl Halides.

**Tolyl Chloride**

See DIMETHYL SULFOXIDE plus Acyl Halides.

## DINITROANILINE HYDROCHLORIDE $(O_2N)_2C_6H_3NH_2$·HCl

**Nitrosylsulfuric Acid**

See NITROSYLSULFURIC ACID plus Dinitroaniline Hydrochloride.

## 2,4-DINITROBENZENE SULFENYL CHLORIDE $(NO_2)_2C_6H_3SCl$

**(self-reactive)**

An explosion may occur when the solvent symmetrical tetrachlorethane is almost removed in the chlorinolysis of 2,4-dinitrophenyl disulfide.
*MCA Guide for Safety,* Appendix 3 (1972).

## 2,4-DINITROCHLOROBENZENE $(O_2N)_2C_6H_3Cl$

**(self-reactive)**

B. D. Halpern, *Chem. and Eng. News,* **29:** 2666 (1951).

## DINITROGEN PENTOXIDE $O_2NONO_2$

**Ozone**

See OZONE plus Dinitrogen Pentoxide.

## 2,4-DINITROPHENYL DISULFIDE $[(O_2N)_2C_6H_3S\text{-}]_2$

**Tetrachlorethane**

See 2, 4-DINITROBENZENE SULFENYL-CHLORIDE (self-reactive).

## DINITROSOPENTAMETHYLENETETRAMINE $(ON)_2(CH_2)_5N_4$

**(self-reactive)**

This chemical is a blowing agent with an exothermic decomposition slightly above its melting point of 203°C.
*Ellern,* p. 161 (1968).

## DIOXANE $\underline{OCH_2CH_2OCH_2CH_2}$

**Hydrogen and Nickel (Raney)**

See HYDROGEN plus Dioxane and Nickel (Raney).

**Silver Perchlorate**

See SILVER PERCHLORATE plus Toluene.

## DIPEROXYTEREPHTHALIC ACID $(HOOOC)_2C_6H_4$

**(self-reactive)**

This acid explodes under the influence of a shock or an increase in temperature.
*Chem. Reviews* **45:** 14, 15 (1949).

## DIPHENYLAMINE $(C_6H_5)_2NH$

**Hexachloromelamine**

See HEXACHLOROMELAMINE plus Organic Contaminants.

**Trichloromelamine**

See HEXACHLOROMELAMINE plus Organic Contaminants.

## DIPHENYL DIAZOSULFIDE $(C_6H_5N_2)_2S$

**Air**

Phenyldiazosulfide explodes when air-dried.
*Chem. and Eng. News* **29:** 5473 (1951).

## 1,2-DIPHENYLETHYLENE $C_6H_5CH{=}CHC_6H_5$

**Oxygen**

See OXYGEN plus Diphenylethylene.

## DIPHENYLTETRACETYLENE $(C_6H_5C{\equiv}CC{\equiv}C)_2$

**(self-reactive)**

Diphenyltetracetylene was stable for at least 13 months at room temperature in the dark. When placed on a metallic plate, it decomposed explosively with much soot.
*Chem. Abst.* **45:** 7082 (1962).

## DIPHOSPHINE $H_2PPH_2$

**Air**

The liquid is spontaneously flammable in air and the presence of a trace of the vapor makes phosphine and other combustible gases spontaneously flammable in air.
*Mellor* **8:** 829 (1946–1947).
*Mellor* **1:** 376 (1946–1947).
*Mellor* **8, Supp. 3:** 273 (1971).

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**DIPHOSPHORYL CHLORIDE** $P_2O_3Cl_2$

**Water**
The vigorous hydrolysis of pyrophosphoryl chloride is like that of phosphorus pentoxide.
*Mellor* **8, Supp. 3:** 505.

**DIPROPARGYL ETHER** $(CH{\equiv}CCH_2)_2O$

**Air**
An explosion occurred in a 50-gallon stainless steel still during the distillation of dipropargyl ether.
*MCA Guide for Safety,* Appendix 3 (1972).

**DIPROPYLALUMINUM HYDRIDE** $(C_3H_7)_2AlH$

**Air**
Di-n-propylaluminum hydride ignites spontaneously in air.
*Aluminum Alkyls,* p. 21. *Fire Haz. Prop.* (1969).

**Water**
Di-n-propylaluminum hydride reacts violently with water.
*Aluminum Alkyls,* p. 21.

**DIPROPYLZINC** $(C_3H_7)_2Zn$

**Air**
Di-n-propyl zinc is spontaneously flammable in air.
*Douda* (1966).

**DISILANE (SILICOETHANE)** $Si_2H_6$

**Air**
See OXYGEN plus Disilane.

**Carbon Tetrachloride**
Disilane explodes violently when mixed with carbon tetrachloride; reacts vigorously with incandescence in contact with chloroform.
*Mellor* **6:** 223 (1946–1947).

**Chloroform**
See DISILANE plus Carbon Tetrachloride.

**Oxygen**
See OXYGEN plus Disilane.

**Sulfur Hexafluoride**
Disilane explodes violently in contact with sulfur hexafluoride.
*Mellor* **6:** 223 (1946–1947).

**DISILOXANE** $(SiH_3)_2O$

**Air**
See SILANES plus Air.

**(DISILYLAMINO) DIBORANE** $B_2H_5N(SiH_3)_2$

**Air**
Disilylamino diborane is spontaneously flammable in air.
*Douda* (1966).

**DISULFURYL AZIDE** $(N_3SO_2)_2O$

**(self-reactive)**
Pyrosulfuryl azide decomposes explosively below 80°C.
*Mellor* **8, Supp. 2:** 36 (1967).

**DIVANADIUM DODECACARBONYL** $V_2(CO)_{12}$

**Air**
Divanadium dodecacarbonyl is spontaneously flammable in air.
R. L. Pruett and J. E. Wyman, *Chem. and Ind.* **9** (1): 119–120 (1960).

**DIVINYL ETHER** $(CH_2{=}CH)_2O$

**Air**
See OXYGEN plus Ethers.

**Oxygen**
See OXYGEN plus Ethers.

**DIVINYLZINC** $(CH_2{=}CH)_2Zn$

**Air**
Divinyl zinc is spontaneously flammable in air.
*Zeiss* (1960).

**DOWICIL 100 [1-(3-CHLOROALLYL)-3,5,7-TRIAZO-1-AZONIAADAMANTANE CHLORIDE]**
$C_6H_{12}N_4$-$(CH_2CHCHCl)Cl$

**Hydrogen Chloride**
This compound is stable below 120°C if kept dry and away from hydrogen chloride. Both water and hydrogen chloride will cause chemical decomposition. Decomposition is immediate with hydrogen chloride; it is somewhat slower in water.
*Dowicil*

**Water**
See DOWICIL 100 plus Hydrogen Chloride.

**DYSPROSIUM** Dy

**Air**
See RARE EARTH METALS plus Air.

**Halogens**
See RARE EARTH METALS plus Halogens.

**ENDRIN** $C_{12}H_8OCl_6$

**Parathion**
See PARATHION plus Endrin.

**EPICHLOROHYDRIN** $OCH_2CHCH_2Cl$

**2-Aminoethanol**
See 2-AMINOETHANOL plus Epichlorohydrin.

**Chlorosulfonic Acid**
Mixing epichlorohydrin and 2-aminoethanol in a closed container caused the temperature and pressure to increase.
*Flynn and Rossow* (1970). See Note under complete reference.

**Ethylene Diamine**
See ETHYLENE DIAMINE plus Epichlorohydrin.

**Ethyleneimine**
Mixing epichlorohydrin and ethyleneimine in a closed container caused the temperature and pressure to increase.
*Flynn and Rossow* (1970). See Note under complete reference.


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**Nitric Acid**
Mixing epichlorohydrin and 70% nitric acid in a closed container caused the temperature and pressure to increase.
*Flynn and Rossow* (1970). See Note under complete reference.

**Oleum**
Mixing epichlorohydrin and oleum in a closed container caused the temperature and pressure to increase.
*Flynn and Rossow* (1970). See Note under complete reference.

**Potassium Tert.-Butoxide**
See ACETONE plus Potassium Tert.-Butoxide.

**Sulfuric Acid**
See ETHYLENE CYANOHYDRIN plus Sulfuric Acid.
Mixing epichlorohydrin and 96% sulfuric acid in a closed container caused the temperature and pressure to increase.
*Flynn and Rossow* (1970). See Note under complete reference.

## ERBIUM Er

**Air**
See RARE EARTH METALS plus Air.

**Halogens**
See RARE EARTH METALS plus Halogens.

## ERBIUM PERCHLORATE $Er(ClO_4)_3$

**Acetonitrile**
See ACETONITRILE plus Erbium Perchlorate.

## ESTERS

**Nitrates**
See NITRATES plus Esters.

## ETHANE $C_2H_6$

**Chlorine**
See CHLORINE plus Ethane.

**Chlorine Dioxide**
See CHLORINE DIOXIDE plus Butadiene.

## 1,2-ETHANETHIOL $HSCH_2CH_2SH$

**Calcium Hypochlorite**
See CALCIUM HYPOCHLORITE plus 1-Propanethiol.

## ETHERS

**(See also specific ethers)**

**Air or Oxygen**
Peroxides form on standing and are very dangerous.
*Bahme,* p. 46 (1961).

**Boron Triiodide**
See BORON TRIIODIDE plus Ethers.

## ETHOXYACETYLENE $C_2H_5OC{\equiv}CH$

**Ethylmagnesium Iodide**
See ETHYLMAGNESIUM IODIDE plus Ethoxyacetylene.

## (4-ETHOXYBUTYL) DIETHYLALUMINUM $(C_2H_5)_2Al(CH_2)_4OC_2H_5$

**Air**
Diethyl-4-ethoxybutylamine is spontaneously flammable in air.
*Douda* (1966).

## 2-(2-ETHOXYETHOXY)ETHYL ACETATE $CH_3COOCH_2CH_2OCH_2CH_2OC_2H_5$

**Chlorosulfonic Acid**
Mixing ethyl glycol monoethyl ether acetate and chlorosulfonic acid in a closed container caused the temperature and pressure to increase.
*Flynn and Rossow* (1970). See Note under complete reference.

**Oleum**
Mixing ethylene glycol monoethyl ether acetate and oleum in a closed container caused the temperature and pressure to increase.
*Flynn and Rossow* (1970). See Note under complete reference.

## ETHOXYETHYNYLCARBINOL $C_2H_5OCHOHC{\equiv}CH$

**(self-reactive)**
Violent explosions have been recorded in the use of this material.
*Rutledge,* p. 35 (1968).

## ETHOXYTRIETHYLDIPHOSPHINYL OXIDE $(C_2H_5)_2POP(C_2H_5)(OC_2H_5)$

**Air**
Triethyl ethoxy diphosphinyl oxide is spontaneously flammable in air.
*Kaufman* (1961).

## ETHYL ACETATE $C_2H_5COOCH_3$

**Chlorosulfonic Acid**
Mixing ethyl acetate and chlorosulfonic acid in a closed container caused the temperature and pressure to increase.
*Flynn and Rossow* (1970). See Note under complete reference.

**Lithium Aluminum Hydride and 2-Chloromethylfuran**
See 2-CHLOROMETHYLFURAN plus Lithium Aluminum Hydride and Ethyl Acetate.

**Oleum**
Mixing ethylacetate and oleum in a closed container caused the temperature and pressure to increase.
*Flynn and Rossow* (1970). See Note under complete reference.

**Potassium Tert.-Butoxide**
See ACETONE plus Potassium Tert.-Butoxide.

## ETHYL ACETOACETATE $C_2H_5OCOCH_2COCH_3$

**Tribromoneopentyl Alcohol and Zinc**
Tribromoneopentyl alcohol, ethyl acetoacetate and zinc were being reacted to prepare the zinc chelate of tribromoneopentyl acetoacetate. When the reaction had pro-

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ceeded to where 80% of the by-product ethanol had been removed, a violent decomposition occurred.
*Wischmeyer* (1972). *U.S. Pat.* 3,578,619 (1971).

## ETHYL ACRYLATE $C_2H_5OCOCH=CH_2$

**Chlorosulfonic Acid**
Mixing ethyl acrylate and chlorosulfonic acid in a closed container caused the temperature and pressure to increase.
*Flynn and Rossow* (1970). See Note under complete reference.

## ETHYL ALCOHOL $CH_3CH_2OH$

**Acetyl Chloride**
See ACETYL CHLORIDE plus Ethyl Alcohol.

**Ammonium Hydroxide and Silver Oxide**
See SILVER OXIDE plus Aqueous Ammonia and Ethyl Alcohol.

**Bromine Pentafluoride**
See BROMINE PENTAFLUORIDE plus Acetic Acid.

**Calcium Hypochlorite**
See CALCIUM HYPOCHLORITE plus Ethyl Alcohol.

**Chlorine Trioxide**
See CHLORINE TRIOXIDE plus Alcohol.

**Chromic Anhydride**
See CHROMIC ANHYDRIDE plus Ethyl Alcohol.

**Chromyl Chloride**
See CHROMYL CHLORIDE plus Ammonia.

**Cyanuric Acid**
See CYANURIC ACID plus Water.

**Hydrogen Peroxide**
The addition of alcohols to highly concentrated hydrogen peroxide forms powerful explosives which can be detonated by shock.
*Bahme,* p. 9 (1961).

**Hydrogen Peroxide and Sulfuric Acid**
See ALCOHOLS plus Hydrogen Peroxide and Sulfuric Acid.

**Iodine, Methyl Alcohol, and Mercuric Oxide**
See IODINE plus Ethyl Alcohol, Methyl Alcohol, and Mercuric Oxide.

**Manganese Perchlorate and 2,2-Dimethoxypropane**
A violent explosion occurred when manganese perchlorate, absolute alcohol and 2,2-dimethoxypropane were gently refluxed for about two hours under a stream of nitrogen.
*Chem. and Eng. News* **48** (28): 6 (July 6, 1970).

**Mercuric Nitrate**
See MERCURIC NITRATE plus Ethyl Alcohol.

**Nitric Acid**
See NITRIC ACID plus Ethyl Alcohol.

**Perchlorates**
See PERCHLORATES plus Benzene.

**Perchloric Acid**
See PERCHLORIC ACID plus Ethyl Alcohol.

**Permanganates and Sulfuric Acid**
See PERMANGANATES plus SULFURIC Acid and Benzene.

**Permanganic Acid**
See PERMANGANIC ACID plus Ethyl Alcohol.

**Potassium Superoxide**
See POTASSIUM SUPEROXIDE plus Ethyl Alcohol.

**Potassium Tert.-Butoxide**
See ACETONE plus Potassium Tert.-Butoxide.

**Silver and Nitric Acid**
See SILVER plus Ethyl Alcohol and Nitric Acid.

**Silver Nitrate**
See SILVER NITRATE plus Ethyl Alcohol.

**Silver Perchlorate**
See SILVER PERCHLORATE plus Benzene.

**Sodium Hydrazide**
See SODIUM HYDRAZIDE plus Air.

**Uranyl Perchlorate**
See URANYL PERCHLORATE plus Ethyl Alcohol.

## m-ETHYLANILINE $C_2H_5C_6H_4NH_2$

**Nitric Acid**
See NITRIC ACID plus m-Ethylaniline.

## ETHYLENE $CH_2=CH_2$

**Aluminum Chloride**
See ALUMINUM CHLORIDE plus Ethylene.

**Benzoyl Peroxide and Carbon Tetrachloride**
See BENZOYL PEROXIDE plus Carbon Tetrachloride and Ethylene.

**Bromotrichloromethane**
See BROMOTRICHLOROMETHANE plus Ethylene.

**Carbon Tetrachloride**
See CARBON TETRACHLORIDE plus Ethylene.

**Chlorine**
See CHLORINE plus Ethylene.

**Chlorine Dioxide**
See CHLORINE DIOXIDE plus Butadiene.

**Hydrogen**
Ethylene undergoes flame reaction with hydrogen at elevated pressure. Products are similar to ethylene decomposition products. Various catalysts including reduced iron oxides and purification bed packings may cause initiation.
L. G. Britton, "Decomposition Flame Propagation Limits of Ethylene and Mixtures with Other Gases;" Paper 8e, 30th Annual Loss Prevention Symposium, AIChE, New Orleans, Feb. 1996.

**Nitrogen Dioxide**
See NITROGEN TETROXIDE plus Olefins.


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**Nitromethane and Aluminum Chloride**
A mixture of ethylene with nitromethane-aluminum chloride catalyst in an autoclave exploded at a temperature below 40°C.
F. M. Cowen and O. Rorso, *Chem. and Eng. News* **26:** 2257 (1948).
See also ALUMINUM CHLORIDE plus Nitromethane and Organic Matter.

**Ozone**
See OZONE plus Ethylene.

## ETHYLENEDIAMINE $H_2NCH_2CH_2NH_2$

**Acetic Acid**
See ACETIC ACID plus Ethylene Diamine.

**Acetic Anhydride**
See ACETIC ANHYDRIDE plus Ethylene Diamine.

**Acrolein**
See ACROLEIN plus Ethylene Diamine.

**Acrylic Acid**
See ACRYLIC ACID plus Ethylene Diamine.

**Acrylonitrile**
See ACRYLONITRILE plus Ethylene Diamine.

**Allyl Chloride**
See ALLYL CHLORIDE plus Ethylene Diamine.

**Carbon Disulfide**
See CARBON DISULFIDE plus Ethylene Diamine.

**Chlorosulfonic Acid**
Mixing ethylene diamine and chlorosulfonic acid in a closed container caused the temperature and pressure to increase.
*Flynn and Rossow* (1970). See Note under complete reference.

**Epichlorohydrin**
Mixing ethylene diamine and epichlorohydrin in a closed container caused the temperature and pressure to increase.
*Flynn and Rossow* (1970). See Note under complete reference.

**Ethylene Chlorohydrin**
See ETHYLENE CHLOROHYDRIN plus Ethylene Diamine.

**Hydrochloric Acid**
Mixing ethylene diamine and 36% hydrochloric acid in a closed container caused the temperature and pressure to increase.
*Flynn and Rossow* (1970). See Note under complete reference.

**Mesityl Oxide**
See MESITYL OXIDE plus Ethylene Diamine.

**Nitric Acid**
Mixing ethylene diamine and 70% nitric acid in a closed container caused the temperature and pressure to increase.
*Flynn and Rossow* (1970). See Note under complete reference.

**Oleum**
Mixing ethylene diamine and oleum in a closed container caused the temperature and pressure to increase.
*Flynn and Rossow* (1970). See Note under complete reference.

**Propiolactone (BETA-)**
Mixing ethylene diamine and propiolactone (BETA-) in a closed container caused the temperature and pressure to increase.
*Flynn and Rossow* (1970). See Note under complete reference.

**Silver Perchlorate**
See SILVER PERCHLORATE plus Ethylenediamine.

**Sulfuric Acid**
Mixing ethylene diamine and 96% sulfuric acid in a closed container caused the temperature and pressure to increase.
*Flynn and Rossow* (1970). See Note under complete reference.

**Vinyl Acetate**
Mixing ethylene diamine and vinyl acetate in a closed container caused the temperature and pressure to increase.
*Flynn and Rossow* (1970). See Note under complete reference.

## ETHYLENEDIAMINE DIPERCHLORATE
$NH_2CH_2CH_2NH_2(ClO_4)_2$

**(self-reactive)**
This compound is an explosive that exceeds the power and brisance of TNT.
*ACS* **146:**206. *Chem. Reviews* **44:**419–45 (1949).

## ETHYLENE DICHLORIDE $ClCH_2CH_2Cl$

**Aluminum**
See ALUMINUM plus Ethylene Dichloride, Propylene Dichloride, and Orthodichlorobenzene.

**Ammonia**
See AMMONIA plus Ethylene Dichloride.

**Dimethyl Amino Propyl Amine**
A tank of dimethyl amino propyl amine exploded violently when it reacted with wet ethylene dichloride which was the tank's previous contents. Investigation revealed that this combination can be extremely hazardous.
*Doyle* (1973).

## ETHYLENE DIOXYAMINE PERCHLORATE
$CH_2CH_2ONHOHClO_4$

**(self-reactive)**
An explosion occurred in a laboratory during synthesis of ethylene dioxyamine perchlorate. It is believed that during some stage of purification of the material a low order explosion occurred.
*BCISC* **41** (162): 18 (April-June 1970).

## ETHYLENE GLYCOL $HOC_2H_4OH$

**Chlorosulfonic Acid**
Mixing ethylene glycol and chlorosulfonic acid in a closed container caused the temperature and pressure to increase.
*Flynn and Rossow* (1970). See Note under complete reference.

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**Oleum**
Mixing ethylene glycol and oleum in a closed container caused the temperature and pressure to increase.
*Flynn and Rossow* (1970). See Note under complete reference.

**Sulfuric Acid**
Mixing ethylene glycol and 96% sulfuric acid in a closed container caused the temperature and pressure to increase.
*Flynn and Rossow* (1970). See Note under complete reference.

## ETHYLENE OXIDE $(CH_2)_2O$

**Acids and Bases**
Alkali metal hydroxides; acids; anhydrous chlorides of iron, tin, and aluminum; pure oxides of iron and aluminum; and metallic potassium are some of the catalysts that may cause liquid ethylene oxide to rearrange and/or polymerize, liberating heat.
L. G. Hess and V. V. Tilton, *Ind. Eng. Chem.* **42:** 1251–8 (1950). A. K. Gupta, *J. Soc. Chem. Ind.* **68:** 179–83 (1949). B. Beam, L. L. Simpson, G. Viera, *Chem. Eng. Progs.* (April 1992).

**Alcohols**
Explosions occur, although infrequently, from the combination of ethylene oxide and alcohols or mercaptans.
*Chem. and Eng. News* **20:** 1318 (1942).

**Aluminum Chloride**
See ETHYLENE OXIDE plus Acids and Bases. See ETHYLENE OXIDES plus Aluminum Oxide.

**Aluminum Oxide**
Ethylene oxide may polymerize violently when in contact with highly catalytic surfaces such as anhydrous chlorides of iron, tin and aluminum, or the pure oxides of aluminum and iron.
*Hazardous Chemicals Data* (1966).
See also ETHYLENE OXIDE plus Acids and Bases.

**Ammonia**
See AMMONIA plus Ethylene Oxide.

**Copper**
See COPPER plus Ethylene Oxide.

**Insulation**
Ethylene oxide reacts with water in porous insulation, forming low molecular weight polyethylene glycols. Under certain conditions these glycols can spontaneously ignite.
L. Britton, *Plant Operations Progress* (1990).

**Iron Chlorides**
See ETHYLENE OXIDE plus Acids and Bases. See ETHYLENE OXIDE plus Aluminum Oxide.

**Iron Oxides**
See ETHYLENE OXIDE plus Acids and Bases. See ETHYLENE OXIDE plus Aluminum Oxide.

**Magnesium Perchlorate**
See MAGNESIUM PERCHLORATE plus Ethylene Oxide.

**Mercaptans**
See ETHYLENE OXIDE plus Alcohols.

**Potassium**
See POTASSIUM plus Ethylene Oxide. See ETHYLENE OXIDE plus Acids and Bases.

**Tin Chlorides**
See ETHYLENE OXIDE plus Acids and Bases. See ETHYLENE OXIDE plus Aluminum Oxide.

## ETHYLENEIMINE $\underline{NHCH_2CH_2}$

**(self-reactive)**
Undiluted ethyleneimine can polymerize violently in the presence of acids or acid-forming materials.
*Ethyleneimine.*

**Acetic Acid**
See ACETIC ACID plus Ethyleneimine.

**Acetic Anhydride**
See ACETIC ANHYDRIDE plus Ethyleneimine.

**Acrolein**
See ACROLEIN plus Ethyleneimine.

**Acrylic Acid**
See ACRYLIC ACID plus Ethyleneimine.

**Allyl Chloride**
See ALLYL CHLORIDE plus Ethyleneimine.

**Carbon Disulfide**
See CARBON DISULFIDE plus Ethyleneimine.

**Chlorine**
See CHLORINE plus Ethyleneimine.

**Chlorosulfonic Acid**
Mixing ethyleneimine and chlorosulfonic acid in a closed container caused the temperature and pressure to increase.
*Flynn and Rossow* (1970). See Note under complete reference.

**Epichlorohydrin**
See EPICHLOROHYDRIN plus Ethyleneimine.

**Glyoxal**
See GLYOXAL plus Ethyleneimine.

**Hydrochloric Acid**
Mixing ethyleneimine and 36% hydrochloric acid in a closed container caused the temperature and pressure to increase.
*Flynn and Rossow* (1970). See Note under complete reference.

**Hydrofluoric Acid**
Mixing ethyleneimine and 48.7% hydrofluoric acid in a closed container caused the temperature and pressure to increase.
*Flynn and Rossow* (1970). See Note under complete reference.

**Nitric Acid**
Mixing ethyleneimine and 70% nitric acid in a closed container caused the temperature and pressure to increase.
*Flynn and Rossow* (1970). See Note under complete reference.

**Oleum**
See OLEUM plus Ethyleneimine.



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**Propiolactone (BETA-)**
Mixing ethyleneimine and propiolactone (BETA-) in a closed container caused the temperature and pressure to increase.
*Flynn and Rossow* (1970). See Note under complete reference.

**Silver**
See SILVER plus Ethyleneimine.

**Sodium Hypochlorite**
Chlorination of ethyleneimine with sodium hypochlorite gives the explosive compound, 1-chloroethyleneimine.
A. F. Graefe and R. E. Meyer, J. *Am. Chem. Soc.* **80:** 3939 (1958).

**Sulfuric Acid**
Mixing ethyleneimine and 96% sulfuric acid in a closed container caused the temperature and pressure to increase.
*Flynn and Rossow* (1970). See Note under complete reference.

**Vinyl Acetate**
See VINYL ACETATE plus Ethyleneimine.

## ETHYL HYPOCHLORITE $CH_3CH_2OCl$

**(self-reactive)**
Ethyl hypochlorite decomposes explosively when exposed to light and rapidly even in its absence.
*Mellor* **2, Supp. 1:** 560 (1956).
See also ALCOHOLS plus Hypochlorous Acid.

## ETHYLIODOMETHYLARSINE $(CH_3)(C_2H_5)AsI$

**Air**
Methyl ethyliodoarsine occasionally ignites spontaneously in air.
*ACS* **15** (1923).

## S-ETHYLISOTHIOUREA SULFATE
$NH_2C(NH)SC_2H_5 \cdot H_2SO_4$

**Chlorine**
See CHLORINE plus S-Ethyl Isothiourea Sulfate.

## ETHYLLITHIUM $C_2H_5Li$

**Air**
Ethyl lithium is spontaneously flammable in air.
*Ellern* (1961).

## ETHYLMAGNESIUM IODIDE $C_2H_5MgI$

**Ethoxyacetylene**
A laboratory scale-up of this reaction had failed to yield the desired Grignard end-product. After one hour, the reaction vessel exploded.
*Chem. and Eng. News* **44** (8): 40 (1966).

## ETHYLMETHYLARSINE $HAs(CH_3)(C_2H_5)$

**Air**
Ethylmethylarsine is spontaneously flammable in air.
*Ellern,* pp. 24–25 (1968).

## ETHYL METHYL ETHER $CH_3OC_2H_5$

**Air**
See OXYGEN plus Ethers.

**Lithium Aluminum Hydride**
See LITHIUM ALUMINUM HYDRIDE plus Dimethyl Ether.

**Oxygen**
See OXYGEN plus Ethers.

## ETHYL METHYL KETONE $CH_3COC_2H_5$

**Chlorosulfonic Acid**
Mixing methyl ethyl ketone and chlorosulfonic acid in a closed container caused the temperature and pressure to increase.
*Flynn and Rossow* (1970). See Note under complete reference.

**Oleum**
Mixing methyl ethyl ketone and oleum in a closed container caused the temperature and pressure to increase.
*Flynn and Rossow* (1970). See Note under complete reference.

**Potassium Tert.-Butoxide**
See ACETONE plus Potassium Tert.-Butoxide.

## 5-ETHYL-2-METHYLPYRIDINE
$N=C(CH_3)CH=CHC(C_2H_5)=CH$

**Nitric Acid**
See NITRIC ACID plus 2-Methyl-5-Ethylpyridine.
See NITRIC ACID plus 5-Ethyl-2-Methyl Pyridine.

## ETHYL NITRITE $C_2H_5ONO$

**(self-reactive)**
The decomposition of ethyl nitrite above 194°F can be violently explosive.
*Chem. Haz. Data* (1969).

## ETHYL PERCHLORATE $C_2H_5ClO_4$

**(self-reactive)**
This compound is an explosive that exceeds the power and brisance of TNT.
*ACS 146: 296. Chem. Reviews* **44:** 419–45 (1949).

## ETHYLPHOSPHINE $C_2H_5PH_2$

**Bromine**
See BROMINE plus Ethyl Phosphine.

**Chlorine**
See BROMINE plus Ethyl Phosphine.

**Nitric Acid**
See BROMINE plus Ethyl Phosphine.

## 5-ETHYL-2-PICOLINE $C_8H_{11}N$

**Nitric Acid**
This reaction results in the formation of 5-(1,1 dinitroethyl)-2-picoline, an explosive compound. In addition, the reaction itself is potentially violent, especially in closed systems.
H. Rubenstein, G. Hazen, and R. Zerfing, *Chem. Eng. Data* **12:** 149–50 (1967).



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**ETHYL SODIO-ACETOACETATE**
$C_2H_5OCOCH{=}CO(Na)CH_3$

**2-Iodo-3, 5-Dinitrobiphenyl**
See 2-IODO-3, 5-DINITROBIPHENYL plus Ethyl Sodio-Acetoacetate.

**ETHYLSODIUM** $C_2H_5Na$

**Air**
Ethyl sodium is spontaneously flammable in air.
*Douda* (1966).

**EUROPIUM**

**Air**
See RARE EARTH METALS plus Air.

**Halogens**
See RARE EARTH METALS plus Halogens.

**FERRIC BROMIDE** $FeBr_3$

**Potassium**
See POTASSIUM plus Boron Tribromide.

**Sodium**
See SODIUM plus Cobaltous Bromide.

**FERRIC CHLORIDE** $FeCl_3$

**Allyl Chloride**
See SULFURIC ACID plus Allyl Chloride.

**Potassium**
See POTASSIUM plus Boron Tribromide.

**Sodium**
See SODIUM plus Cobaltous Bromide.

**FERRIC FERROCYANIDE** $Fe_4[Fe(CN)_6]_3$

**Lead Chromate**
See LEAD CHROMATE plus Ferric Ferrocyanide.

**FERRIC HYPOPHOSPHITE** $Fe(PH_2O_2)_3$

**(self-reactive)**
Ferric hypophosphite forms impact-sensitive ammunition-priming mixtures.
*Mellor* **8, Supp. 3:** 623 (1971).

**FERRIC OXIDE** $Fe_2O_3$

**Aluminum**
See ALUMINUM plus Iron Oxide.

**Calcium Hypochlorite**
See CALCIUM HYPOCHLORITE plus Lead Oxide.

**Cesium Carbide**
See CESIUM CARBIDE plus Ferric Oxide.

**Ethylene Oxide**
See ETHYLENE OXIDE plus Acids and Bases. See ETHYLENE OXIDE plus Aluminum Oxide.

**FERRIC OXIDE (HYDRATED)** $Fe_2O_3XH_2O$

**Hydrogen Sulfide**
See HYDROGEN SULFIDE plus Hydrated Iron Oxide.

**FERROCENE** $(C_5H_5)_2Fe$

**Ammonium Perchlorate**
See AMMONIUM PERCHLORATE plus Dicyclopentadienyliron.

**FERROUS BROMIDE** $FeBr_2$

**Potassium**
See POTASSIUM plus Boron Tribromide.

**Sodium**
See SODIUM plus Cobaltous Bromide.

**FERROUS CHLORIDE** $FeCl_2$

**Ethylene Oxide**
See ETHYLENE OXIDE plus Acids and Bases.
See ETHYLENE OXIDE plus Aluminum Oxide.

**Potassium**
See POTASSIUM Plus Boron Tribromide.

**Sodium**
See SODIUM plus Ferrous Chloride.

**FERROUS IODIDE** $FeI_2$

**Potassium**
See POTASSIUM plus Boron Tribromide.

**Sodium**
See SODIUM plus Cobaltous Bromide.

**FERROUS OXIDE** FeO

**Air**
Ferrous oxide is spontaneously flammable in air.
*Chem. Abst.* **45:** 3276i (1951).

**Ethylene Oxide**
See ETHYLENE OXIDE plus Acids and Bases.
See ETHYLENE OXIDE plus Aluminum Oxide.

**Fluorine**
See FLUORINE plus Ferrous Oxide.

**Nitric Acid**
When pyrophoric iron oxide is gently warmed with nitric acid, the oxide becomes incandescent.
*Mellor* **13:** 716 (1946–1947).

**Sulfur Dioxide**
When ferrous oxide, prepared at 300°C., is heated in sulfur dioxide, the mass becomes incandescent.
*Mellor* **13:** 715 (1946–1947).

**FERROUS SULFIDE** FeS

**Air**
Moist ferrous sulfide readily oxidizes in air and the heat evolved may cause incandescence. When ground in a mortar, the mass becomes incandescent.
*Mellor* **14:** 157 (1946–1947).

**Hydrogen Peroxide**
See ANTIMONY TRISULFIDE plus Hydrogen Peroxide.

**Lithium**
See LITHIUM plus Ferrous Sulfide.


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## FLUOBORIC ACID

**Acetic Anhydride**
Dehydration of the aqueous 48 percent acid by addition to the anhydride is rather exothermic, and caution is advised.
*Bretherick* (1979).

## FLUORINE $F_2$

**Acetaldehyde**
See BROMINE plus Acetaldehyde.

**Acetylene**
Acetylene and fluorine will react violently.
*Chem. Safety Data Sheet* **SD-7** (1957).

**Acrylonitrile-Butadiene Copolymer**
See FLUORINE plus Solid Nonmetals and Oxygen.

**Alkali Oxides**
The oxides of the alkalies and alkaline earths are vigorously attacked by fluorine gas with incandescence.
*Mellor* **2:** 13 (1946–1947).

**Alkaline Earth Oxides**
See FLUORINE plus Alkali Oxides.

**Alkenes**
Fluorine causes unsaturated hydrocarbons to ignite spontaneously.
*Mellor* **2, Supp. 1:** 55 (1956).

**Alkylbenzenes**
Fluorine causes aromatic hydrocarbons to ignite spontaneously.
*Mellor* **2, Supp. 1:** 55 (1956).

**Aluminum**
See FLUORINE plus Metals.

**Ammonia**
Fluorine and ammonia burst into flame.
*Mellor* **1:** 12; **8:** 216 (1946–1947).
*Mellor* **8, Supp. 2:** 329 (1964).

**Ammonium Hydroxide**
Combination of fluorine and ammonium hydroxide results in flames and explosion.
*Mellor* **2, Supp. 1:** 56 (1956).

**Antimony**
See ANTIMONY plus Bromine.

**Antimony Trisulfide**
The reaction at ordinary temperatures between fluorine and antimony trisulfide is accompanied by a blue flame.
*Mellor* **9:** 522 (1946–1947).

**Arsenic**
Fluorine vigorously reacts with arsenic at ordinary temperatures.
*Mellor* **9:** 34 (1946–1947).

**Arsenic Trioxide**
Fluorine reacts violently with arsenic trioxide.
*Mellor* **9:** 101 (1946–1947).

**Asphalt**
See FLUORINE plus Common Materials and Oxygen.

**Bakelite®**
See FLUORINE plus Solid Nonmetals.

**Boron**
See BORON plus Fluorine.

**Bromides**
See FLUORINE plus Chlorides.

**Bromine**
Bromine unites with fluorine at ordinary temperatures with a luminous flame, forming bromine trifluoride.
*Mellor* **2:** (1946–1947).

**Buna N**
See FLUORINE plus Solid Nonmetals and Oxygen.

**Calcium**
See CALCIUM plus Fluorine.

**Calcium Carbonate**
See FLUORINE plus Carbonates.

**Calcium Oxide**
Even when cold, fluorine will attack calcium oxide, evolving much heat and some light.
*Mellor* **3:** 663 (1946–1947).

**Calcium Silicide**
Calcium silicide burns readily in fluorine.
*Mellor* **6:** 169 (1946–1947).

**Carbon**
Graphitic or crystallized carbon tends to react explosively with fluorine after an intermediate induction period in a manner similar to that of ice.
*NASA SP-***3037:** 53, 84.
*Mellor* **5:** 822–30: **2:** 310 (1946–1947).
*Mellor* **2, Supp. 1:** 60 (1956).

**Carbonates**
The carbonates of sodium, lithium, calcium and lead in contact with fluorine are decomposed at ordinary temperatures with incandescence.
*Mellor* **2:** 13 (1946–1947).

**Carbon Disulfide**
A mixture of fluorine and carbon disulfide ignites at ordinary temperatures.
*Mellor* **2:** 13; **6:** 111 (1946–1947).

**Carbon Tetrachloride**
The reaction is violent and sometimes explosive.
*NASA SP-***3037:** 82. *Mellor* **2, Supp. I.** 198 (1956).

**Cellulose**
Fluorine in contact with cotton produces a violent explosion.
*Mellor* **2, Supp. 1:** 54 (1956).

**Cesium Acetylene Carbide**
Cesium acetylene carbide burns in cold fluorine.
*Mellor* **5:** 849 (1946–1947).

**Cesium Monoxide**
See BROMINE plus Cesium Monoxide.

**Cesium Perfluoro-propoxide**
During preparation of perfluoropropyl hypofluorite, the intermediate cesium compound was being fluorinated with a 50/50 fluorine-nitrogen mix at minus 50°C. After 10 hours addition of fluorine, the set-up exploded.
*Chem. and Eng. News* **43** (9): 36 (1965). *MCA Case History* **1045** (1964).



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**Charcoal**
See FLUORINE plus Common Materials and Oxygen.

**Chlorides**
Chlorides, bromides, iodides and cyanides are generally vigorously attacked by fluorine in the cold.
*Mellor* **2:** 13 (1946–1947).

**Chlorinated Polyethylene**
See FLUORINE plus Solid Nonmetals.

**Chlorine**
See CHLORINE plus Fluorine.

**Chlorine Dioxide**
The uncontrolled reaction between chlorine dioxide and fluorine is explosive.
*Lawless and Smith,* p. 133 (1968).
*Mellor* **2, Supp. 1:** 532 (1956).

**Chromous Sulfide**
Chromous sulfide combines with fluorine with incandescence.
*Mellor* **11:** 430 (1946–1947).

**Chromyl Chloride**
Fluorine reacts with chromyl chloride, producing flame at certain concentrations.
*Mellor* **2, Supp. 1:** 64 (1956).

**Coke**
See FLUORINE plus Common Materials and Oxygen.

**Common Materials and Oxygen**
Spill tests of 100% liquid fluorine, 30% liquid fluorine-in-oxygen, and 100% liquid oxygen on various common materials demonstrated the following effects of the fluorine content: asphalt and also crushed limestone (calcium carbonate) burned with sputtering and small flames; JP-4 fuel produced loud, rapid explosions and a large fireball; coke burned with a small flame; charcoal burned smoothly with a large, brilliant fireball; and rich soil burned with a bright flame.
*NASA SP-***3037:** 110–119 (1967).

**Copper**
When fluorine flows too rapidly or under too much pressure in copper tubing, the copper burns in the fluorine atmosphere. See also FLUORINE plus Metals.
*Yunker* (1966). *Cady* (1966).

**Copper Hydride**
See BROMINE plus Copper Hydride.

**Cyanides**
See FLUORINE plus Chlorides.

**Cyanogen**
Cyanogen is decomposed by fluorine gas at ordinary temperatures with the production of a white flame.
*Mellor* **2:** 13 (1946–1947).

**Ferrous Oxide**
Fluorine does not act in the cold on ferrous oxide, but with gentle heat a reaction sets in with incandescence.
*Mellor* **13:** 715 (1946–1947).

**Graphite**
Graphite burns in a stream of fluorine. See also FLUORINE plus Carbon.
*Mellor* **2, Supp. I:** 198 (1956).

**Halogenated Compounds**
See FLUORINE plus Hydrogen.

**Hexafluoropropylene-Vinylidene Fluoride Copolymer**
See FLUORINE plus Solid Nonmetals and Oxygen.

**Hydrazine**
Spontaneous ignition occurs when these chemicals are mixed.
*Mellor* **8, Supp. 2:** 95 (1967).

**Hydriodic Acid**
The reaction of fluorine with gaseous hydriodic acid is accompanied by flame.
*Mellor* **2:** 12 (1946–1947).

**Hydrobromic Acid**
The reaction of fluorine with gaseous or aqueous hydrobromic acid is accompanied by flame.
*Mellor* **2:** 12 (1946–1947).

**Hydrocarbons**
Violent explosions are encountered when attempts are made to fluorinate hydrocarbons in the liquid phase with elementary fluorine. Many lubricants burn in fluorine.
*Mellor* **2: Supp. I:** 198 (1956).
*NASA SP-***3037:** 82–84 (1967).
*Mellor* **2, Supp. 1:** 55 (1956).

**Hydrochloric Acid**
The reaction of fluorine with gaseous or aqueous hydrochloric acid is accompanied by flame.
*Mellor* **2:** 12, 204–6 (1946–1947).

**Hydrofluoric Acid (Aqueous)**
If fluorine is passed into a 50 per cent solution of hydrofluoric acid, there is an energetic reaction with the water and it is accompanied by flame.
*Mellor* **2:** 12 (1946–1947).

**Hydrogen**
Hydrogen and fluorine combine with extreme violence. The reactions of most organic compounds with fluorine occur explosively. Even halogenated organic materials burn or explode in a fluorine atmosphere. The reaction with water is violent even at minus 210°C.
*Matheson Gas Data,* p. 215 (1961). *Stecher,* pp. 301–2 (1953).
Fluorine and hydrogen react as low as minus 210°C when impurities are present.
*Mellor* **1:** 327 (1946–1947).

**Hydrogen Azide**
See AZINE FLUORIDE (self-reactive).

**Hydrogen Sulfide**
Fluorine ignites in contact with hydrogen sulfide.
*Mellor* **10:** 133 (1946–1947).

**Iodides**
See FLUORINE plus Chlorides.

**Iodine**
Iodine unites with fluorine at ordinary temperatures with a luminous flame.
*Mellor* **2:** 12 (1946–1947).

**Iridium**
See IRIDIUM plus Fluorine.

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**Iron**
See FLUORINE plus Metals. See also IRON plus FLUORINE.

**JP-4 Fuel**
See FLUORINE plus Common Materials and Oxygen.

**Lead Carbonate (Basic)**
White lead burns in fluorine. See also FLUORINE plus Carbonates.
*NASA SP*-**3037:** 83 (1967).

**Lead Oxide and Glycerol**
A mixture of litharge and glycerol burns in fluorine.
*NASA SP*-**3037:** 84 (1967).

**Limestone (crushed)**
See FLUORINE plus Common Materials and Oxygen.

**Lithium Carbide**
See BROMINE plus Lithium Carbide.

**Lithium Carbonate**
See FLUORINE plus Carbonates.

**Lithium Silicide**
When lithium silicide is warmed with gaseous fluorine, a reaction takes place with incandescence. With chlorine, bromine, and iodine a higher temperature is required.
*Mellor* **6:** 169 (1946–1947).

**Lucite®**
See FLUORINE plus Solid Nonmetals and Oxygen.

**Magnesium**
See MAGNESIUM plus Fluorine.

**Manganese**
See MANGANESE plus Fluorine.

**Manganous Oxide**
See FLUORINE plus Trimanganese Tetroxide.

**Manufactured Gas**
Unlighted manufactured gas issuing from a gas jet is immediately ignited by fluorine gas.
*Mellor* **2:** 13 (1946–1947).

**Mercuric Cyanide**
Fluorine and mercuric cyanide react vigorously when gently heated, producing flames.
*Mellor* **2, Supp. 1:** 63 (1956).

**Metals**
Metals (powdered) are in general attacked by fluorine at ordinary temperatures. If the temperature is raised nearly all the metals are vigorously attacked with incandescence.
*Mellor* **2:** 13 (1946–1947).
Some average ignition temperatures (°F) of various metals in fluorine are: aluminum, greater than 1220; copper, 692; iron, 672; molybdenum, 205; monel, 396; nickel, 1162; stainless steel (No. 302), 681; and tungsten, 283.
*NASA SP*-**3037:** 79–80 (1967).

**Molybdenum**
See FLUORINE plus Metals. See also MOLYBDENUM plus FLUORINE.

**Monel®**
See FLUORINE plus Metals.

**Neoprene**
When pieces of neoprene are dropped into liquid fluorine slight explosions occur and the neoprene burns. Neoprene covered fiberglass exploded in liquid fluorine. See also FLUORINE plus Solid Nonmetals.
*NASA SP*-**3037:** 84
*Mellor* **2, Supp. 1:** 54 (1956).
*Chem. and Eng. News* **26:** 3336–7 (1948).

**Nickel**
See FLUORINE plus Metals.

**Nickel Monoxide**
Nickel monoxide becomes incandescent in fluorine gas.
*Ann. Chim. et Phys.* (5) **21:** 199, 386.
*NASA SP*-**3037:** 84.

**Niobium (Columbium)**
See NIOBIUM plus Fluorine.

**Nitric Acid**
If fluorine is passed into nitric acid, each bubble of gas is attended by the decomposition of the acid and accompanied by flame.
*Ann. Chim. et Phys.* (6) **24:** 224.
Fluorine in contact with nitric acid creates a danger of explosion if acid is not 100% strength.
*Mellor* **8, Supp. 2:** 319 (1967).

**Nitric Oxide**
Fluorine reacts immediately with nitric oxide with a pale yellow flame.
*Ann. Chim. et Phys.* (8) **9:** 221.
*Mellor* **2, Supp. 1:** 54 (1956).

**Nitrogen Dioxide**
Fluorine and nitrogen dioxide react vigorously when heated.
*Mellor* **2, Supp. 1:** 54 (1956).

**Nylon**
See FLUORINE plus Solid Nonmetals and Oxygen.

**Organic Matter (Leather)**
Fluorine in contact with leather causes it to smolder and char.
*Mellor* **2, Supp. 1:** 54 (1956).

**Perchloric Acid**
Reaction of fluorine and perchloric acid produces fluorine perchlorate, a highly reactive material.
*Mellor* **2, Supp. 1:** 59 (1956).
See also FLUORINE PERCHLORATE (self-reactive).
The action of fluorine gas in 60–72% perchloric acid leads to the formation of fluorine perchlorate, a very unstable gas that explodes under the most diverse physical and chemical influences.
*Pascal* **16:** 316 (1931–1934). *Kirk and Othmer, Second Ed.* **5:** 74 (1963).

**Perfluoropropionyl Fluoride**
Fluorination of perfluoropropionyl fluoride to synthesize perfluoropropionyl hypofluorite in the presence of activated cesium fluoride catalyst involves potential explosion hazards. No temperature change was noted during the 10-hour addition of fluorine at minus 40°C, but the set-up exploded at the finish of the addition.
*MCA Case History* **1045** (1965).
*Chem. and Eng. News* **43:** 36 (March 1, 1965).



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**Phenol-Formaldehyde Resin**
See FLUORINE plus Solid Nonmetals and Oxygen.

**Phosphorus**
Fluorine reacts with red or yellow phosphorus at ordinary temperatures and the reaction is accompanied by incandescence.
*Mellor* **8:** 785 (1946–1947).
*Mellor* **2, Supp. 1:** 60 (1956).
See also PHOSPHORUS plus Chlorine.

**Phosphorus Pentachloride**
When phosphorus pentachloride is treated with fluorine, the entire mass becomes incandescent.
*Moissan,* p. 134 (1900).

**Phosphorus Trichloride**
Phosphorus trichloride reacts with fluorine with incandescence.
*Moissan,* p. 134 (1900).

**Phosphorus Trifluoride**
A yellow flame appears when fluorine contacts phosphorus trifluoride.
*Comp. Rend.* **138:** 789.

**Polyamide**
See FLUORINE plus Solid Nonmetals and Oxygen.

**Polychloroprene**
See FLUORINE plus Solid Nonmetals and Oxygen.

**Polyethylene**
See FLUORINE plus Solid Nonmetals and Oxygen.

**Polymethylmethacrylate**
See FLUORINE plus Solid Nonmetals and Oxygen.

**Polytetrafluoroethylene**
See FLUORINE plus Solid Nonmetals and Oxygen.

**Polyurethane**
See FLUORINE plus Solid Nonmetals and Oxygen.

**Polyvinylchloride Acetate**
See FLUORINE plus Solid Nonmetals and Oxygen.

**Potassium**
See POTASSIUM plus Fluorine.

**Potassium Hydride**
See CHLORINE plus Potassium Hydride.

**Potassium Nitrate**
Fluorine attacks potassium nitrate to give fluorine nitrate.
*Mellor* **2, Supp. 1:** 62 (1956).
See also FLUORINE NITRATE (self-reactive).

**Potassium Perchlorate**
The action at low pressure of fluorine on potassium perchlorate produces fluorine perchlorate, which is very unstable and explodes easily.
*Pascal* **16:** 316 (1931–1934).

**Rhenium**
See RHENIUM plus Fluorine.

**Rubber (LS-53 and LS-63)**
See FLUORINE plus Solid Nonmetals and Oxygen.

**Rubidium Acetylene Carbide**
See BROMINE plus Rubidium Acetylene Carbide.

**Selenium**
Selenium, silicon, or sulfur ignites in fluorine gas at ordinary temperatures.
*Mellor* **2:** 11–13; **6:** 161–4 (1946–1947).

**Silicon**
See FLUORINE plus Selenium.

**Silver Cyanide**
Fluorine and silver cyanide react with explosive violence at ordinary temperatures.
*Mellor* **2, Supp. 1:** 63 (1956).

**Sodium**
See SODIUM plus Fluorine.

**Sodium Acetate**
Fluorine and sodium acetate produce an explosive reaction involving formation of diacetyl peroxide.
*Mellor* **2, Supp. 1:** 56 (1956).
See also DIACETYL PEROXIDE (self-reactive).

**Sodium Carbonate**
See FLUORINE plus Carbonates.

**Sodium Hydride**
See CHLORINE plus Sodium Hydride.

**Sodium Silicate**
Sodium silicate (water glass) burns in fluorine.
*NASA SP-***3037:** 82 (1967).

**Soil (rich)**
See FLUORINE plus Common Materials and Oxygen.

**Solid Nonmetals and Oxygen**
Numerous nonmetal materials were tested statically on gaseous and liquid fluorine-oxygen mixtures with 50 to 100% fluorine. Substances that burned or reacted violently were: Tygon® (polyvinyl chloride-acetate), nylon (polyamide), Bakelite® (phenol-formaldehyde resin), polyethylene, neoprene (polychloroprene), Buna N (acrylonitrile-butadiene copolymer), LS-53 and LS-63 Rubber (trifluoropropyl methyl polysiloxane), Viton A® (vinylidene fluoride-hexafluoropropylene copolymer) and polyurethane foam. Under dynamic conditions, i.e., flow and pressure, other materials such as Lucite® (polymethyl methacrylate), Teflon® (polytetrafluoroethylene), and CPE products (chlorinated polyethylenes) also ignited in fluorine-oxygen mixtures.
*NASA SP-***3037:** 87–110 (1967).

**Stainless Steel (302)**
See FLUORINE plus Metals.

**Strontium Phosphide**
Mixtures of these materials ignite at room temperatures.
*Mellor* **8:** 841 (1946–1947).

**Sulfur**
See FLUORINE plus Selenium.

**Sulfur Dioxide**
Each bubble of sulfur dioxide gas led into a container of fluorine produces an explosion.
*Mellor* **2:** 1 (1946–1947)

**Tantalum**
Fluorine attacks powdered tantalum with incandescence.
*Mellor* **9:** 891 (1946–1947).

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Fluorine reacts vigorously with tantalum. The metal should not be used to handle it.
*Mellor* **2, Supp. 1:** 62 (1956).

**Teflon®**
See FLUORINE plus Solid Nonmetals and Oxygen.

**Tellurium**
Fluorine attacks tellurium with incandescence.
*Mellor* **11:** 26, 40 (1946–1947).

**Thallium**
Fluorine acts so vigorously on thallium that the metal becomes incandescent.
*Mellor* **5:** 421, 434 (1946–1947).

**Thallous Chloride**
Fluorine and thallous chloride react violently, melting the product.
*Mellor* **2, Supp. 1:** 63 (1956).

**Titanium**
When titanium is fractured in a liquid fluorine atmosphere, it ignites. With catalysis, titanium has ignited in gaseous fluorine at minus 113°F.
*NASA SP-***3037:** 70 (1967).

**Trifluoropropyl Methyl Polysiloxane**
See FLUORINE plus Solid Nonmetals and Oxygen.

**Trimanganese Tetroxide**
Fluorine and trimanganese tetroxide or manganous oxide react vigorously below 100°C, even when diluted with nitrogen.
*Mellor* **2, Supp. 1:** 64 (1956).

**Tungsten**
The reaction between fluorine and tungsten is accompanied by incandescence. See also FLUORINE plus Metals.
*Mellor* **11:** 730 (1946–1947).

**Tungsten Carbide**
Tungsten carbide becomes incandescent in cold fluorine.
*Mellor* **5:** 890 (1946–1947).

**Tygon®**
See FLUORINE plus Solid Nonmetals and Oxygen.

**Uranium**
Electrolytic uranium, as fine powder, is vigorously attacked by fluorine, and burns. Uranium ignites spontaneously in cold fluorine.
*Mellor* **2:** 13; **12:** 31, 32 (1946–1947).

**Uranium Carbide**
See BROMINE plus Uranium Dicarbide.

**Viton A®**
See FLUORINE plus Solid Nonmetals and Oxygen.

**Water**
Water *vapor* will react combustively with fluorine; an explosive reaction occurs between liquid fluorine and ice, after an intermediate induction period.
*NASA SP-***3037:** 52 (1967).
If liquid air which has stood for some time is treated with fluorine, a precipitate is formed which is very likely to explode. Explosive material is thought to be fluorine hydrate.
*Mellor* **2:** 11 (1946–1947).
See also FLUORINE plus Hydrogen.

**Zinc**
Zinc burns in moist fluorine.
*Mellor* **4:** 476 (1946–1947).

**Zirconium Dicarbide**
See BROMINE plus Zirconium Dicarbide.

## FLUORINE AZIDE $N_3F$

**(self-reactive)**
Azine fluoride was detected in the products obtained from the reaction of fluorine with nitrogen-diluted hydrogen azide. The liquid is extremely shock- and light-sensitive and often explodes on vaporization.
*Lawless and Smith,* p. 104 (1968).
Fluorine azide is extremely unstable and easily decomposes explosively.
*Mellor* **2, Supp. 1:** 59 (1956).
*Mellor* **8, Supp. 2:** 24 (1967).

## FLUORINE FLUOROSULFATE $FSO_2OF$

**(self-reactive)**
Fluorine fluorosulfate, which has a vapor pressure of 10 atmospheres at room temperature, was distilled cold into a steel cylinder rated at 135 atmospheres. When the cylinder reached room temperature, it exploded. The violence indicated a chemical explosion.
*Chem. and Eng. News* **44:** 40 (Feb. 21, 1966).
*MCA Case History* **1189** (1966).

## FLUORINE NITRATE $FONO_2$

**(self-reactive)**
Fluorine nitrate explodes on slight concussion.
*Merck Index,* p. 464 (1968).

## FLUORINE PERCHLORATE $FOClO_3$

**(self-reactive)**
Pure fluorine perchlorate exploded in three attempts to determine its freezing point. The gas readily explodes on contact with a small flame or spark.
*ACS* **146:** 209. *J. Am. Chem. Soc.* **69:** 667–8 (1947).
*Mellor* **2, Supp. 1:** 59, 184 (1956).
See also POTASSIUM PERCHLORATE plus Fluorine.

**Organic Matter**
Fluorine perchlorate undergoes explosive decomposition on contact with grease, dirt, or rubber tubing.
*Mellor* **2, Supp. 1:** 184 (1956).

**Potassium Iodide**
A sample of fluorine perchlorate exploded on contact with a potassium iodide solution.
*ACS* **146:** 209–10. *J. Am. Chem. Soc.* **69:** 667–8 (1947).
Fluorine perchlorate in contact with potassium iodide can cause an explosion.
*Mellor* **2, Supp. 1:** 184 (1956).

## FLUORINE PEROXIDE $F_2O_2$

**(self-reactive)**
Fluorine peroxide is a very unstable vapor above minus 100°C, decomposing to fluorine and oxygen gases.
*Mellor* **2, Supp. 1:** 194 (1956).



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**FLUOROACETYLENE** HC≡CF

**(self-reactive)**

Fluoroacetylene is a colorless gas that freezes at minus 196°C to a white solid, which melts to a liquid whose boiling point is a little below minus 80°C. The liquid sometimes explodes with great force. The silver salt detonates when warmed, and the mercury salt decomposes violently without detonation when warmed.
*Rutledge,* p. 135 (1968).

**FLUOROCHLORO-LUBRICANTS**

**Aluminum**

See ALUMINUM plus Fluorochloro-lubricants.

**FLUORODIMETHYLARSINE** $(CH_3)_2AsF$

**Air**

Dimethylfluoroarsine is spontaneously flammable in air.
*Ripley* (1966).

**1-FLUORO-2,2-DINITROETHANE** $CH_2FCH(NO_3)_2$

**Air**

Abnormal operating conditions during the nitration process in preparation of dinitrofluoroethane caused the operator to relieve the vacuum by introducing air. The resulting reaction with air caused an explosion.
*MCA Case History* **784** (1962).

**FORMALDEHYDE** HCHO

**Nitrogen Dioxide**

The slow reaction between nitrogen dioxide and formaldehyde becomes explosive in the region of 180°C.
F. H. Pollard and P. Woodward, *Trans. Faraday Soc.* **45:** 767–770 (1949).

**Perchloric Acid and Aniline**

See PERCHLORIC ACID plus Aniline and Formaldehyde.

**Performic Acid**

See PERFORMIC ACID plus Formaldehyde.

**FORMAMIDINE THIOLACETIC ACID HYDROCHLORIDE** $NH_2C(NH)SCH_2COOH{\cdot}HCl$

**Chlorine**

See CHLORINE plus S-Ethyl Isothiourea Sulfate.

**FORMIC ACID** HCOOH

**Furfuryl Alcohol**

See FURFURYL ALCOHOL plus Formic Acid.

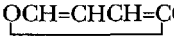
**Hydrogen Peroxide**

See HYDROGEN PEROXIDE plus Formic Acid and Organic Matter.

**Thallium Trinitrate Trihydrate**

See THALLIUM TRINITRATE TRIHYDRATE plus Formic Acid.

**FURAN-2-PEROXYCARBOXYLIC ACID**



**(self-reactive)**

This acid explodes when heated to 30 to 40°C, or at room temperature upon addition of organic or inorganic materials such as carbon black, calcium chloride, barium chloride, strontium chloride or magnesium chloride.
*Chem. Reviews* **45:** 15, 16 (1949).

**FURFURYL ALCOHOL** $OCH{=}CHCH{=}CCH_2OH$

**Cyanoacetic Acid**

An explosion occurred in a laboratory when cyanoacetic acid was reacted with furfuryl alcohol in an attempt to form the ester, furfuryl cyanoacetate. The explosion occurred a few minutes after the agitator was turned on and the heat applied.
*MCA Case History* **858** (1963).

**Formic Acid**

During an attempt to prepare furfuryl formate from furfuryl alcohol and concentrated formic acid, an explosion occurred.
*Chem. and Eng. News* **18:** 72 (1940).

**Mineral Acids**

Furfuryl alcohol will polymerize rapidly, and sometimes with explosive violence, in the presence of strong mineral acids.
*Hexagon Alpha Chi Sigma* (October 1949).

**Nitric Acid**

See NITRIC ACID plus Organic Matter.
See NITRIC ACID plus Furfuryl Alcohol.
See also NITRIC ACID plus Diborane.

**Nitric Acid, Nitrogen Tetroxide, and Sulfuric Acid**

See UNSYMMETRICAL DIMETHYLHYDRAZINE plus Nitric Acid, Nitrogen Tetroxide, and Sulfuric Acid.

**GADOLINIUM** Gd

**Air**

See RARE EARTH METALS plus Air.

**Halogens**

See RARE EARTH METALS plus Halogens.

**GALLIC ACID** $(OH)_3C_6H_2COOH$

**Potassium Chlorate**

See POTASSIUM CHLORATE plus Gallic Acid.

**GALLIUM HYDRIDE** $Ga_2H_6$

**Air**

Gallium hydride is spontaneously flammable in air.
*Hurd,* p. 99 (1952).

**GALLIUM PERCHLORATE** $Ga(ClO_3)_3$

**Urea**

The double salt formed decomposes violently on heating.
*Mellor* **2, Supp. 1:** 611 (1956).

**GERMANE (GERMANIUM HYDRIDE)** $GeH_4$

**Air**

The germanium hydrides are spontaneously flammable in air.
*Fawcett* (1965). *Brauer* (1965).

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**GERMANIUM** Ge

**Bromine**
When heated in bromine, germanium burns with a yellowish flame.
*Mellor* **7:** 260 (1946–1947).

**Chlorine**
When germanium is heated in chlorine, it burns with a bluish-white flame. Powdered germanium ignites spontaneously in chlorine at ordinary temperatures.
*Mellor* **7:** 260 (1946–1947).

**Nitric Acid**
The action of concentrated nitric acid on powdered germanium is very violent.
*Mellor* **7:** 260 (1946–1947).

**Oxygen**
Germanium burns with incandescence when heated in oxygen.
*Mellor* **7:** 260 (1946–1947).

**Potassium Chlorate**
See GERMANIUM plus Potassium Nitrate.

**Potassium Nitrate**
Mixture of germanium with potassium nitrate or potassium chlorate explodes when heated.
*Mellor* **7:** 261 (1946–1947).

**GERMANIUM HYDRIDE** $GeH_4$

**Air**
See GERMANE plus Air.

**GERMANIUM HYDRIDES** $GeH_4$; $Ge_2H_6$; $Ge_3H_8$

**Air**
The germanium hydrides decompose in air, often bursting into flames.
*Brauer* (1965).

**GERMANIUM SULFIDE** $GeS_2$

**Potassium Nitrate**
When germanium sulfide is mixed with potassium nitrate and heated, it explodes.
*Mellor* **7:** 274 (1946–1947).

**GERMANIUM TETRACHLORIDE** $GeCl_4$

**Water**
Germanium tetrachloride is decomposed by water and much heat is developed.
*Mellor* **7:** 270 (1946–1947).

**GERMANIUM TETRAIODIDE** $GeI_4$

**Air**
The vapor of germanium tetraiodide is flammable in air.
*Mellor* **7:** 272, 273 (1946–1947).

**GLASS**

**Chlorine Trifluoride**
See CHLORINE TRIFLUORIDE plus Charcoal.

**GLYCERIDES** $(RCOOCH_2)CHOCOR$

**Nitric Acid and Sulfuric Acid**
See NITRIC ACID plus Sulfuric Acid and Glycerides.

**GLYCEROL** $HOCH_2CHOHCH_2OH$

**Acetic Anhydride**
See ACETIC ANHYDRIDE plus Glycerol.

**Aniline and Nitrobenzene**
See ANILINE plus Nitrobenzene and Glycerine.

**Calcium Hypochlorite**
See CALCIUM HYPOCHLORITE plus Glycerol and CALCIUM HYPOCHLORITE plus Ethyl Alcohol.

**Chlorine**
See CHLORINE plus Polypropylene.

**Chromic Anhydride**
See CHROMIC ANHYDRIDE plus Naphthalene.

**Chromium Oxide**
See CHROMIUM OXIDE plus Glycerol.

**Fluorine and Lead Oxide**
See FLUORINE plus Lead Oxide and Glycerol.

**Perchloric Acid and Lead Oxide**
See LEAD OXIDE plus Perchloric Acid and Glycerine.

**Potassium Permanganate**
See POTASSIUM PERMANGANATE plus Glycerol.

**Potassium Peroxide**
See SODIUM PEROXIDE plus Aniline.

**Silver Perchlorate**
See SILVER PERCHLORATE plus Acetic Acid.

**Sodium Peroxide**
See SODIUM PEROXIDE plus Aniline.

**GLYCOL ETHERS**

**Perchloric Acid**
See PERCHLORIC ACID plus Glycol Ethers.

**GLYCOLONITRILE** $HOCH_2CN$

**(self-reactive)**
A bottle containing freshly purified glycolonitrile sat for a week before a portion of it was removed. Six days later, the remainder polymerized and exploded the bottle.
*Chem. and Eng. News* **42** (48): 50 (Nov. 28, 1966).

**GLYCOL PERCHLORATES**

**(self-reactive)**
Glycol perchlorate and epichlorohydrin perchlorate are more explosive than nitroglycerine. Ethylene glycol perchlorate is so sensitive that a few drops of water cause a violent explosion.
*ACS* **146:** 214. *Berichte* **42:** 2031–4 (1909).

**GLYCOLS**

**Perchloric Acid**
See PERCHLORIC ACID plus Glycol Ethers.

**GLYOXAL** OCHCHO

**(self-reactive)**
See GLYOXAL plus Water.

**Air**
Mixtures with air may explode.
*Merck Index*, p. 502 (1968).
See also GLYOXAL plus Water.



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**Chlorosulfonic Acid**
Mixing glyoxal and chlorosulfonic acid in a closed container caused the temperature and pressure to increase.
*Flynn and Rossow* (1970). See Note under complete reference.

**Ethyleneimine**
Mixing glyoxal and ethyleneimine in a closed container caused the temperature and pressure to increase.
*Flynn and Rossow* (1970). See Note under complete reference.

**Nitric Acid**
See NITRIC ACID plus Glyoxal.

**Oleum**
Mixing glyoxal and oleum in a closed container caused the temperature and pressure to increase.
*Flynn and Rossow* (1970). See Note under complete reference.

**Sodium Hydroxide**
See SODIUM HYDROXIDE plus Glyoxal.

**Water**
Glyoxal polymerizes quickly on standing, on contact with water (violent reaction), or when dissolved in solvents containing water.
*Merck Index,* p. 502 (1968).

## GOLD Au

**Ammonia**
The reaction between ammonia and gold, silver, or mercury produces fulminate-like compounds of variable and uncertain composition that explode when dried. Severe accidents have occurred.
*Chem. Abst.* **60:** 12, 14327 (1964).
*Mellor* **3:** 579–84 (1946–1947).
*Allison* (1966). J. K. Luchs, *Phot. Sci. Eng.* **10:** 334–7 (1966).

**Ammonium Hydroxide and Aqua Regia**
In an effort to precipitate finely divided gold from aqua regia, ammonium hydroxide was substituted for ammonium oxalate. When the gold precipitate was heated in a muffle furance with other metals to produce an alloy, an explosion occurred.
*U. Wash. Occ. Health Newsletter* **16** (1967).

**Hydrogen Peroxide**
Finely divided gold and a strong hydrogen peroxide solution may explode.
*Mellor* **1:** 936 (1946–1947).

## GOLD CYANIDE AuCN; $Au(CN)_3 3H_2O$

**Magnesium**
See MAGNESIUM plus Gold Cyanide.

## GOLD SALTS

**Nitromethane**
See COPPER SALTS plus Nitromethane.

## GRAPHITE C

**Chlorine Trifluoride**
See CHLORINE TRIFLUORIDE plus Charcoal.

**Fluorine**
See FLUORINE plus Charcoal.

**Potassium**
See POTASSIUM plus Charcoal.

**Potassium Superoxide**
See POTASSIUM plus Graphite and Air.
Also see POTASSIUM plus Graphite and Potassium Superoxide.

## GUANIDINE PERCHLORATE $(NH_2)_3CClO_4$

**(self-reactive)**
Guanidine perchlorate is unusually sensitive to initiation and has extraordinary explosive power.
*ACS* **146:** 213 *Davis* (1943).

## HAFNIUM TETRAHYDROBORATE $Hf(BH_4)_4$

**Air**
Hafnium borohydride burns violently when exposed to air.
*Gaylord,* p. 58 (1966).

## HALOGEN FLUORIDES

**Organic Matter**
See BROMINE MONOFLUORIDE plus Water.
See individual fluoride plus Organic Matter.

## HALOGENS

**Cerium**
See RARE EARTH METALS plus Halogens.

**Dysprosium**
See RARE EARTH METALS plus Halogens.

**Erbium**
See RARE EARTH METALS plus Halogens.

**Europium**
See RARE EARTH METALS plus Halogens.

**Gadolinium**
See RARE EARTH METALS plus Halogens.

**Hafnium**
See RARE EARTH METALS plus Halogens.

**Holmium**
See RARE EARTH METALS plus Halogens.

**Lutetium**
See RARE EARTH METALS plus Halogens.

**Neodymium**
See RARE EARTH METALS plus Halogens.

**Praseodymium**
See RARE EARTH METALS plus Halogens.

**Rare Earth Metals**
See RARE EARTH METALS plus Halogens.

**Samarium**
See RARE EARTH METALS plus Halogens.

**Terbium**
See RARE EARTH METALS plus Halogens.

**Thulium**
See RARE EARTH METALS plus Halogens.


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**Tri-iso-Butyl Aluminum**
See TRI-iso-BUTYL ALUMINUM plus Acids.

**Ytterbium**
See RARE EARTH METALS plus Halogens.

**Yttrium**
See RARE EARTH METALS plus Halogens.

## N-HALOIMIDES (INCLUDING TRICHLOROISOCYANURIC ACID)

**Alcohols, Amines, Diallyl Sulfide, Hydrazine, or Xylene**
Many of the reactions of several N-chloro- and N-bromoimides are extremely violent or explosive.
*Bretherick* (1978).

## HEPTANE $C_7H_{16}$

**Phosphorus and Chlorine**
See PHOSPHORUS plus Chlorine and Heptane.

## HEXABORANE (10) $B_6H_{10}$

**Air**
Boron hexahydride is spontaneously flammable in air.
*Douda* (1966).

## HEXABORANE (12) $B_6H_{12}$

**Air**
This hydride is spontaneously flammable in air.
*Mellor* **5:** 36 (1946–1947).
*Douda* (1966).

## HEXACHLOROBENZENE $C_6Cl_6$

**Dimethyl Formamide**
See DIMETHYL FORMAMIDE plus Hexachlorobenzene.

## HEXACHLOROMELAMINE
$N=C(NCl_2)N=C(NCl_2)N=C(NCl_2)$

**Acetone**
See HEXACHLOROMELAMINE plus Organic Contaminants.

**Ammonia**
See HEXACHLOROMELAMINE plus Organic Contaminants.

**Aniline**
See HEXACHLOROMELAMINE plus Organic Contaminants.

**Diphenylamine**
See HEXACHLOROMELAMINE plus Organic Contaminants.

**Organic Contaminants**
Organic contaminants added to hexachloromelamine cause a very rapid reaction to take place with or without visible flame. Contaminants tested were acetone, aniline, diphenylamine, ammonia and others. The hexachloromelamine would explode if the amount were large and confined. Trichloromelamine behaves similarly; however, it consumes itself less rapidly, but with more flame and fume production. After the contaminant is added, there is a delay of several seconds before anything happens.
*Ventrone* (1968).

**Turpentine**
See HEXACHLOROMELAMINE plus Organic Contaminants.

## 1,5-HEXADIEN-3-YNE $H_2C=CHC\equiv CCH=CH_2$

**Air**
Divinylacetylene reacts with oxygen to form an explosive peroxide polymer. Divinylacetylene must be handled in an oxygen-free atmosphere. After experiments are completed the equipment should be rinsed immediately with solvents containing a polymerization inhibitor to prevent formation of unstable films. Handy and Bensen, *J. Org. Chem.* **27:** 39 (1962).

## 2, 4-HEXADIYN-1, 6-BISCHLOROSULFITE
$(ClSOOCH_2C\equiv C-)_2$

**(self-reactive)**
See THIONYL CHLORIDE plus 2, 4-Hexadiyn-1, 6-Diol.
2, 4-hexadiyn-1, 6-bischlorosulfite is shock-sensitive and decomposes violently upon distillation.
P. E. Drieder and H. V. Isaacson, *Chem. and Eng. News* **50** (12): 51 (1972).

## 2, 4-HEXADIYN-1, 6-DIOL $(HOCH_2C\equiv C-)_2$

**Phosgene**
See PHOSGENE plus 2, 4-Hexadiyn-1, 6-Diol.

**Thionyl Chloride**
See THIONYL CHLORIDE plus 2, 4-Hexadiyn-1, 6-Diol.

## HEXAFLUOROPROPYLENE-VINYLIDINE COPOLYMER

**Fluorine**
See FLUORINE plus Solid Nonmetals and Oxygen.

## HEXAMETHYLBENZENE $C_6(CH_3)_6$

**Nitromethane**
The electro-oxidation of various methyl benzenes was being studied. During the reactions, violent explosions occurred at the auxiliary electrode.
*Chem. and Eng. News* **49** (23): 6 (1971).

## HEXAMETHYLENE DIISOCYANATE $OCN(CH_2)_6NCO$

**Alcohols**
See ALCOHOLS plus Isocyanates.

## HEXAMETHYLENETETRAMINE $(CH_2)_6N_4$

**Sodium Peroxide**
See SODIUM PEROXIDE plus Hexamethylenetetramine.

## HOLMIUM Ho

**Air**
See RARE EARTH METALS plus Air.

**Halogens**
See RARE EARTH METALS plus Halogens.

## HYDRAZINE $H_2NNH_2$

**Air**
Hydrazine may ignite spontaneously while absorbed on porous materials such as earth, asbestos, cloth, or wood unless the heat of the gradual hydrazine-air reaction has

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a chance to dissipate. Spontaneous ignition can occur with hydrogen peroxide and nitric acid. Contact with many metallic oxide surfaces may lead to flaming decomposition.
*Haz. Chem. Data* (1966).
*Mellor* **8, Supp. 2:** 95 (1967).

**Alkali Metals and Ammonia**
Explosive metal hydrazides form when hydrazine and alkali metals are mixed in liquid ammonia.
*Mellor* **8, Supp. 2:** 73 (1967).

**Chlorine**
See CHLORINE plus Hydrazine.

**Chromates**
See CHROMATES plus Hydrazine.

**Cupric Oxide**
See CUPRIC OXIDE plus Hydrazine.

**Cupric Salts**
See CUPRIC SALTS plus Hydrazine.

**Fluorine**
See FLUORINE plus Hydrazine.

**Hydrogen Peroxide**
See HYDRAZINE plus Air.
*Mellor* **8, Supp. 2:** 95 (1967).

**Iron Oxide**
While boiling a sample of a polyester fiber in hydrazine in a glass beaker, the technician used a somewhat rusty pair of metal tweezers to handle the sample. When the tweezers were put in the solution, the solution ignited. The ignition temperature of hydrazine varies from 75°F in the presence of iron oxide to 518°F in a glass container.
*MCA Case History* **1893** (1973).

**Metallic Oxides**
See HYDRAZINE plus Air.

**Nickel**
See NICKEL plus Hydrazine.

**Nickel Perchlorate**
See NICKEL PERCHLORATE plus Hydrazine.

**Nitric Acid**
See HYDRAZINE plus Air.
Spontaneous ignition occurs when these chemicals are mixed.
*Mellor* **8, Supp. 2:** 95 (1967).

**Nitrous Oxide**
See NITROUS OXIDE plus Lithium Hydride.

**Oxygen**
See OXYGEN plus Hydrazine.

**Oxygen (liquid)**
See OXYGEN (LIQUID) plus Hydrazine.

**Potassium Dichromate**
See POTASSIUM DICHROMATE plus Hydrazine.

**Sodium Dichromate**
See POTASSIUM DICHROMATE plus Hydrazine.

**Tetryl**
During the measurement of shock sensitivity of a mixture containing hydrazine, a drop of the hydrazine mixture fell inadvertently on the tetryl donor explosive. The tetryl immediately burst into flame.
*ASESB Operational Incident Report* **105.**

**Zinc Diamide**
See ZINC DIAMIDE plus Hydrazine.

**Zinc Diethyl**
See ZINC DIAMIDE plus Hydrazine.

## HYDRAZINE AZIDE $H_2NNH_3N_3$

**(self-reactive)**
This is an explosive salt.
*Mellor* **8, Supp. 2:** 86 (1967).

**Air**
When hydrazine azide is rapidly heated in air, as by a white-hot wire, the salt decomposes violently. Similar explosions occur when a detonator is used. The moist salt is also explosive.
*Mellor* **8:** 344 (1946–1947).

## HYDRAZINE CHLORITE $H_2NNH_3ClO_2$

**(self-reactive)**
This is an explosive salt, highly flammable when dry.
*Mellor* **8, Supp. 2:** 85 (1967).
*Mellor* **2, Supp. 1:** 573 (1956).

## HYDRAZINE HYDRATE $H_2NNH_2{\cdot}H_2O$

**2,4-Dinitrochlorobenzene**
This reaction is exothermic; it shattered the reaction flask.
*Wischmeyer* (1967).

**Mercuric Oxide**
See MERCURIC OXIDE plus Hydrazine Hydrate.

**Sodium**
See SODIUM plus Hydrazine Hydrate.

**Stannous Chloride**
See STANNOUS CHLORIDE plus Hydrazine Hydrate.

## HYDRAZINE MONONITRATE $H_2NNH_2HNO_3$

**Copper**
See ZINC plus Hydrazine Mononitrate.

**Metal Carbides**
See ZINC plus Hydrazine Mononitrate.

**Metal Nitrides**
See ZINC plus Hydrazine Mononitrate.

**Metal Oxides**
See ZINC plus Hydrazine Mononitrate.

**Metal Sulfides**
See ZINC plus Hydrazine Mononitrate.

**Zinc**
See ZINC plus Hydrazine Mononitrate.

## HYDRAZINE NITRATE $H_2NNH_3NO_3$

**(self-reactive)**
This explosive salt is less stable than ammonium nitrate.
*Mellor* **8, Supp. 2:** 86 (1967).


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**HYDRAZINE PERCHLORATE** $H_2NNH_3ClO_4$

**(self-reactive)**
Dry hydrazine perchlorate can be detonated by shock or friction.
*ACS*-**146:** 209.
*Comp. Rend.* **228:** 1497–8 (1949).
*Mellor* **8, Supp. 2:** 85 (1967).

**HYDRAZINE SELENATE** $H_2NNH_2SeO_3OH$

**(self-reactive)**
This salt is explosive.
*Mellor* **8, Supp. 2:** 85 (1967).

**HYDRAZOIC ACID** $N_3H$

**Cadmium**
See CADMIUM plus Hydrazoic Acid.

**Copper**
See COPPER plus Hydrazoic Acid.

**Nickel**
See NICKEL plus Hydrazoic Acid.

**Nitric Acid**
The reaction of hydrazoic acid and nitric acid is energetic.
*Mellor* **8, Supp. 2:** 4 (1967).

**HYDRIODIC ACID** HI

**(See also HYDROGEN IODIDE)**

**Fluorine**
See FLUORINE plus Hydriodic Acid.

**Perchloric Acid**
See PERCHLORIC ACID plus Hydriodic Acid.

**HYDROBROMIC ACID** HBr

**Fluorine**
See FLUORINE plus Hydrobromic Acid.

**HYDROCARBONS**

**Chlorine**
See CHLORINE plus Hydrocarbons.

**Fluorine**
See FLUORINE plus Hydrocarbons.

**Magnesium Perchlorate**
See MAGNESIUM PERCHLORATE plus Hydrocarbons.

**HYDROCHLORIC ACID** HCl

**(See also HYDROGEN CHLORIDE)**

**Acetic Anhydride**
See ACETIC ANHYDRIDE plus Hydrochloric Acid.

**2-Aminoethanol**
See 2-AMINOETHANOL plus Hydrochloric Acid.

**Ammonium Hydroxide**
Mixing hydrochloric acid and 28% ammonia in a closed container caused the temperature and pressure to increase.
*Flynn and Rossow* (1970). See Note under complete reference.

**Calcium Phosphide**
See CALCIUM PHOSPHIDE plus Hydrochloric Acid.

**Chlorosulfonic Acid**
See CHLOROSULFONIC ACID plus Hydrochloric Acid.

**Ethylene Diamine**
See ETHYLENE DIAMINE plus Hydrochloric Acid.

**Ethyleneimine**
See ETHYLENEIMINE plus Hydrochloric Acid.

**Oleum**
See OLEUM plus Hydrochloric Acid.

**Perchloric Acid**
The hydronium compound decomposes spontaneously with violence.
*Mellor* **2, Supp. 1:** 613 (1956).

**Propiolactone (BETA-)**
See PROPIOLACTONE (BETA-) plus Hydrochloric Acid.

**Propylene Oxide**
See PROPYLENE OXIDE plus Hydrochloric Acid.

**Silver Perchlorate and Carbon Tetrachloride**
See SILVER PERCHLORATE plus Carbon Tetrachloride and Hydrochloric Acid.

**Sodium Hydroxide**
See SODIUM HYDROXIDE plus Hydrochloric Acid.

**Sulfuric Acid**
Mixing 36% hydrochloric acid and 96% sulfuric acid in a closed container caused the temperature and pressure to increase.
*Flynn and Rossow* (1970). See Note under complete reference.

**Uranium Phosphide**
See URANIUM PHOSPHIDE plus Hydrochloric Acid.

**Vinyl Acetate**
See VINYL ACETATE plus Hydrochloric Acid.

**HYDROFLUORIC ACID** HF

**(See also HYDROGEN FLUORIDE)**

**Acetic Anhydride**
See ACETIC ANHYDRIDE plus Hydrofluoric Acid.

**2-Aminoethanol**
See 2-AMINOETHANOL plus Hydrofluoric Acid.

**Ammonium Hydroxide**
Mixing 48.7% hydrofluoric acid and 28% ammonia in a closed container caused the temperature and pressure to increase.
*Flynn and Rossow* (1970). See Note under complete reference.

**Bismuthic Acid**
See BISMUTHIC ACID plus Hydrofluoric Acid.

**Calcium Oxide**
See CALCIUM OXIDE plus Hydrofluoric Acid.

**Chlorosulfonic Acid**
See CHLOROSULFONIC ACID plus Hydrofluoric Acid.

**Ethylene Diamine**
See ETHYLENE DIAMINE plus Hydrofluoric Acid.

**Ethyleneimine**
See ETHYLENEIMINE plus Hydrofluoric Acid.

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**Fluorine**
See FLUORINE plus Hydrofluoric Acid.

**Nitric Acid and Lactic Acid**
See NITRIC ACID plus Lactic Acid and Hydrofluoric Acid.

**Oleum**
See OLEUM plus Hydrofluoric Acid.

**Propiolactone (BETA-)**
See PROPIOLACTONE (BETA-) plus Hydrofluoric Acid.

**Propylene Oxide**
See PROPYLENE OXIDE plus Hydrofluoric Acid.

**Sodium**
See SODIUM plus Hydrofluoric Acid.

**Sodium Hydroxide**
See SODIUM HYDROXIDE plus Hydrofluoric Acid.

**Sulfuric Acid**
Mixing 48.7% hydrofluoric acid and 96% sulfuric acid in a closed container caused the temperature and pressure to increase.
*Flynn and Rossow* (1970). See Note under complete reference.

**Vinyl Acetate**
See VINYL ACETATE plus Hydrofluoric Acid.

## HYDROGEN $H_2$

**Air and Platinum**
Finely divided platinum and some other metals will cause a mixture of hydrogen and oxygen to explode at ordinary temperatures. If a jet of hydrogen in air impinges on platinum black, the metal becomes hot enough to ignite the gas.
*Mellor* **1:** 325; **16:** 146 (1946–1947).

**Bromine**
See BROMINE plus Hydrogen.

**Chlorine**
See CHLORINE plus Hydrogen.

**Chlorine Trifluoride**
See CHLORINE TRIFLUORIDE plus Ammonia.

**Dioxane and Nickel (Raney)**
Dioxane reacts explosively with hydrogen and Raney nickel above 210°C.
*Organic Synthesis,* **Coll. Vol. III:** 182 (1955).

**Fluorine**
See FLUORINE plus Hydrogen.

**Lithium**
See LITHIUM plus Hydrogen.

**Magnesium and Calcium Carbonate**
See MAGNESIUM plus Hydrogen and Calcium Carbonate.

**Nitroanisole**
Catalytic hydrogenation of nitroanisole in the presence of nickel catalyst has resulted in an explosion.
*J. Am. Chem. Soc.* **53:** 2417 (1931).

**Nitrogen Trifluoride**
Explosive reactions occur upon ignition of mixtures of nitrogen trifluoride with good reducing agents such as ammonia, carbon monoxide, hydrogen, hydrogen sulfide or methane.
*Lawless and Smith,* p. 34 (1968).

**Oxygen Difluoride**
Mixtures of hydrogen, carbon monoxide, or methane and oxygen difluoride are exploded when a spark is discharged.
*Mellor* **2, Supp. 1:** 192 (1956).

**Oxygen and Platinum**
See HYDROGEN plus Air and Platinum.

**Palladium and Isopropyl Alcohol**
When a stream of hydrogen entrained isopropyl alcohol vapors and palladium particles, the mixture caught fire on exposure to air.
*Confidential information furnished to NFPA.*

**1-Pentol**
An explosion and subsequent investigation revealed that heating 1′-pentol and 1″-pentol under hydrogen pressure is extremely dangerous. It appears to cause this acetylenic compound to break down suddenly to elemental carbon, hydrogen, and carbon monoxide with the release of sufficient energy to develop pressures in excess of 1,000 atmospheres. The presence of small quantities of sulfuric acid or potassium hydroxide reduces the temperature of instability of 1-pentol. Also heating 1-pentol isomers above 100°C during vacuum distillation should be avoided to prevent polymerization.
F. Lorenz, *AIChE Loss Prevention, 1967,* p. 1.

## HYDROGEN AZIDE $HN_3$

**Fluorine**
See AZINE FLUORIDE (self-reactive).

## HYDROGEN BROMIDE HBr

**Ammonia**
The reaction is vigorous even at minus 80°C with intensely dried reactants.
*Mellor* **2, Supp. 1:** 737 (1956).

**Ozone**
See OZONE plus Hydrogen Bromide.

## HYDROGEN CHLORIDE HCl

**(See also HYDROCHLORIC ACID)**

**Calcium Carbide**
See CALCIUM CARBIDE plus Hydrogen Chloride.

**Cesium Acetylene Carbide**
See CESIUM ACETYLENE CARBIDE plus Hydrogen Chloride.

**Cesium Carbide**
See CESIUM CARBIDE plus Hydrochloric Acid.

**Dowicil 100**
See DOWICIL 100 plus Hydrogen Chloride.

**Lithium Silicide**
See LITHIUM SILICIDE plus Hydrogen Chloride.

**Magnesium Boride**
See MAGNESIUM BORIDE plus Hydrochloric Acid.

**Mercuric Sulfate**
See MERCURIC SULFATE plus Hydrogen Chloride.

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**Rubidium Acetylene Carbide**
See RUBIDIUM ACETYLENE CARBIDE plus Hydrochloric Acid.

**Rubidium Carbide**
See RUBIDIUM CARBIDE plus Hydrochloric Acid.

**Sodium**
See SODIUM plus Hydrochloric Acid.
See SODIUM plus Hydrogen Chloride.

## HYDROGEN CYANIDE HCN

**(self-reactive)**
Hydrogen cyanide containing water up to 10% was polymerized in glass ampoules at 50–60°C or catalyzed at room temperature under the effect of a minute amount of alkali. In view of the possibility of running into dangerous conditions with a water content of 2–5%, it is important to keep it below this range.
*J. Chem. Soc. Japan Ind. Chem. Sec.* **71** (8): 1119–1123 (1968).

**Acetaldehyde**
See ACETALDEHYDE plus Ammonia (Anhydrous).

## HYDROGEN DIPHOSPHIDE $P_2H$

**Air**
Hydrogen diphosphide in air ignites when suddenly heated to 100°C., or when struck with a hammer.
*Mellor* **8:** 831 (1946–1947).

## HYDROGEN FLUORIDE HF

**(See also HYDROFLUORIC ACID)**

**Arsenic Trioxide**
Hydrogen fluoride and arsenic trioxide react with incandescence.
*Mellor* **9:** 101 (1946–1947).

**Phosphorus Pentoxide**
See PHOSPHORUS PENTOXIDE plus Hydrogen Fluoride.

## HYDROGEN IODIDE HI

**(See also HYDRIODIC ACID)**

**Magnesium**
See MAGNESIUM plus Hydrogen Iodide.

**Nitric Acid**
When hydrogen iodide is passed through fuming nitric acid, each bubble produces a red flame with the separation of iodine.
*Berichte* **3:** 3660.

**Ozone**
See OZONE plus Hydrogen Iodide.

**Potassium**
See POTASSIUM plus Hydrogen Iodide.

**Potassium Chlorate**
See POTASSIUM CHLORATE plus Hydrogen Iodide.

## HYDROGEN PEROXIDE $H_2O_2$

**Acetic Acid**
Even dilute hydrogen peroxide added to dilute acetic acid and heated will initiate an exothermic reaction with production of peracetic acid which will explode at 110°C.
*Weed* (1966).

**Acetic Anhydride**
Addition of hydrogen peroxide to acetic anhydride yields peroxyacetic acid; but an excess of acetic anhydride reacts with peroxyacetic acid yielding diacetyl peroxide, which is very unstable and explodes readily.
*Chem. Reviews* **45:** 5 (1949).
See also HYDROGEN PEROXIDE plus Acetic Acid.
See also PERACETIC ACID plus Acetic Anhydride.

**Acetone**
See HYDROGEN PEROXIDE plus Organic Matter.

**Alcohols and Sulfuric Acid**
See ALCOHOLS plus Hydrogen Peroxide and Sulfuric Acid.

**Ammonium Hydroxide**
A mixture of ammonium hydroxide and hydrogen peroxide exploded.
*Chem. and Eng. News*, p. 2 (July 23, 1990).

**Antimony Trisulfide**
See ANTIMONY TRISULFIDE plus Hydrogen Peroxide.

**Arsenic Trisulfide**
See ANTIMONY TRISULFIDE plus Hydrogen Peroxide.

**Brass**
See IRON plus Hydrogen Peroxide.

**Bronze**
See IRON plus Hydrogen Peroxide.

**t-Butyl Alcohol**
The preparation of di tertiary butyl peroxide by the addition of tertiary butyl alcohol to a mixture of hydrogen peroxide and sulfuric acid (2 to 1 weight ratio of 78% sulfuric acid to 50% hydrogen peroxide) has resulted in severe explosions particularly during the early stages of large batches.
T. A. Schenach, *Chem. and Eng. News.* **51** (6): 39 (Feb. 5, 1973).

**Cellulose**
Hydrogen peroxide plus cellulose (in cotton) ignites spontaneously.
*Mellor* **1:** 938 (1946–1947).

**Charcoal**
Charcoal mixed with a trace of manganese dioxide ignites immediately in contact with hydrogen peroxide.
*Mellor* **1:** 938 (1946–1947).

**Chlorine and Potassium Hydroxide**
See CHLORINE plus Hydrogen Peroxide and Potassium Hydroxide.

**Chlorosulfonic Acid**
See CHLOROSULFURIC ACID plus Hydrogen Peroxide.

**Chromium**
See IRON plus Hydrogen Peroxide.

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**Copper**
See IRON plus Hydrogen Peroxide.

**Cupric Sulfide**
See ANTIMONY TRISULFIDE plus Hydrogen Peroxide.

**Dimethylbenzylcarbinol and Sulfuric Acid**
See ALCOHOLS plus Hydrogen Peroxide and Sulfuric Acid.

**Ethyl Alcohol**
See ETHYL ALCOHOL plus Hydrogen Peroxide.

**Ethyl Alcohol and Sulfuric Acid**
See ALCOHOLS plus Hydrogen Peroxide and Sulfuric Acid.

**Ferrous Sulfide**
See ANTIMONY TRISULFIDE plus Hydrogen Peroxide.

**Formic Acid and Organic Matter**
A chemist working with a 50–50 mixture of formic acid and 90 per cent hydrogen peroxide, introduced a small amount of organic material into the solution. When the reaction had subsided, the container was removed to a workbench. Later, when the flask was picked up, the material exploded violently.
*Chem. and Eng. News* **28:** 418 (1950).

**Gold**
See GOLD plus Hydrogen Peroxide.

**Hydrazine**
See HYDRAZINE plus Air.
See HYDRAZINE plus Hydrogen Peroxide.

**Hydrogen Selenide**
See HYDROGEN SELENIDE plus Hydrogen Peroxide.

**Iron**
See IRON plus Hydrogen Peroxide.

**Ketones and Nitric Acid**
See KETONES plus Nitric Acid and Hydrogen Peroxide.

**Lead**
See IRON plus Hydrogen Peroxide.

**Lead Dioxide**
See LEAD DIOXIDE plus Hydrogen Peroxide.

**Lead Monoxide**
See LEAD DIOXIDE plus Hydrogen Peroxide.

**Lead Sulfide**
See ANTIMONY TRISULFIDE plus Hydrogen Peroxide.

**Magnesium**
See MAGNESIUM plus Hydrogen Peroxide.

**Manganese**
See IRON plus Hydrogen Peroxide.

**Manganese Dioxide**
See MANGANESE DIOXIDE plus Hydrogen Peroxide.

**Mercuric Oxide**
See LEAD DIOXIDE plus Hydrogen Peroxide.

**Mercurous Oxide**
See MERCUROUS OXIDE plus Hydrogen Peroxide.

**Molybdenum Disulfide**
See ANTIMONY TRISULFIDE plus Hydrogen Peroxide.

**Nitric Acid**
This mixture is unstable when more than 50% of acid is present.
*Mellor* **8, Supp. 2:** 315 (1967).

**Organic Matter**
Under certain circumstances, hydrogen peroxide is capable of developing an explosive power in excess of its weight equivalent of TNT when mixed with organic compounds; the acetone-hydrogen peroxide system is a good example.
*Chem. Safety Data Sheet* **SD-53** (1955). **SD-53 Supp. A** (1961). **SD-53 Supp. B** (1961).
*BCISC* **36:** 29 (July-Sept. 1969). *BCISC* **40** (158): 17 (1969). *Chem. in Brit.* **5** (1): 36 (1969).
*Chem. in Brit.* **5** (6): 287 (1969).

**1-Phenyl-2-methyl-propyl Alcohol and Sulfuric Acid**
See ALCOHOLS plus Hydrogen Peroxide and Sulfuric Acid.

**Platinum**
See PLATINUM plus Hydrogen Peroxide.

**Potassium**
See LEAD DIOXIDE plus Hydrogen Peroxide.

**Potassium Permanganate**
See POTASSIUM PERMANGANATE plus Hydrogen Peroxide.

**Silver**
See IRON plus Hydrogen Peroxide.
See SILVER plus Hydrogen Peroxide.

**Sodium**
See LEAD DIOXIDE plus Hydrogen Peroxide.

**Sodium Iodate**
See SODIUM IODATE plus Hydrogen Peroxide.

**Sulfuric Acid**
A 50–50 mixture of concentrated sulfuric acid and 30% hydrogen peroxide (piranha solution) is susceptible to spontaneous and unpredictable explosive decomposition.
*Chem. and Eng. News,* p. 2 (April 23, 1990).

**Thiodiglycol**
See THIODIGLYCOL plus Hydrogen Peroxide.

**Unsymmetrical Dimethyl Hydrazine**
See UNSYMMETRICAL DIMETHYL HYDRAZINE plus Hydrogen Peroxide.

## HYDROGEN SELENIDE $SeH_2$

**Hydrogen Peroxide**
Hydrogen selenide and hydrogen peroxide undergo a very swift decomposition.
*Mellor* **1:** 941 (1946–1947).

**Nitric Acid**
Fuming nitric acid reacts with incandescence with hydrogen selenide.
*Berichte* **3:** 658.

## HYDROGEN SULFIDE $H_2S$

**Acetaldehyde**
See ACETALDEHYDE plus Ammonia (Anhydrous).


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**Barium Oxide, Mercurous Oxide and Air**
See HYDROGEN SULFIDE plus Soda Lime.

**Barium Oxide, Nickel Oxide and Air**
See HYDROGEN SULFIDE plus Soda Lime.

**Bromine Pentafluoride**
See BROMINE PENTAFLUORIDE plus Acetic Acid.

**Chlorine Monoxide**
Hydrogen sulfide ignites in contact with chlorine monoxide.
*Mellor* **10:** 134 (1946–1947).

**Chlorine Trifluoride**
See CHLORINE TRIFLUORIDE plus Ammonia.

**Chromic Anhydride**
See CHROMIC ANHYDRIDE plus Hydrogen Sulfide. Also see CHROMIC ANHYDRIDE plus Naphthalene.

**Copper**
See COPPER plus Hydrogen Sulfide.

**Fluorine**
See FLUORINE plus Hydrogen Sulfide.

**Hydrated Iron Oxide**
A pyrophoric iron sulfide was made from hydrated iron oxide and hydrogen sulfide under gasoline.
*Ellern,* p. 33 (1968).

**Lead Dioxide**
See LEAD DIOXIDE plus Hydrogen Sulfide.

**Nitric Acid**
Fuming nitric acid reacts with incandescence with hydrogen sulfide.
*Berichte* **3:** 658.
*Chem. Safety Data Sheet* **SD-5,** p. 6.

**Nitrogen Iodide**
See BROMINE plus Nitrogen Triiodide.

**Nitrogen Trichloride**
See NITROGEN TRICHLORIDE plus Ammonia.

**Nitrogen Trifluoride**
See HYDROGEN plus Nitrogen Trifluoride.

**Oxygen Difluoride**
See OXYGEN DIFLUORIDE plus Hydrogen Sulfide.

**Phenyl Diazonium Chloride**
See PHENYL DIAZONIUM CHLORIDE plus Hydrogen Sulfide.

**Soda Lime (Sodium Hydroxide and Calcium Oxide) and Air**
The reaction between hydrogen sulfide and soda lime is attended with incandescence in the presence of air; in oxygen, there is a violent explosion. Mixtures of barium oxide with mercurous or nickel oxide also react vigorously with hydrogen sulfide in air and vivid incandescence or explosions may result.
*Mellor* **10:** 140 (1946–1947).

**Sodium**
See SODIUM plus Hydrogen Sulfide.

**Sodium Peroxide**
When hydrogen sulfide is passed over sodium peroxide, a very vigorous reaction occurs, even in the absence of air, and the reaction may be accompanied by flame.
*Mellor* **10:** 132 (1946–1947).

## HYDROGEN TELLURIDE $H_2Te$

**Nitric Acid**
See NITRIC ACID plus Hydrogen Telluride.

## HYDROGEN TRISULFIDE HSSSH

**Amyl Alcohol**
The decomposition of amyl alcohol by hydrogen trisulfide is explosively violent.
*Mellor* **10:** 158 (1946–1947).

**Iron Oxide (Magnetite)**
See HYDROGEN TRISULFIDE plus Lead Oxide.

**Lead Oxide**
Lead oxide, stannic oxide, and magnetite ($Fe_3O_4$) brought about a violent decomposition of hydrogen trisulfide.
*Mellor* **10:** 159 (1946–1947).

**Potassium Permanganate**
Potassium permanganate decomposes hydrogen trisulfide so rapidly that sufficient heat is liberated to ignite the trisulfide.
*Mellor* **10:** 159 (1946–1947).

**Stannic Oxide**
See HYDROGEN TRISULFIDE plus Lead Oxide.

## HYDROQUINONE $C_6H_4(OH)_2$

**Sodium Hydroxide**
See SODIUM HYDROXIDE plus Hydroquinone.

## HYDROXIDES

**(See also specific hydroxides as primary entries or see under other reactants)**

**Acrolein**
See SODIUM HYDROXIDE plus Acrolein.

## 4-HYDROXY-3, 5-DINITROBENZENEAR SONIC ACID
$4,3,5,1\text{-}OHC_6H_2(NO_2)_2AsO_3H_2$

**(self-reactive)**
This compound and its metallic salts may be as explosive as its close relative picric acid. When a wet cake of the acid was heated an explosion occurred that was accompanied by liberation of arsenic or arsine.
M. A. Phillips, *Chem. & Ind.* **1947:** 61.

## a-HYDROXYISOBUTYRONITRILE $(CH_3)_2COHCN$

**Sulfuric Acid**
During addition of sulfuric acid to a vat of acetone cyanhydrin, pressure produced by rapid reaction ruptured the vessel explosively.
*Occupancy Fire Record* **FR57–5:** 5 (1957).

## HYDROXYLAMINE $NH_2OH$

**Barium Dioxide**
See BARIUM DIOXIDE plus Hydroxylamine.

**Barium Oxide**
See BARIUM OXIDE plus Hydroxylamine.

**Chlorine**
See CHLORINE plus Hydroxylamine.

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**Copper Sulfate**
See COPPER SULFATE plus Hydroxylamine

**Lead Dioxide**
See LEAD DIOXIDE plus Hydroxylamine.

**Oxidants**
Hydroxylamine is a powerful reducing agent, particularly when anhydrous. It explodes on contact with air above 70°C. Barium dioxide will ignite aqueous hydroxylamine.
*Mellor* (1941); *Brauer* (1963).

**Phosphorus Pentachloride**
See PHOSPHORUS TRICHLORIDE plus Hydroxylamine.

**Phosphorus Trichloride**
See PHOSPHORUS TRICHLORIDE plus Hydroxylamine.

**Potassium Dichromate**
See POTASSIUM DICHROMATE plus Hydroxylamine.

**Potassium Permanganate**
See POTASSIUM PERMANGANATE plus Hydroxylamine.

**Sodium**
See SODIUM plus Hydroxylamine.

**Zinc**
See ZINC plus Hydroxylamine.

## HYDROXYLAMINE HYPOPHOSPHITE $NH_2OHPH_2O_2$

**(self-reactive)**
Hydroxylamine hypophosphite detonates above 100°C.
*Mellor* **8:** 880 (1946–1947).

## HYDROXYLAMINES

**(See also under other reactants)**

**(self-reactive)**
Several scale-ups of previously successful hydroxylamine reactions have resulted in explosions, e.g.: 1) During preparation of an oxime from an aldehyde, an ether solution of the reaction mixture, containing hydroxylamine hydrochloride decomposed violently under vacuum distillation at 80°C. 2) The hydrochloride can be made to decompose exothermically at 140°C. and solid hydroxylamine sulfate will explode when heated to 170°C. 3) A mixture containing the hydrochloride, pyridine, and sodium acetate in a stainless steel autoclave at 90°C. suddenly heated and pressurized to 5000 psi to rupture the relief disk.
*Chem. Process (Chicago)* **26:** 30 (1963).

## 4-HYDROXY-3-METHOXYBENZALDEHYDE $CH_3O(HO)C_6H_3CHO$

**(See also VANILLIN.)**

**Bromine**
See BROMINE plus Methyl Alcohol.

**Perchloric Acid**
See PERCHLORIC ACID plus Ethyl Alcohol.

**Potassium Tert.-Butoxide**
See ACETONE plus Potassium Tert.-Butoxide.

**Tetrachlorobenzene and Sodium Hydroxide**
See SODIUM HYDROXIDE plus Tetrachlorobenzene and Methyl Alcohol.

## n-HYDROXYMETHYLACRYLAMIDE $HOCH_2NHCOCH{=}CH_2$

**Contaminant**
Among four fiber drums of this chemical, two of which had never been opened, excessive heat, smoke, crackling, and small flames were noted. Very small amounts of contaminant are believed to have catalyzed this polymerization reaction, but storage in excessively heated areas can also start the reaction.
*Coventry* (1965). *Spence* (1966).

## 3-HYDROXYPROPIONITRILE $HOCH_2CH_2CN$

**Chlorosulfonic Acid**
Mixing ethylene cyanohydrin and chlorosulfonic acid in a closed container caused the temperature and pressure to increase.
*Flynn and Rossow* (1970). See Note under complete reference.

**Oleum**
See OLEUM plus Ethylene Cyanohydrin.

**Sodium Hydroxide**
See SODIUM HYDROXIDE plus Ethylene Cyanohydrin.

**Sulfuric Acid**
Mixing ethylene cyanohydrin and 96% sulfuric acid in a closed container caused the temperature and pressure to increase.
*Flynn and Rossow* (1970). See Note under complete reference.

## HYPOCHLORITES

**(See also specific hypochlorites as primary entries or under other reactants)**

**Urea**
Hypochlorites react with urea to form nitrogen trichloride which explodes spontaneously in air.
*J. Am. Chem. Soc.* **63:** 3530–32.

## HYPOCHLOROUS ACID HOCl

**Alcohols**
See ALCOHOLS plus Hypochlorous Acid.

**Ammonia**
Gaseous ammonia explodes in contact with hypochlorous acid; toxic chlorine is liberated.
*Mellor* **8:** 217 (1946–1947).

**Arsenic**
See ARSENIC plus Hypochlorous Acid.

## HYPOPHOSPHITES

**(See also specific hypophosphites as primary entries or see under other reactants.)**

**Perchloric Acid**
Some inorganic materials, such as hypophosphites, tend to form explosive mixtures with perchloric acid when hot. When a precipitate of scandium hypophosphite was heated in a perchloric acid solution, the perchloric acid concentrated from evaporation and the mixture of per-


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chloric acid with the inorganic reducing compound exploded violently.
*Analyst* **84:** 215 (April 1959). *NSC Newsletter, Chem. Sec.* (November 1966).

**HYPOPHOSPHORIC ACID** $H_4P_2O_6$

**Mercuric Nitrate**
See MERCURIC NITRATE plus Hypophosphoric Acid.

**HYPOPHOSPHOROUS ACID** $H_3PO_2$

**Mercuric Oxide**
See MERCURIC OXIDE plus Hypophosphorous Acid.

**INDANE** $\underline{CH_2CH{=}CH}C_6H_4$

**Nitric Acid and Sulfuric Acid**
In the preparation of 4 and 5 nitroindanes according to the procedure of Lindner and Brukin (*Chem. Ber.* **60,** 435 (1925)) the crude nitro mix was distilled in vacuo. After allowing the pot to cool, air was admitted to the residue. After a short period the pot erupted. A second preparation exploded at the beginning of the distillation.
G. W. Grebble, *Chem. and Eng. News* **51** (6): 39 (Feb. 5, 1973).

**INDIUM** In

**Sulfur**
When indium is heated with sulfur, the elements unite with incandescence.
*Mellor* **5:** 393 (1946–1947).

**INDIUM MONOXIDE** InO

**Air**
Indium monoxide is spontaneously flammable in air.
*Ellern* (1961).

**IODATES**

**(See also specific iodates as primary entries or under other reactants)**

**Aluminum**
See ALUMINUM plus Bromates.

**Arsenic**
See ARSENIC plus Bromates.

**Carbon**
See CARBON plus Bromates.

**Copper**
See COPPER plus Bromates.

**Metal Sulfides**
See METAL SULFIDES plus Bromates.

**Organic Matter**
See BROMATES plus Organic Matter.

**Phosphonium Iodide**
See BROMATES plus Phosphonium Iodide.

**Phosphorus**
See PHOSPHORUS plus Bromates.

**Sulfur**
See SULFUR plus Bromates.

**IODIC ACID** $HIO_3$

**Boron**
See BORON plus Iodic Acid.

**Phosphonium Iodide**
See PHOSPHONIUM IODIDE plus Bromic Acid.

**IODINE** $I_2$

**Acetaldehyde**
See BROMINE plus Acetaldehyde.

**Acetylene**
Acetylene can react explosively with iodine.
*Von Schwartz,* p. 142 (1918).

**Aluminum**
See ALUMINUM plus Iodine.

**Ammonia**
Mixture explodes spontaneously.
*Von Schwartz,* p. 324 (1918).

**Ammonium Hydroxide**
The reaction of excess iodine with strong aqueous ammonium hydroxide forms explosive iodide.
*Mellor* **8, Supp. 1:** 330 (1964).
Nitrogen iodides, which detonate on drying, are formed from concentrated solutions.
*Mellor* **2, Supp. 1:** 851 (1956).

**Antimony**
See ANTIMONY plus Bromine.

**Bromine Pentafluoride**
See ARSENIC plus Bromine Pentafluoride.
An immediate reaction with evolution of heat occurs between iodine and bromine pentafluoride.
*Mellor* **2, Supp. 1:** 173 (1956).

**Cesium Acetylene Carbide**
Cesium Acetylene Carbide burns in the vapors of iodine.
*Mellor* **5:** 844 (1946–1947).

**Cesium Carbide**
Cesium carbide, rubidium carbide or lithium carbide (after warming) burn in iodine vapor.
*Mellor* **5:** 848 (1946–1947).

**Cesium Monoxide**
See BROMINE plus Cesium Monoxide.

**Chlorine**
See CHLORINE plus Iodine.

**Chlorine Trifluoride**
See CHLORINE TRIFLUORIDE plus Mercuric Iodide.

**Cuprous Acetylide**
See BROMINE plus Cuprous Acetylide.

**Ethyl Alcohol, Methyl Alcohol, and Mercuric Oxide**
The Petrov method of preparing 1-iodo-2-ethoxy-3-butene calls for addition of 15 grams of mercuric oxide to 0.11 molar ethyl alcohol in 25 ml of methyl alcohol, followed by 25 grams of powdered iodine at –10 to –15°C, filtration, and dilution. A change in the procedure used 1 molar ethyl alcohol. While the alcohol was being distilled off under vacuum, a violent explosion occurred.
*Chem. and Eng. News* **44** (42): 7 (October 17, 1966).
*Chem. Abst.* **44:** 1003-d (1950).

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**Fluorine**
See FLUORINE plus Iodine.

**Lithium**
A highly luminous reaction occurs at room temperature, between iodine and lithium, potassium, and sodium.
*Mellor* **2, Supp. 1:** 848 (1956).

**Lithium Carbide**
See BROMINE plus Lithium Carbide.
See IODINE plus Cesium Carbide.

**Lithium Silicide**
See FLUORINE plus Lithium Silicide.

**Magnesium**
See MAGNESIUM plus Iodine.

**Oxygen Difluoride**
See BROMINE plus Oxygen Difluoride.

**Phosphorus**
Ordinary (white or yellow) phosphorus unites with iodine at ordinary temperatures. Even at minus 24°C., heat is developed. The product is spontaneously flammable in air. With red phosphorus, the reaction does not occur at ordinary temperatures; but when warmed, it reacts without incandescence.
C. L. Gazzaniga, *Bibl. Univ. Genève* **54:** 186 (1833).
See also PHOSPHORUS plus Oxygen.

**Potassium**
Potassium burns on contact with liquid iodine.
*Mellor* **2:** 469 (1946–1947).
Iodine and potassium vapors at 0.001 mm pressure react with luminescence.
*Mellor* **2, Supp. 3:** 1563 (1963).

**Rubidium Acetylene Carbide**
See BROMINE plus Rubidium Acetylene Carbide.

**Rubidium Carbide**
See IODINE plus Cesium Carbide.

**Silver Azide**
Silver azide in a cold ethereal solution of iodine gives a yellow explosive, iodoazide.
*Mellor* **8:** 336–7 (1946–1947).

**Sodium Hydride**
Sodium hydride reacts with iodine with incandescence at 100°C.
*Mellor* **2:** 483 (1946–1947).

**Zirconium Dicarbide**
See BROMINE plus Zirconium Dicarbide.

## IODINE AZIDE $N_3I$

**(self-reactive)**
Iodine azide is spontaneously explosive.
*Mellor* **8:** 336 (1946–1947).
*Mellor* **8, Supp. 2:** 50 (1967).

## IODINE HEPTAFLUORIDE $IF_7$

**Ammonium Bromide**
Iodine heptafluoride reacts violently with ammonium bromide, ammonium chloride or ammonium iodide.
*Mellor* **2, Supp. 1:** 179 (1956).

**Ammonium Chloride**
See IODINE HEPTAFLUORIDE plus Ammonium Bromide.

**Ammonium Iodide**
See IODINE HEPTAFLUORIDE plus Ammonium Bromide.

**Carbon Monoxide**
Carbon monoxide burns in gaseous iodine heptafluoride.
*Mellor* **2, Supp. 1:** 179 (1956).

**Organic Matter**
See BROMINE MONOFLUORIDE plus Water.

**Sulfuric Acid**
In reaction between iodine heptafluoride and sulfuric acid, the acid becomes effervescent.
*Mellor* **2, Supp. 1:** 185 (1956).

**Water**
See BROMINE MONOFLUORIDE plus Water.

## IODINE MONOBROMIDE IBr

**Phosphorus**
See PHOSPHORUS plus Iodine Monobromide.

**Potassium**
See POTASSIUM plus Iodine Monobromide.

**Sodium**
See SODIUM plus Ferrous Chloride.
See SODIUM plus Iodine Monobromide.

## IODINE MONOCHLORIDE ICl

**Aluminum Foil**
See ALUMINUM plus Iodine Monochloride.

**Cadmium Sulfide**
The reaction between iodine monochloride and cadmium sulfide, lead sulfide, silver sulfide, or zinc sulfide is vigorous.
*Mellor* **2, Supp. 1:** 502 (1956).

**Lead Sulfide**
See IODINE MONOCHLORIDE plus Cadmium Sulfide.

**Organic Matter**
Iodine monochloride produces a vigorous reaction with cork, rubber and other organic substances.
*Mellor* **2, Supp. 1:** 500 (1956).

**Phosphorus**
See PHOSPHORUS plus Iodine Monobromide.

**Phosphorus Trichloride**
The reaction of iodine monochloride and phosphorus trichloride is intensely exothermal.
*Mellor* **2, Supp. 1:** 502 (1956).

**Potassium**
See POTASSIUM plus Iodine Monochloride.

**Rubber**
See IODINE MONOCHLORIDE plus Organic Matter.

**Silver Sulfide**
See IODINE MONOCHLORIDE plus Cadmium Sulfide.


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**Sodium**
See POTASSIUM plus Iodine Monochloride.
See SODIUM plus Iodine Monochloride.

**Zinc Sulfide**
See IODINE MONOCHLORIDE plus Cadmium Sulfide.

## IODINE PENTAFLUORIDE $IF_5$

**Arsenic**
See ARSENIC plus Iodine Pentafluoride.

**Bismuth**
See ARSENIC plus Iodine Pentafluoride.

**Dimethyl Sulfoxide**
See DIMETHYL SULFOXIDE plus Iodine Pentafluoride.

**Organic Matter**
See ARSENIC plus Iodine Pentafluoride.
See also BROMINE MONOFLUORIDE plus Water.
See also IODINE PENTAFLUORIDE plus Water.

**Phosphorus**
See ARSENIC plus Iodine Pentafluoride.

**Potassium**
See POTASSIUM plus Iodine Pentafluoride.

**Silicon**
See ARSENIC plus Iodine Pentafluoride.

**Sodium**
See POTASSIUM plus Iodine Pentafluoride.

**Sulfur**
See ARSENIC plus Iodine Pentafluoride.

**Tetrafluoroethylene and Limonene**
Compressed gas cylinders made of tetrafluoroethylene were being purged with nitrogen. Failure of a ball check valve in a related system caused the purge gas to be contaminated with iodine pentafluoride. The iodine pentafluoride reacted with the polymerization inhibitor, limonene, in the TFE, generating enough heat to cause deflagration of the cylinder material.
*MCA Case History* **1520** (1968).

**Tetraiodoethylene**
Explosions occur with too rapid admixture of iodine pentafluoride and tetraiodoethylene.
*Mellor* **2, Supp. 1:** 176 (1956).

**Tungsten**
See ARSENIC plus Iodine Pentafluoride.

**Water**
Iodine pentafluoride reacts violently with water.
*Matheson Gas Data,* p. 254 (1961).
The reaction between iodine pentafluoride and water is violent. Water-containing materials and many organics also react violently.
*Mellor* **2, Supp. 1:** 176 (1956).
See also BROMINE MONOFLUORIDE plus water.

## IODINE PENTOXIDE $I_2O_5$

**Carbon**
See CARBON plus Iodine Pentoxide.

**Organic Matter**
See CARBON plus Iodine Pentoxide.

**Sulfur**
See CARBON plus Iodine Pentoxide.

## IODODIACETYLENE $HC{\equiv}CC{\equiv}CI$

**(self-reactive)**
Iododiacetylene detonates if scratched in light.
*Rutledge,* p. 137 (1968).

## IODODIMETHYLARSINE $(CH_3)AsI$

**Air**
Dimethyliodarsine is spontaneously flammable in air.
*Ripley* (1966).

## 2-IODO-3, 5-DINITROBIPHENYL $IC_6H_2(NO_2)_2C_6H_5$

**Ethyl Sodio-Acetoacetate**
The condensation of 2-iodo-3, 5-dinitrobiphenyl with ethyl sodio-aceto-acetate should be carried out with only 5–6 grams of the 2-iodo-3, 5-dinitrobiphenyl since larger amounts lead to explosions.
S. H. Zahur and I. K. Kocker.
*J. Indian Chem. Soc.* **32:** 491 (1955).

## IODOFORM $CHI_3$

**Lithium**
See LITHIUM plus Bromoform.

## 3-IODO-1-PHENYL-1-PROPYNE $C_6H_5C{\equiv}C{\cdot}CH_2I$

**(self-reactive)**
While being distilled at about 180°C 3-iodo-1-phenyl-1-propyne detonated.
*Chem. and Eng. News* **50** (23): 86, 87 (June 5, 1972).

## 2-IODOXYBENZOIC ACID (PERIODINANE)

Dry material is shock sensitive. Also explodes when heated under confinement.
*Chem. and Eng. News* (July 16, 1990).

## IRIDIUM Ir

**Chlorine Trifluoride**
Chlorine trifluoride reacts with iridium with incandescence.
*Mellor* **15:** 745 (1946–1947).
*Mellor* **2, Supp. 1:** 156 (1956).

**Fluorine**
Powdered iridium and fluorine react vigorously at 260°C, forming the hexafluoride.
*Mellor* **2, Supp. 1:** 65 (1956).

**Oxygen Difluoride**
An incandescent reaction occurs when any of the following metals are warmed gently in gaseous oxygen difluoride: iridium, osmium, palladium, platinum, rhodium, ruthenium.
*Mellor* **2, Supp. 1:** 192 (1956).

## IRIDIUM-AMMINE NITRATES

**(self-reactive)**
Iridium-ammine nitrates may be impact-sensitive.
$Ir(NH_3)_5OH(NO_3)_3$ and Ir $(NH_3)_5Cl(NO_3)_3$ detonate at red heat.
*Mellor* **15:** 787 (1946–1947).

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**IRIDIUM-AMMINE PERCHLORATES**

**(self-reactive)**
Iridium-ammine perchlorates may be impact-sensitive.
*Mellor* **15:** 787 (1946–1947).

**IRON** Fe

**(For iron compounds see also FERRIC and FERROUS compounds)**

**Chlorine**
Hot iron (wire) burns in chlorine gas.
*Mellor* **2:** 95, 469 (1946–1947).
*Mellor* **2, Supp. 1:** 380 (1956).

**Chlorine Trifluoride**
Chlorine trifluoride reacts with iron with incandescence.
*Mellor* **13:** 315 (1946–1947).
*Mellor* **2, Supp. 1:** 156 (1956).

**Fluorine**
Powdered iron reacts with fluorine below redness with incandescence.
*Mellor* **13:** 314 (1946–1947).

**Hydrogen Peroxide**
Violent decomposition of hydrogen peroxide (52% by weight or greater) may be caused by contact with many substances, such as iron, copper, chromium, brass, bronze, lead, silver, manganese, etc., and their salts.
*Chem. Safety Data Sheet* **SD-53** (1955); **SD-53 Supp. A** (1961); **SD-53 Supp. B** (1961).
Iron and hydrogen peroxide ignite immediately if a trace of manganese dioxide is present.
*Mellor* **1:** 938 (1946–1947).

**Nitrogen Dioxide**
Reduced iron decomposes nitrogen dioxide at ordinary temperatures with incandescence.
*Mellor* **13:** 342 (1946–1947).

**Phosphorus**
See COPPER plus Phosphorus.

**Sodium Carbide**
See MERCURY plus Sodium Carbide.

**Sulfuric Acid**
While steel piping, which had held sulfuric acid in cold climates during the winter, was being refitted, two explosions occurred; these were possibly due to trapped hydrogen from the acid-metal reaction.
*Chem. and Eng. News* **29:** 1770 (1951). *Chem. and Eng. News* **30:** 707 (1952).

**IRON CARBIDE** $FeC_2$

**Bromine**
See CHLORINE plus Iron Carbide.

**Chlorine**
See CHLORINE plus Iron Carbide.

**IRON OXIDE** $Fe_2O_3$

**Hydrazine**
See HYDRAZINE plus Iron Oxide.

**IRON OXIDE (MAGNETITE)** $Fe_3O_4$

**Hydrogen Trisulfide**
See HYDROGEN TRISULFIDE plus Iron Oxide.

**IRON PENTACARBONYL** $Fe(CO)_5$

**Air**
Iron pentacarbonyl is spontaneously flammable in air.
R. Kamo, *IIT Progs. Rept. 1*, p. 23 (1962).

**ISOAMYL NITRITE** $(CH_3)_2CHCH_2CH_2ONO$

**(self-reactive)**
Vapors will explode when heated.
*Von Schwartz and Salter*, p. 322 (1940).

**ISOBUTANETHIOL** $(CH_3)_2CHCH_2SH$

**Calcium Hypochlorite**
See CALCIUM HYPOCHLORITE plus 1-Propanethiol.

**ISOBUTYL METHYL KETONE** $CH_3COCH_2CH(CH_3)_2$

**Potassium Tert.-Butoxide**
See ACETONE plus Potassium Tert.-Butoxide.

**ISOBUTYROPHENONE** $(CH_3)_2CHCOC_6H_5$

**Bromine**
See BROMINE plus Isobutyrophenone.

**ISOCYANATES**

**See ALCOHOLS plus Isocyanates.**

**ISOCYANOETHANE** $C_2H_5NC$

**(self-reactive)**
Ethyl isonitrile is reported to have exploded when heated on a hot plate.
*Chem. and Eng. News* **46** (42): 7 (1968).

**ISOCYANOMETHANE** $CH_3NC$

**(self-reactive)**
The dehydration of n-methyl formamide by benzenesulfonyl chloride in tributylamine solution produces methyl isonitrile. In a subsequent distillation, the isonitrile was allowed to go to dryness and the flask exploded.
*Chem. and Eng. News* **46** (42): 7 (1968).

**ISOPRENE** $CH_2=C(CH_3)CH=CH_2$

**Chlorosulfonic Acid**
Mixing isoprene and chlorosulfonic acid in a closed container caused the temperature and pressure to increase.
*Flynn and Rossow* (1970). See Note under complete reference.

**Nitric Acid**
Mixing isoprene and 70% nitric acid in a closed container caused the temperature and pressure to increase.
*Flynn and Rossow* (1970). See Note under complete reference.

**Oleum**
Mixing isoprene and oleum in a closed container caused the temperature and pressure to increase.
*Flynn and Rossow* (1970). See Note under complete reference.

**Sulfuric Acid**
Mixing isoprene and 96% sulfuric acid in a closed container caused the temperature and pressure to increase.
*Flynn and Rossow* (1970). See Note under complete reference.


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**ISOPROPYL ALCOHOL** $(CH_3)_2CHOH$

**Air**

Forms unstable peroxides upon prolonged contact with air which can concentrate and explode during distillation/evaporation.
*Chem. and Eng. News,* p. 4 (Jan. 2, 1989).

**Hydrogen and Palladium**

See HYDROGEN plus Palladium and Isopropyl Alcohol.

**Nitroform**

See NITROFORM plus Isopropyl Alcohol.

**Oleum**

See OLEUM plus Isopropyl Alcohol.

**Phosgene**

The reaction between isopropyl alcohol and phosgene forms isopropyl chloroformate and hydrogen chloride. In the presence of iron salts thermal decomposition can occur, which in some cases can become explosive.
Konstantinov, I.I, Pereslegina, L. S., Zhuravlev, E. Z., and Gusev, Yu. M.
*Tr. po Khim. i Khim. Teknol.* **10** (2): 171–4 (1967).

**Potassium Tert.-Butoxide**

See ACETONE plus Potassium Tert.-Butoxide.

**ISOPROPYL CHLOROFORMATE** $(CH_3)_2CHOCOCl$

**(self-reactive)**

Isopropylchloroformate stored in a refrigerator exploded.
*Wischmeyer* (1973).
See also ISOPROPYL ALCOHOL plus Phosgene.

**ISOPROPYL HYPOCHLORITE** $(CH_3)_2CHOCl$

**(self-reactive)**

Isopropyl hypochlorite decomposes explosively when exposed to light and rapidly even in its absence.
*Mellor* **2, Supp. 1:** 550 (1956).
See also ALCOHOLS plus Hypochlorous Acid.

**JP-4 FUEL**

**Fluorine**

See FLUORINE plus Common Materials and Oxygen.

**KETONES**

**(See also specific ketones)**

**Acetaldehyde**

See ACETALDEHYDE plus Acid Anhydrides.

**Nitric Acid**

See NITRIC ACID plus Ketones (Cyclic).

**Nitric Acid and Hydrogen Peroxide**

These reactants produce solids or oils that are highly explosive. The reaction itself proceeds explosively with excess of nitric acid or inadequate cooling.
*Trans. Roy. Soc. Can.* **Sect. III 44:** 1934–5 (1954).

**Perchloric Acid**

See PERCHLORIC ACID plus Glycol Ethers.

**LACTIC ACID** $CH_3CHOHCOOH$

**Nitric Acid and Hydrofluoric Acid**

See NITRIC ACID plus Lactic Acid and Hydrofluoric Acid.

**LANTHANUM** La

**Air**

See RARE EARTH METALS plus Air.

**Halogens**

See RARE EARTH METALS plus Halogens.

**Phosphorus**

See CERIUM plus Phosphorus.

**LANTHANUM OXIDE** $La_2O_3$

**Chlorine Trifluoride**

See CHLORINE TRIFLUORIDE Plus Arsenic Trioxide.

**LANTHANUM PHOSPHIDE** LaP

**Water**

See CEROUS PHOSPHIDE plus Water.

**LEAD** Pb

**Ammonium Nitrate**

See AMMONIUM NITRATE plus Metals (powdered)

**Chlorine Trifluoride**

See ALUMINUM plus Chlorine Trifluoride.

**Hydrogen Peroxide**

See IRON plus Hydrogen Peroxide.

**Sodium Azide**

See SODIUM AZIDE plus Copper.

**Sodium Carbide**

See MERCURY plus Sodium Carbide.

**Zirconium**

An alloy of 10% to 70% zirconium plus lead will ignite when struck with a hammer.
*U.S. Pat.* 2,611,316 (1952).

**LEAD ACETATE** $(CH_3COO)_2Pb$

**Potassium Bromate**

See POTASSIUM BROMATE plus Lead Acetate.

**LEAD AZIDE** $Pb(N_3)_2$

**(self-reactive)**

Lead azide decomposes at 250°C. It is explosively unstable.
*Mellor* **8, Supp. 2:** 43 (1967).
See also SODIUM AZIDE plus Copper.

**Brass**

See COPPER plus Lead Azide.

**Calcium Stearate**

In the production of lead azide, addition of calcium stearate was tried for the first time. An explosion ensued. Cause not understood.
*MCA Case History* **949** (1963).

**Carbon Disulfide**

See CARBON DISULFIDE plus Azides.



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**Copper**
See COPPER plus Lead Azide.

**Zinc**
See COPPER plus Lead Azide.

**LEAD CARBONATE** $PbCO_3$

**Fluorine**
See FLUORINE plus Carbonates and FLUORINE plus Lead Carbonate (Basic).

**LEAD CARBONATE (BASIC)** $2PbCO_3 \cdot Pb(OH)_2$

**Fluorine**
See FLUORINE plus Lead Carbonate (Basic) and FLUORINE plus Carbonates.

**LEAD CHLORATE** $Pb(ClO_3)_3$

**Sulfur**
See SULFUR plus Lead Chlorate.

**LEAD CHLORITE** $Pb(ClO_2)_2$

**(self-reactive)**
Lead chlorite has detonator properties but its behavior is somewhat unpredictable.
*Mellor* **2, Supp. 1:** 574 (1956).

**Sulfur**
See SULFUR plus Lead Chlorite.

**LEAD CHROMATE** $PbCrO_4$

**Ferric Ferrocyanide**
While these two chemicals were being ground together in a ball mill to form chrome green, a spark initiated a reaction that produced a fierce fire in the pigment.
*Chem. Process* (Chicago) **30:** 118 (August 1967)

**LEAD CYANIDE** $Pb(CN)_2$

**Magnesium**
See MAGNESIUM plus Cadmium Cyanide.

**LEAD DIOXIDE** $PbO_2$

**(See also LEAD OXIDE)**

**Aluminum Carbide**
See ALUMINUM CARBIDE plus Lead Peroxide.

**Barium Sulfide**
See BARIUM SULFIDE plus Lead Dioxide.

**Boron**
See BORON plus Lead Dioxide.

**Calcium Sulfide**
See BARIUM SULFIDE plus Lead Dioxide.

**Cesium Acetylene Carbide**
See CESIUM ACETYLENE CARBIDE plus Cupric Oxide.

**Chlorine Trifluoride**
See CHLORINE TRIFLUORIDE plus Aluminum Oxide.

**Hydrogen Peroxide**
Hydrogen peroxide reacts violently with lead dioxide, lead monoxide, mercuric oxide, potassium, and sodium.
*Mellor* **1:** 937 (1946–1947).

**Hydrogen Sulfide**
When hydrogen sulfide is passed over moist or dry lead dioxide, the mass becomes red-hot, producing a blue flame.
*Mellor* **7:** 689 (1946–1947).

**Hydroxylamine**
A mixture of hydroxylamine with barium dioxide or lead dioxide ignites.
*Mellor* **8:** 291 (1946–1947).

**Molybdenum**
See MOLYBDENUM plus Lead Dioxide.

**Performic Acid**
See PERFORMIC ACID plus Lead Dioxide.

**Phenyl Hydrazine**
Lead dioxide reacts instantly and vigorously with phenyl hydrazine.
*Mellor* **7:** 637 (1946–1947).

**Phosphorus**
See PHOSPHORUS plus Lead Dioxide.

**Phosphorus Trichloride**
When lead dioxide is added to warm phosphorus trichloride, the mixture becomes incandescent.
*Mellor* **7:** 690 (1946–1947).

**Sulfur**
See SULFUR plus Lead Dioxide.

**Sulfuryl Chloride**
See SULFURYL CHLORIDE plus Lead Dioxide.

**Tungsten**
See MOLYBDENUM plus Lead Dioxide.

**Zirconium**
See ZIRCONIUM plus Cupric Oxide.

**LEAD FLUORIDE** $PbF_2$

**Calcium Carbide**
See CALCIUM CARBIDE plus Lead Fluoride.

**Fluorine**
See FLUORINE plus Lead Fluoride.

**LEAD HYPOPHOSPHITE** $Pb(PH_2O_2)_2$

**(self-reactive)**
Lead hypophosphite forms impact-sensitive ammunition-priming mixtures.
*Mellor* **8, Supp. 3:** 623 (1971).

**Lead Nitrate**
This mixture forms a highly explosive double salt with rate of detonation greater than that of mercury fulminate.
*Mellor* **8:** 887 (1946–1947).

**LEAD IMIDE** PbNH

**Acids**
See LEAD IMIDE plus Water.

**Water**
Lead imide explodes when heated or when treated with water or dilute acids.
*Mellor* **8:** 265 (1946–1947).

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**LEAD MONOXIDE** PbO

**Hydrogen Peroxide**
See LEAD DIOXIDE plus Hydrogen Peroxide.

**Lithium Carbide**
See LITHIUM CARBIDE plus Lead Monoxide.

**LEAD NITRATE** $Pb(NO_3)_2$

**Ammonium Thiocyanate**
See AMMONIUM THIOCYANATE plus Lead Nitrate.

**Carbon**
See CARBON plus Lead Nitrate.

**Lead Hypophosphite**
See LEAD HYPOPHOSPHITE plus Lead Nitrate.

**LEAD OXIDE** PbO; $PbO_2$; $Pb_2O_3$; $Pb_3O_4$

**(See also LEAD DIOXIDE)**

**Aluminum**
See ALUMINUM plus Lead Oxide.

**Cesium Acetylene Carbide**
See CESIUM ACETYLENE CARBIDE plus Cupric Oxide.

**Fluorine and Glycerol**
See FLUORINE plus Lead Oxide and Glycerol.

**Hydrogen Trisulfide**
See HYDROGEN TRISULFIDE plus Lead Oxide.

**Perchloric Acid and Glycerine**
Over a period of time, perchloric acid fumes from a laboratory hood condensed on the cover plate of the exhaust fan, which was sealed with a cement of glycerine and litharge (lead monoxide). When a workman tapped the plate with a chisel, a violent explosion caused two injuries and one fatality.
*Serious Acc. Series* **184** (1962).

**Rubidium Acetylene Carbide**
See RUBIDIUM ACETYLENE CARBIDE plus Lead Oxide.

**Rubidium Carbide**
See RUBIDIUM CARBIDE plus Lead Oxide.

**Silicon and Aluminum**
See SILICON plus Aluminum and Lead Oxide.

**Sodium**
See SODIUM plus Lead Oxide.

**Sulfur Trioxide**
The reaction between sulfur trioxide and lead oxide is attended by white luminescence.
*Mellor* **7:** 654 (1946–1947).

**Titanium**
See TITANIUM plus Cupric Oxide.

**Zirconium**
See ZIRCONIUM plus Cupric Oxide.

**LEAD OXYCHLORIDE** $Pb_2OCl_2$

**Potassium**
See POTASSIUM plus Boric Acid.

**LEAD PERCHLORATE** $Pb(ClO_4)_2$

**Methyl Alcohol**
A flask containing a saturated solution of anhydrous lead perchlorate dissolved in methyl alcohol exploded when it was disturbed.
*ACS* **146:** 209. *J. Am. Chem. Soc.* **52:** 2391–6 (1930).

**LEAD PEROXIDE** $PbO_2$

**(See also LEAD DIOXIDE)**

**Potassium**
See POTASSIUM plus Boric Acid.

**LEAD PHOSPHITE** $Pb(H_2PO_3)_2$

**(self-reactive)**
A fiber drum of lead diphosphite caught fire apparently without any external cause. Since phosphite salts decompose rapidly at elevated temperatures (200°C), it is believed a gradual decomposition took place, yielding lead phosphate, water, and phosphine. Phosphine, in turn, is spontaneously flammable in air and was the probable secondary cause of the fire.
*Schwab* (1967). *Kirk and Othmer* **10:** 489 (1947).

**LEAD STYPHNATE** $PbO_2C_6H(NO_2)_3$

**(self-reactive)**
This compound is a weak but highly sensitive explosive.
*Urbanski*, Vol. III, p. 213 (1967).
An employee was removing a beaker of lead styphnate from a laboratory oven when he apparently bumped the beaker on the side of the oven. A detonation occurred.
*MCA Case History* **957** (1966).
Three kilograms of lead styphnate detonated from an unknown cause in the anteroom of a dry-house. Wet material in two adjacent drying rooms did not detonate.
*Chem. Abst.* **26:** 5210 (1932).

**LEAD SULFATE** $PbSO_4$

**Potassium**
See POTASSIUM plus Boric Acid.

**LEAD SULFIDE** PbS

**Iodine Monochloride**
See IODINE MONOCHLORIDE plus Cadmium Sulfide.

**Hydrogen Peroxide**
See ANTIMONY TRISULFIDE plus Hydrogen Peroxide.

**LEAD TETRAAZIDE** $Pb(N_3)_4$

**(self-reactive)**
Lead tetraazide is too unstable to be isolated. The ammonium double salt is an unstable explosive compound.
*Mellor* **8, Supp. 2:** 22 (1967).

**LEWIS-TYPE CATALYSTS**

**Allyl Chloride**
See SULFURIC ACID plus Allyl Chloride.

**LIMESTONE (CRUSHED)**

**Fluorine**
See FLUORINE plus Common Materials and Oxygen.

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## LIMONENE $C_{10}H_{16}$

**Iodine Pentafluoride and Tetrafluoroethylene**
See IODINE PENTAFLUORIDE plus Tetrafluoroethylene and Limonene.

## LINSEED OIL

**Chlorine**
See CHLORINE plus Polypropylene.

## LITHIUM Li

**Air**
Lithium is spontaneously flammable in air if heated to 180°C., if the surface of the metal is clean. See also LITHIUM plus Oxygen.
*Mellor* **2:** 468 (1946–1947).

**Arsenic**
The reaction of lithium is violent with both strongly heated arsenic and phosphorus.
*Mellor* **2, Supp. 1:** 77 (1956).

**Beryllium**
See LITHIUM plus Vanadium.

**Bromine**
See BROMINE plus Potassium.

**Bromoform**
Lithium mixed with the following compounds can explode on impact: bromoform, carbon tetrabromide, chloroform, iodoform, methyl dichloride, and methyl diiodide.
*Mellor* **2, Supp. 2:** 83 (1961).

**Carbides**
Molten lithium attacks carbides and silicates.
*Mellor* **2, Supp. 2:** 84 (1961).

**Carbon Dioxide**
See LITHIUM plus Oxygen.
See also LITHIUM Plus Water.

**Carbon Monoxide and Water**
The product of the reaction between lithium and carbon monoxide, lithium carbonyl, detonates violently with water, igniting gaseous products.
*Mellor* **2, Supp. 2:** 88 (1961).

**Carbon Tetrabromide**
See LITHIUM plus Bromoform.

**Carbon Tetrachloride**
There was no reaction when a drop or two of carbon tetrachloride was added to burning lithium. When the quantity was eventually increased to about 25 cc of carbon tetrachloride, a violent explosion occurred.
*Allison* (1968).
See also LITHIUM plus Trichlorotrifluoroethane.
A billet-cutting knife initiated a violently explosive reaction between lithium and carbon tetrachloride.
*Mellor* **2, Supp. 2:** (1961).
See also LITHIUM plus Water.

**Chlorine**
See CESIUM plus Chlorine.

**Chloroform**
Chloroform with various alkali metals is impact-sensitive as follows: weak explosion with lithium; fairly strong with sodium; strong with potassium; and violent with sodium-potassium.
H. Staudinger, *Z. Electrochem.* **31:** 549–52 (1925).
See LITHIUM plus Bromoform.

**Chromic Oxide**
The reaction of lithium and chromic oxide occurs around 180°C with consequent temperature rise to 965°C.
*Mellor* **2, Supp. 2:** 81 (1961).

**Chromium**
See LITHIUM plus Vanadium.

**Chromium Trichloride**
On dusting a lithium strip with either chromium trichloride or zirconium tetrachloride then warming in a nitrogen atmosphere, the lithium burns vigorously, presumably forming lithium nitride.
*BCISC* **40** (158): 17 (1968).

**Cobalt Alloys**
Molten lithium attacks the following alloys: cobalt alloys, iron alloys, manganese alloys, nickel alloys.
*Mellor* **2, Supp. 2:** 80 (1961).

**Diborane**
See ALUMINUM plus Diborane.

**Ferrous Sulfide**
The reaction of lithium and ferrous sulfide occurs around 260°C with consequent temperature rise to 945°C.
*Mellor* **2, Supp. 2:** 82 (1961).

**Halogenated Hydrocarbons**
See LITHIUM plus Oxygen.

**Hydrogen**
Lithium burns in gaseous hydrogen.
*Mellor* **1:** 327 (1946–1947).

**Iodine**
See IODINE plus Lithium.

**Iodoform**
See LITHIUM plus Bromoform.

**Iron Alloys**
See LITHIUM plus Cobalt Alloys.

**Maleic Anhydride**
See ALKALI METALS plus Maleic Anhydride.

**Manganese Alloys**
See LITHIUM plus Cobalt Alloys.

**Methyl Dichloride**
See LITHIUM plus Bromoform.

**Methyl Diiodide**
See LITHIUM plus Bromoform.

**Molybdenum Trioxide**
The reaction of lithium and molybdenum trioxide occurs at about 180°C with consequent temperature rise to 1400°C.
*Mellor* **2, Supp. 2:** 82 (1961).

**Monofluorotrichloromethane**
See LITHIUM plus Trichlorotrifluoroethane.

**Nickel Alloys**
See LITHIUM plus Cobalt Alloys.


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**Niobium Pentoxide**
The reaction of lithium and niobium pentoxide occurs around 320°C, with consequent temperature rise to 490°C.
*Mellor* **2, Supp. 2:** 81 (1961).

**Nitric Acid**
When 15 ml. of nitric acid were poured onto 15 grams of lithium in an attempt to dissolve the metal, a small fire started in the flask. In less than a minute, the reaction was so vigorous that burning lithium was thrown upward in the laboratory hood.
*Acc. and Fire Prev. Inf.* (March 31, 1954).

**Nitrogen**
See LITHIUM plus Oxygen; also LITHIUM plus Trichlorotrifluoroethane.
The reaction of lithium and nitrogen increases greatly as the metal melts.
*Mellor* **2, Supp. 2:** 77 (1961).

**Organic Matter**
Molten lithium attacks plastics and rubber.
*Mellor* **2, Supp. 2:** 84 (1961).

**Oxygen**
Lithium will burn in air, oxygen, nitrogen, and carbon dioxide. The susceptibility of molten lithium surfaces to spontaneous ignition is increased by the presence of lithium oxides or nitrides. These reactions and the reaction with water are extremely violent at higher temperatures. Contact with halogenated hydrocarbons can produce extremely violent reactions, especially on impact.
*ASESB Pot. Incid.* **39** (1968).
*Haz. Chem. Data* (1966).

**Phosphorus**
See LITHIUM plus Arsenic.
See PHOSPHORUS plus Cesium.

**Platinum**
Platinum and molten lithium react violently at 540°C plus or minus 20°. An intermetallic compound is formed.
*Chem. and Eng. News* **39** (5): 42 (January 30, 1961).

**Rubber**
See LITHIUM plus Organic Matter.

**Silicates**
See LITHIUM plus Carbides.

**Sodium Chloride**
Sodium chloride extinguishant should not be used on lithium fires since the reaction releases sodium and results in a more violent fire.
*Fatt and Tashima,* p. 32.

**Sodium Nitrite**
Lithium reacts with sodium nitrite to form lithium sodium hydronitrite, a compound which decomposes violently around 100°–130°C.
*Mellor* **2, Supp. 2:** 78 (1961).

**Sulfur**
The reaction of lithium and sulfur is very violent when either is molten, starting with explosive violence.
*Mellor* **2, Supp. 2:** 74 (1961).

**Tantalum Pentoxide**
The reaction of lithium and tantalum pentoxide occurs around 410°C with consequent temperature rise to 595°C.
*Mellor* **2, Supp. 2:** 81 (1961).

**Tetrachloroethylene**
See LITHIUM plus Trichlorotrifluoroethane.

**Titanium Dioxide**
The reaction of lithium and titanium dioxide occurs around 200°C with a flash of light; the temperature can reach 900°C.
*Mellor* **2, Supp. 2:** 81 (1961).

**Trichloroethylene**
See LITHIUM plus Trichlorotrifluoroethane.

**Trichlorotrifluoroethane**
It has been determined experimentally that mixtures of lithium shavings and a number of halogenated hydrocarbons possess an explosive capability. Specifically, impact sensitivity tests have shown that lithium shavings in contact with monofluorotrichloromethane, trichlorotrifluoroethane, carbon tetrachloride, trichloroethylene, or tetrachloroethylene can detonate.
*ASESB Pot. Incid.* **39** (1968).

**Tungsten Trioxide**
The reaction of lithium and tungsten trioxide occurs at about 200°C with consequent temperature rise to 1030°C.
*Mellor* **2, Supp. 2:** 82 (1961).

**Vanadium**
Molten lithium at 180°C attacks vanadium, beryllium, or chromium severely.
*Mellor* **2, Supp. 2:** 80 (1961).

**Vanadium Pentoxide**
The reaction of lithium and vanadium pentoxide occurs around 400°C; the temperature then rises rapidly to 768°C.
*Mellor* **2, Supp. 2:** 81 (1961).

**Water**
See LITHIUM plus Oxygen.
Liquid lithium is readily ignited and reacts with most extinguishing agents, including water, carbon tetrachloride and carbon dioxide.
*Mellor* **2, Supp. 2:** 71 (1961).

**Zirconium Tetrachloride**
See LITHIUM plus Chromium Trichloride.

## LITHIUM ACETYLENE CARBIDE DIAMMINO
$LiC{\equiv}CHNH_3$

**Carbon Dioxide**
Lithium acetylene carbide diammino burns on contact with carbon dioxide, chlorine, sulfur dioxide, and water.
*Mellor* **5:** 849 (1946–1947).

**Chlorine**
See LITHIUM ACETYLENE CARBIDE DIAMMINO plus Carbon Dioxide.

**Sulfur Dioxide**
See LITHIUM ACETYLENE CARBIDE DIAMMINO plus Carbon Dioxide.



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**Water**
See LITHIUM ACETYLENE CARBIDE DIAMMINO plus Carbon Dioxide.

## LITHIUM ALUMINUM HYDRIDE $LiAlH_4$

**Air**
Lithium aluminum hydride can burn in heated or moist air.
*Haz. Chem. Data*, p. 101 (1966).
*Lab. Govt. Chemist* (1965).

**Alcohols**
See LITHIUM ALUMINUM HYDRIDE plus Water.

**Acids**
See LITHIUM ALUMINUM HYDRIDE plus Water.

**Benzoyl Peroxide**
See BENZOYL PEROXIDE plus Lithium Aluminum Hydride.

**Boron Trifluoride Etherate**
In a laboratory effort to prepare diborane gas from these reactants, the boron trifluoride etherate in ether was frozen at liquid nitrogen temperature, lumps of lithium aluminum hydride were added, and the system was evacuated. Because of insufficient vacuum, the connection between the apparatus and the vacuum source was reopened. When this action jarred the reaction flask, an explosion and orange flame resulted. The presence of oxides in the etherate probably initiated the reaction.
*Chem. and Eng. News* **45** (20): 51 (1967); **45** (27): **7** (1967).

**2-Chloromethylfuran and Ethyl Acetate**
See 2-CHLOROMETHYLFURAN plus Lithium Aluminum Hydride and Ethyl Acetate.

**Diethylene Glycol Dimethyl Ether**
A violent explosion occurred when lithium aluminum hydride was being used to dry diethylene glycol dimethyl ether. About 75 per cent of the ether had been distilled when the explosion occurred.
R. M. Adams, *Chem. and Eng. News* **31:**2334 (1953).
*MCA Case History* **1494** (1968).

**Diethyl Ether**
With aluminum chloride as a catalyst, occasional explosions involving these materials have been traced to carbon dioxide as an impurity in the ether.
*J. Am. Chem. Soc.* **70:** 877 (1948).

**1,2-Dimethoxyethane**
When the solvent, dimethoxyethane was poured into a funnel previously used to introduce the hydride into a reaction flask, a fire ignited in the funnel.
*MCA Case History* **1182** (1966).

**Dimethyl Ether**
Use of lithium aluminum hydride to dry methyl ethers may cause explosions, which are attributed to solubility of carbon dioxide. High concentrations of peroxides were found to be present.
*MCA Guide for Safety*, Appendix 3 (1972).

**Methyl Ethyl Ether**
See LITHIUM ALUMINUM HYDRIDE plus Dimethyl Ether.

**Nitriles and Water**
The nitrile reaction with an ether solution of the hydride was conducted in a flask equipped with a reflux condenser having a drying tube. After the apparatus had stood over the weekend, moisture worked back into the flask through the ground glass joint. The lubricant had evidently been dissolved by the ether. When the moisture reached the reactants in the flask an explosion resulted.
*NSC Newsletter, Chem. Sec.* (April 1967).

**Perfluorosuccinamide**
Perfluorosuccinamide was added to an ether solution of lithium aluminum hydride in a nitrogen atmosphere. Hydrolysis was then attempted but as the second drop of water was added, a violent explosion occurred.
*MCA Guide for Safety*, Appendix 3 (1972).

**Perfluorosuccinamide and Water**
Perfluorosuccinamide was added to an ether solution of lithium aluminum hydride in an atmosphere of nitrogen. When hydrolysis of the mixture was attempted, a violent explosion and fire occurred after the second drop of water was added.
T. S. Reid and G. H. Smith, *Chem. and Eng. News* **29:** 3042 (1951).

**Tetrahydrofuran**
See TETRAHYDROFURAN plus Lithium Aluminum Hydride.

**Water**
Lithium aluminum hydride reacts vigorously with hydroxy compounds: water, alcohols, carboxylic acids.
*Mellor* **2, Supp. 2:** 142 (1961).

## LITHIUM AMIDE $LiNH_2$

**Water**
Lithium amide reacts readily with water and develops a dangerous amount of heat.
*Chaney* (1948). *Chapman* (1948). F. W. Bergstrom and W. C. Fernelius, *Chem. Reviews* **12:** 61 (1933).

## LITHIUM AZIDE $LiN_3$

**Carbon Disulfide**
See AZIDES plus Carbon Disulfide.

## LITHIUM CARBIDE $Li_2C_2$

**Bromine**
See BROMINE plus Lithium Carbide.

**Chlorine**
See BROMINE plus Lithium Carbide.

**Fluorine**
See BROMINE plus Lithium Carbide.

**Iodine**
See BROMINE plus Lithium Carbide.
See IODINE plus Cesium Carbide.

**Lead Monoxide**
Lithium carbide in the presence of lead monoxide is reduced with great vigor and with incandescence. *Mellor* **5:** 849 (1946–1947).

**Phosphorus**
See PHOSPHORUS plus Lithium Carbide.

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**Selenium**
See SULFUR plus Lithium Carbide.

**Sulfur**
See SULFUR plus Lithium Carbide.

**LITHIUM CARBONATE** $Li_2CO_3$

**Fluorine**
See FLUORINE plus Carbonates.

**LITHIUM CHLORIDE** LiCl

**Bromine Trifluoride**
See BROMINE TRIFLUORIDE plus Barium Chloride.

**LITHIUM HEXAPHENYLTUNGSTATE ETHERATE**
$Li_3W(C_6H_5)_63(C_2H_5)_2O$

**Air**
Triphenyl tungsten-tris(phenyl lithium)-tri (diethyl ether) is spontaneously flammable in air.
*Douda* (1966).

**LITHIUM HYDRIDE** LiH

**Nitrous Oxide**
See NITROUS OXIDE plus Lithium Hydride.

**Oxygen (Liquid)**
See OXYGEN (LIQUID) plus Lithium Hydride.

**LITHIUM METHYLIDE** $CH_2Li_2$

**Air**
Methylene dilithium is spontaneously flammable in air.
*Douda* (1966).

**LITHIUM PHOSPHIDE** $Li_3P$

**Water**
Lithium phosphide reacts with water to form spontaneously flammable phosphine.
*Van Wazer* (1958).

**LITHIUM SILICIDE** $Li_6Si_2$

**Bromine**
See FLUORINE plus Lithium Silicide.

**Fluorine**
See FLUORINE plus Lithium Silicide.

**Hydrogen Chloride**
Lithium silicide in contact with hydrogen chloride becomes incandescent. When dilute hydrochloric acid is used, a gas spontaneously flammable in air is evolved.
*Mellor* **6:** 170 (1946–1947).

**Nitric Acid**
Lithium silicide reacts explosively with nitric acid, producing nitrogen dioxide and silica.
*Mellor* **6:** 170 (1946–1947).

**Phosphorus**
See PHOSPHORUS plus Lithium Silicide.

**Selenium**
See PHOSPHORUS plus Lithium Silicide.

**Sulfuric Acid**
When lithium silicide is placed on sulfuric acid, it becomes incandescent.
*Mellor* **6:** 170 (1946–1947).

**Tellurium**
See PHOSPHORUS plus Lithium Silicide.

**Water**
The reaction between lithium silicide and water is very violent; a spontaneously flammable gas is evolved.
*Mellor* **6:** 170 (1946–1947).

**LITHIUM TETRAHYDROBORATE** $LiBH_4$

**Cellulosic Material**
Lithium borohydride is likely to ignite in contact with cellulosic materials.
*Lab. Govt. Chemist* (1965).

**Water**
Lithium borohydride is likely to ignite when moistened with water.
*Lab. Govt. Chemist* (1965). *Gaylord,* p. 22 (1956).

**LITHIUM TETRAMETHYLBORATE** $LiB(CH_3)_4$

**Water**
Lithium tetramethyl borate may ignite spontaneously in moist air.
*Dreisback,* pp. 93–94 (1961).

**LITHIUM TRI-tert-BUTOXYALUMINATE**
$LiAl(OC(CH_3)_3)_3H$

**Water**
Lithium aluminum tri-tert-butoxyhydride reacts with water to form hydrogen. Ignition sometimes occurs.
*Rose* (1961).

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**Fluorine**
See FLUORINE plus Solid Nonmetals and Oxygen.

**LUTETIUM** Lu

**Air**
See RARE EARTH METALS plus Air.

**Halogens**
See RARE EARTH METALS plus Halogens.

**MAGNESIUM** Mg

**Air**
Magnesium ribbon and fine magnesium shavings can be ignited at air temperatures of about 950°F and very finely divided magnesium powder has been ignited at air temperatures below 900°F.
*Magnesium Standard,* p. 4 (1967).

**Aluminum and Potassium Perchlorate**
See ALUMINUM plus Magnesium and Potassium Perchlorate.

**Ammonium Nitrate**
See AMMONIUM NITRATE plus Metals (powdered).

**Barium Nitrate, Barium Dioxide and Zinc**
A mixture consisting of barium dioxide, barium nitrate, magnesium and zinc exploded from an unknown cause, demolishing a small plant.
*Sprengstoffe, Waffen u. Munitions* (1905).

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**Beryllium Oxide**
Oxides of beryllium, cadmium, mercury, molybdenum and zinc can react explosively with magnesium when heated.
*Mellor* **4:** 272 (1946–1947).

**Boron Phosphodiiodide**
Powdered magnesium and boron phosphodiiodide react with incandescence.
*Mellor* **8:** 845 (1946–1947).

**Bromobenzyl Trifluoride**
Bromobenzyl trifluoride was added to magnesium turnings in sodium-dried ether at a rate so as to maintain reflux. After a period of time an explosion occurred.
*MCA Case History* **1834** (1972).

**Cadmium Cyanide**
Magnesium reacts with incandescence when heated with cyanides of cadmium, cobalt, copper, lead, nickel, or zinc.
*Mellor* **4:** 271 (1946–1947).

**Cadmium Oxide**
See MAGNESIUM plus Beryllium Oxide.

**Calcium Carbide**
Magnesium reacts with incandescence when heated in air with calcium carbide.
*Mellor* **4:** 271 (1946–1947).

**Carbonates**
A mixture of the two may cause an explosion.
*Pieters,* p. 30 (1957).

**Carbon Tetrachloride**
See MAGNESIUM plus Trichloroethylene; also ALUMINUM plus Chloroform.

**Chlorine**
Magnesium exposed to moist chlorine is spontaneously flammable.
*Mellor* **4:** 267 (1946–1947).

**Chlorine Trifluoride**
See ALUMINUM plus Chlorine Trifluoride.

**Chloroform**
When chloroform or methyl chloride (or mixtures of both) contacts magnesium, an explosion occurs.
C. C. Clogston, *UL Technical Report* **34:** 15 (1945).

**Cobalt Cyanide**
See MAGNESIUM plus Cadmium Cyanide.

**Copper Cyanide**
See MAGNESIUM plus Cadmium Cyanide.

**Copper Sulfate (anhydrous), Ammonium Nitrate, Potassium Chlorate and Water**
The water permits both the exothermic reaction of $Mg+Cu^{++}$ to give $Cu+Mg^{++}$ and the metathetical reaction of the salts, which produces the unstable ammonium chlorate. The mixture is unstable and hazardous.
*Ellern,* p. 46 (1968).

**Cupric Oxide**
The reduction of heated cupric oxide by admixed magnesium is accompanied by incandescence and an explosion.
*Mellor* **3:** 138 (1946–1947).

**Cupric Sulfate**
The action of magnesium on a solution of cupric sulfate is attended by the evolution of hydrogen.
*Mellor* **3:** 247 (1946–1947).

**Fluorine**
Magnesium exposed to moist fluorine is spontaneously flammable.
*Mellor* **4:** 267 (1946–1947).

**Gold Cyanide**
Cyanides of gold or mercury decompose to the metals and cyanogen. The latter reacts explosively with magnesium.
*Mellor* **4:** 271 (1946–1947).

**Hydrogen and Calcium Carbonate**
When a mixture of magnesium and calcium carbonate is heated in a current of hydrogen, a violent explosion occurs.
*Mellor* **4:** 272 (1946–1947).

**Hydrogen Iodide**
Magnesium burns momentarily in hydrogen iodide.
*Mellor* **2:** 206 (1946–1947).

**Hydrogen Peroxide**
Magnesium mixed with a trace of manganese dioxide ignites immediately in contact with hydrogen peroxide.
*Mellor* **1:** 938 (1946–1947).

**Iodine**
Magnesium burns vigorously when heated in iodine vapor.
*Mellor* **4:** 267 (1946–1947).

**Lead Cyanide**
See MAGNESIUM plus Cadmium Cyanide.

**Mercuric Oxide**
See MAGNESIUM plus Beryllium Oxide.

**Mercury Cyanide**
See MAGNESIUM plus Gold Cyanide.

**Methyl Chloride**
See MAGNESIUM plus Chloroform.

**Molybdenum Trioxide**
When molybdenum trioxide is heated with molten magnesium, a violent detonation occurs.
H. N. Warren, *Chem. News* **64:** 75 (1891).
See MAGNESIUM plus Beryllium Oxide.

**Nickel Cyanide**
See MAGNESIUM plus Cadmium Cyanide.

**Nitric Acid**
A mixture of finely divided magnesium and nitric acid is explosive.
*Pieters,* p. 28 (1957).

**Nitrogen Dioxide**
Magnesium, phosphorus or sulfur burns vigorously in nitrogen dioxide.
*Comp. Rend.* **116:** 756

**Oxygen (Liquid)**
*Liquid* oxygen (LOX) gives a detonable mixture when combined with *powdered* magnesium.
*Kirschenbaum* (1956).

**Performic Acid**
Powdered magnesium can decompose performic acid violently.
*Berichte* **48:** 1139 (1915).


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**Phosphates**
A mixture of the two may cause an explosion.
*Pieters,* p. 30 (1957).

**Potassium Chlorate**
An explosion occurred during heating of a mixture of potassium chlorate and magnesium.
*Chem. and Eng. News* **14:** 451 (1936).

**Potassium Perchlorate**
Powdered magnesium plus potassium (or sodium) perchlorate is a friction-sensitive explosive mixture.
V. E. Ready, *Safety Eng. Reports* (1947).

**Silver Nitrate**
A mixture of the two ingredients will burst into flame on moistening. The water causes electrochemical exchange between the magnesium and the silver ion. The heat of reaction of this exchange provokes the pyrochemical effect.
*Ellern,* p. 46 (1968).

**Silver Oxide**
See SILVER OXIDE plus Magnesium.

**Sodium Perchlorate**
See MAGNESIUM plus Potassium Perchlorate.

**Sodium Peroxide**
Sodium peroxide oxidizes magnesium powder with incandescence. The mixture explodes when heated to redness. When the mixture is exposed to moist air, spontaneous combustion occurs.
*Mellor* **2:** 490; **5:** 217 (1946–1947).

**Sodium Peroxide and Carbon Dioxide**
When carbon dioxide gas is passed over a mixture of powdered magnesium and sodium peroxide, the mixture explodes.
*Mellor* **2:** 490 (1946–1947).

**Stannic Oxide**
Stannic oxide, heated with magnesium, explodes.
*Mellor* **7:** 401 (1946–1947).

**Sulfates**
A mixture of the two may cause an explosion.
*Pieters,* p. 30 (1957).

**Trichloroethylene**
It has been determined experimentally that a mixture of magnesium powder with trichloroethylene or with carbon tetrachloride will flash or spark under heavy impact.
*ASESB Pot. Incid.* **39** (1968).

**Zinc Cyanide**
See MAGNESIUM plus Cadmium Cyanide.

**Zinc Oxide**
See MAGNESIUM plus Beryllium Oxide.

## MAGNESIUM ALLOYS

**Air**
Magnesium alloy powders containing more than 50% magnesium readily ignite in air.
*Lab. Govt. Chemist* (1965).
*Magnesium Standard,* p. 5 (1967).

## MAGNESIUM ALUMINUM PHOSPHIDE $Mg_3AlP_3$

**Water**
In contact with water or damp air, magnesium aluminum phosphide evolves phosphine, which is spontaneously flammable in air.
*Lab. Govt. Chemist* (1965).

## MAGNESIUM BORIDE $Mg_3B_2$

**Hydrochloric Acid**
Magnesium boride, when treated with concentrated hydrochloric acid, produces a spontaneously flammable gas.
*Mellor* **5:** 25 (1946–1947).

## MAGNESIUM BROMATE $Mg(BrO_3)_2$

**Aluminum**
See ALUMINUM plus Bromates.

**Arsenic**
See ARSENIC plus Bromates.

**Carbon**
See CARBON plus Bromates.

**Copper**
See COPPER plus Bromates.

**Metal Sulfides**
See METAL SULFIDES plus Bromates.

**Organic Matter**
See BROMATES plus Organic Matter.

**Phosphorus**
See PHOSPHORUS plus Bromates.

**Sulfur**
See SULFUR plus Bromates.

## MAGNESIUM CHLORATE $Mg(ClO_3)_2$

**Aluminum**
See ALUMINUM plus Bromates.

**Antimony Sulfide**
See CHLORATES plus Antimony Sulfide.
See METAL SULFIDES plus Bromates.

**Arsenic**
See ARSENIC plus Bromates.

**Arsenic Sulfide**
See CHLORATES plus Arsenic Sulfide. See METAL SULFIDES plus Bromates.

**Carbon**
See CARBON plus Bromates.

**Charcoal**
See CHLORATES plus Organic Matter.

**Copper**
See COPPER plus Bromates.

**Copper Sulfide**
See COPPER SULFIDE plus Cadmium Chlorate.

**Manganese Dioxide**
See CHLORATES plus Manganese Dioxide.

**Metal Sulfides**
See METAL SULFIDES plus Bromates.



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**Organic Acids (Dibasic)**
See CHLORATES plus Organic Acids.

**Organic Matter**
See BROMATES plus Organic Matter. See CHLORATES plus Organic Matter.

**Phosphorus**
See PHOSPHORUS plus Bromates.

**Stannic Sulfide**
See STANNIC SULFIDE plus Cadmium Chlorate. See METAL SULFIDES plus Bromates.

**Stannous Sulfide**
See STANNIC SULFIDE plus Cadmium Chlorate. See METAL SULFIDES plus Bromates.

**Sulfur**
See SULFUR plus Bromates. See CHLORATES plus Organic Matter.

## MAGNESIUM CHLORIDE MgCl

**2-Furan Percarboxylic Acid**
See 2-FURAN PERCARBOXYLIC ACID (self-reactive).

## MAGNESIUM HYDRIDE $MgH_2$

**Air**
Magnesium hydride ignites spontaneously in air.
*Merck Index,* p. 637 (1968).

**Water**
Magnesium hydride ignites violently with water.
*Merck Index,* p. 637 (1968).

## MAGNESIUM HYDROXIDE $Mg(OH)_2$

**Maleic Anhydride**
See SODIUM HYDROXIDE plus Maleic Anhydride.

**Phosphorus**
See PHOSPHORUS plus Alkaline Hydroxide.

## MAGNESIUM HYPOPHOSPHITE $Mg(PH_2O_2)_2$

**(self-reactive)**
Magnesium hypophosphite liberates spontaneously flammable phosphine when heated.
*Mellor* **8:** 885 (1946–1947).

## MAGNESIUM IODATE $Mg(IO_3)_2$

**Aluminum**
See ALUMINUM plus Bromates.

**Arsenic**
See ARSENIC plus Bromates.

**Carbon**
See CARBON plus Bromates.

**Copper**
See COPPER plus Bromates.

**Metal Sulfides**
See METAL SULFIDES plus Bromates.

**Organic Matter**
See BROMATES plus Organic Matter.

**Phosphorus**
See PHOSPHORUS plus Bromates.

**Sulfur**
See SULFUR plus Bromates.

## MAGNESIUM METHYLIDE $CH_2Mg$

**Air**
Methylene magnesium is spontaneously flammable in air.
*Coates,* p. 29 (1956).

## MAGNESIUM NITRATE $Mg(NO_3)_2$

**Dimethyl Formamide**
See DIMETHYL FORMAMIDE plus Magnesium Nitrate.

## MAGNESIUM OXIDE MgO

**Chlorine Trifluoride**
See CHLORINE TRIFLUORIDE plus Aluminum Oxide.

**Phosphorus Pentachloride**
See PHOSPHORUS PENTACHLORIDE plus Magnesium Oxide.

## MAGNESIUM PERCHLORATE $Mg(ClO_4)_2$

**Acids (Mineral)**
Magnesium perchlorate should not be contacted by mineral acids because of the danger of explosion.
*ACS* **146:** 208. *Chem. Weekblad.* **38:** 85 (1941); **54:** 277 (1958). *Ind. & Eng. Chem. News* **17:** 70 (1939).

**Ammonia**
Magnesium perchlorate was contained in a small steel refrigeration-type drying tube and the ammonia was passed through it (after the system was evacuated) in small increments in an attempt to further desiccate it. It was noted that the outside of the drying tube was warm to the touch. Shortly thereafter the tube exploded violently.
*F. F. Chapman* (1973).

**Butyl Fluoride**
The butyl fluoride content of hydrocarbon gases being dried by magnesium perchlorate hydrolyzed. Reaction of the acid formed with the perchlorate caused an explosion.
*ACS* **146:** 208–9. *Chem. Weekblad.* **38:** 85 (1941); **54:** 277 (1958). *Ind. & Eng. Chem. News* **17:** 70 (1939).

**Dimethyl Sulfoxide**
See DIMETHYL SULFOXIDE plus Magnesium Perchlorate.

**Ethylene Oxide**
Drying gaseous ethylene oxide with magnesium perchlorate resulted in an explosion.
*NSC Newsletter, Chem. Sec.* (Oct. 1959).

**Hydrocarbons**
Magnesium perchlorate, used in drying hydrocarbon gases, exploded when it was heated to 220°C.
*ACS* **146:**208–9, *Chem. Weekblad.* **38:**85 (1941); **54:**277 (1958). *Ind. & Eng. Chem. News* **17:** 70 (1939).
Magnesium perchlorate, used in drying unsaturated hydrocarbons, exploded on being heated to 220°C.
P. M. Heertjes and J. P. W. Houtman, *Chem. Weekblad* **38:**85 (1941).


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**Organic Matter**
Several instances of explosions from using magnesium perchlorate as a drying agent for organic matter have been documented.
*Chem. and Eng. News* **43** (37):62 (1965); **43**(47):5 (1965).

**Phosphorus**
See PHOSPHORUS plus Magnesium Perchlorate.

**Trimethyl Phosphite**
As soon as trimethyl phosphite contacted a small quantity of magnesium perchlorate in a small flask there was a brilliant flash and a loud explosion that shattered the flask.
*Allison* (1968).

## MAGNESIUM PHOSPHIDE $Mg_3P_2$

**Bromine**
See CHLORINE plus Magnesium Phosphide.

**Chlorine**
See CHLORINE plus Magnesium Phosphide.

**Nitric Acid**
Nitric acid oxidizes magnesium phosphide with incandescence.
*Mellor* **8**:842 (1946–1947).

**Water**
Magnesium phosphide produces spontaneously flammable phosphine and diphosphine on contact with water.
*Douda* (1966).

## MAGNESIUM-TITANIUM ALLOY

**Nitric Acid**
See TITANIUM-MAGNESIUM ALLOY plus Nitric Acid.

## MALEIC ANHYDRIDE $\underline{OCOCH=CHCO}$

Raw maleic anhydride was being distilled at reduced pressure (0.2 bar) in a plate column 3 m in diameter × 10 m high. The base temperature was 165°C, but several hours into the distillation, the temperature began to rise at an increasing rate, reaching 260°C in 3 hours. At this point the column pressure exceeded atmospheric pressure and the safety valves opened, emitting "violent" jets of white vapor. The column then exploded with one fragment weighing over a ton landing 200 m away. The primary explosion was followed by a secondary combustion of the vapors and a fireball.
Louis A. Medard, *Accidental Explosions* **2:** 769 (1989).

**Alkali Metals**
See ALKALI METALS plus Maleic Anhydride.

**Amines**
See SODIUM HYDROXIDE and Maleic Anhydride; also SODIUM HYDROXIDE plus Pyridine or other Tertiary Amines.

**Calcium Hydroxide**
See SODIUM HYDROXIDE plus Maleic Anhydride.

**Caustic Soda**
In 1960 a factory was cleaning an apparatus with caustic soda. One valve was not water tight in the off position and a small amount of caustic soda was introduced into a 3-cu m stainless steel vessel containing maleic anhydride. Heat of hydration and neutralization triggered an exothermic reaction with gas emission. The vessel exploded and two people were killed by the fragments.
Louis A. Medard, *Accidental Explosions* **2:** 769 (1989).

**Lithium**
See ALKALI METALS plus Maleic Anhydride.

**Potassium**
See ALKALI METALS plus Maleic Anhydride.

**Potassium Hydroxide**
See SODIUM HYDROXIDE plus Maleic Anhydride.

**Pyridine or Other Tertiary Amines**
A 0.1 per cent solution of pyridine in maleic anhydride at 185°C. gives an exothermic decomposition with rapid evolution of gas.
*Chem. and Eng. News* **42** (8):41 (1964). *Chem. Haz. Info. Series* **C-71,** p. 5 (1960).

**Sodium**
See ALKALI METALS plus Maleic Anhydride.

**Sodium Hydroxide**
See SODIUM HYDROXIDE plus Maleic Anhydride.

## MANGANESE Mn

**Aluminum and Air**
During a fire in an industrial bag filter, a mixture of aluminum and manganese dusts was inadvertently released from the hopper below the bag and a drastic explosion resulted.
*Occ. Haz.* **28**:44–6 (November 1966).

**Chlorine**
Heated manganese ignites in chlorine and burns brilliantly. Powdered manganese ignites in chlorine and burns brilliantly.
*Mellor* **12**:185–7 (1946–1947).

**Fluorine**
When powdered manganese is exposed to fluorine, the reaction takes place with incandescence.
*Mellor* **12**:344 (1946–1947).

**Hydrogen Peroxide**
See IRON plus Hydrogen Peroxide.

**Nitric Acid**
Concentrated nitric acid reacts with powdered manganese with incandescence and a feeble explosion.
*Mellor* **12**:188 (1946–1947).

**Nitrogen Dioxide**
Manganese or potassium ignites in nitrogen dioxide.
*Ann. Chim. et Phys.* (2) **2**:317.

**Phosphorus**
When manganese is heated in the vapor of phosphorus at a very dull red heat, union occurs with incandescence.
*Mellor* **8**:853 (1946–1947).

**Sulfur Dioxide**
Pyrophoric manganese burns with a brilliant flame when heated in sulfur dioxide vapor.
*Mellor* **12**:187 (1946–1947).

## MANGANESE ALLOYS

**Lithium**
See LITHIUM plus Cobalt Alloys.

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**MANGANESE DIOXIDE** $MnO_2$

**Chlorates**
See *CHLORATES* plus Manganese Dioxide.

**Chlorine Trifluoride**
Chlorine trifluoride reacts with manganese dioxide with incandescence.
*Mellor* **12:**254 (1946–1947).
See also CHLORINE TRIFLUORIDE plus Aluminum Oxide.

**Hydrogen Peroxide**
Powdered manganese dioxide dropped into a concentrated solution of hydrogen peroxide may cause an explosion.
*Mellor* **1:**936, 938 (1946–1947).

**Permonosulfuric Acid**
See PERMONOSULFURIC ACID plus Manganese Dioxide. See PLATINUM plus Permonosulfuric Acid.

**Potassium Azide**
When manganese dioxide is gently heated with potassium azide the reaction is very violent.
*Mellor* **8:**347 (1946–1947).

**Rubidium Acetylene Carbide**
See RUBIDIUM ACETYLENE CARBIDE plus Manganese Dioxide.

**Sodium Peroxide**
See SODIUM PEROXIDE plus Manganese Dioxide.

**MANGANESE HEPTOXIDE** $Mn_2O_7$

**(self-reactive)**
About three cubic centimeters of manganese heptoxide, stored in a brown glass bottle, exploded 5 or 6 hours after its preparation from sulfuric acid and potassium permanganate.
*Delhez* (1967).

**Organic Matter**
When these materials are mixed, explosions may result.
A. M. Patterson, *Chem. and Eng. News* **26:**711 (1948). J. R. Archer, *Chem. and Eng. News* **26:**205 (1948).
See also POTASSIUM PERMANGANATE plus Sulfuric Acid.

**MANGANESE TRIFLUORIDE** $MnF_3$

**Glass**
When manganese trifluoride is heated in a glass vessel, there is a violent reaction involving the silicon in the glass, since silicon tetrafluoride is released.
*Mellor* **12:**344 (1946–1947).

**MANGANOCENE** $Mn(C_5H_5)_2$

**Air**
Biscyclopentadienyl manganese is spontaneously flammable in air.
*Douda* (1966).

**MANGANOUS BROMIDE** $MnBr_2$

**Potassium**
See POTASSIUM plus Ammonium Bromide.

**MANGANOUS CHLORIDE** $MnCl_2$

**Potassium**
See POTASSIUM plus Aluminum Bromide.

**Sodium**
See SODIUM plus Ferrous Chloride.

**Zinc**
See ZINC plus Manganese Chloride.

**MANGANOUS HYPOPHOSPHITE** $Mn(PH_2O_2)_2$

**(self-reactive)**
Manganous hypophosphite detonates above 200°C.
*Mellor* **8:**889 (1946–1947).

**MANGANOUS IODATE** $Mn(IO_3)_3$

**Bromine Trifluoride**
See BROMINE TRIFLUORIDE plus Bismuth Pentoxide.

**MANGANOUS IODIDE** $MnI_2$

**Potassium**
See POTASSIUM plus Ammonium Bromide.

**MANGANOUS OXIDE** MnO

**Calcium Hypochlorite**
See CALCIUM HYPOCHLORITE plus Iron Oxide.

**Fluorine**
See FLUORINE plus Trimanganese Tetroxide.

**MANGANOUS PERCHLORATE** $Mn(ClO_4)_2 6H_2O$

**Ethyl Alcohol and 2,2-Dimethoxypropane**
See ETHYL ALCOHOL plus Manganese Perchlorate and 2,2-Dimethoxypropane.

**MANGANOUS PHOSPHIDE** $Mn_3P_2$

**Chlorine**
See CHLORINE plus Manganese Ditritaphosphide.

**MANGANOUS SULFIDE** MnS

**Air**
Red manganese sulfide, when dried in vacuo, becomes red-hot when exposed to air.
*Mellor* **12:** 344 (1946–1947).

**MANGANOUS TETRAHYDROALUMINATE** $Mn(AlH_4)_2$

**Air**
Manganese aluminohydride is spontaneously flammable in air.
*Chem. Abst.* **49:** 766e (1955). J. Aubrey and G. Monnier, *Comp. Rend.* **238:** 2534–2535 (1954).

**MERCAPTANS** RSH

**Calcium Hypochlorite**
See CALCIUM HYPOCHLORITE plus Mercaptans.

**MERCURIC AZIDE** $Hg(N_3)_2$

**(self-reactive)**
Mercuric azide decomposes at 190°C. It is explosively unstable.
*Mellor* **8, Supp. 2:** 43 (1967).



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**MERCURIC BROMIDE** $HgBr_2$

**Sodium**
See SODIUM plus Ferrous Chloride.

**Potassium**
See POTASSIUM plus Aluminum Bromide.

**MERCURIC CHLORIDE** $HgCl_2$

**Potassium**
See POTASSIUM plus Aluminum Bromide.

**Sodium**
See SODIUM plus Ferrous Chloride.

**MERCURIC CHLORITE** $Hg(ClO_2)_2$

**(self-reactive)**
Mercuric chlorite is an explosive salt.
*Mellor* **2, Supp. 1:** 575 (1956).

**MERCURIC CYANIDE** $Hg(CN)_2$

**Fluorine**
See FLUORINE plus Mercuric Cyanide.

**Magnesium**
See MAGNESIUM plus Gold Cyanide.

**MERCURIC CYANIDE OXIDE** $Hg_2(CN)_2O$

**(self-reactive)**
Several instances are cited where explosions have occurred in handling or manipulating this substance. Rubbing the material is a frequent cause of the explosions.
*Chem. Abst.* **16:** 2010 (1972).
*Chem. Abst.* **11:** 300 (1917).

**MERCURIC FLUORIDE** $HgF_2$

**Potassium**
See POTASSIUM plus Aluminum Bromide.

**Sodium**
See SODIUM plus Ferrous Chloride.

**MERCURIC IODIDE** $HgI_2$

**Chlorine Trifluoride**
See CHLORINE TRIFLUORIDE plus Mercuric Iodide.

**Potassium**
See POTASSIUM plus Aluminum Bromide.

**Sodium**
See SODIUM plus Ferrous Chloride.

**MERCURIC NITRATE** $Hg(NO_3)_2$

**Acetylene**
Acetylene forms a sensitive acetylide when passed into an aqueous solution of mercuric nitrate.
*Mellor* **4:** 933 (1946–1947).

**Ethyl Alcohol**
Alcohols should not be mixed with mercuric nitrate, as explosive mercury fulminate may be formed.
*Bahme,* p. 9 (1961).

**Hypophosphoric Acid**
Mercuric nitrate is violently reduced to mercury by hypophosphoric acid.
*Mellor* **4:** 993 (1946–1947).

**Phosphine**
The reaction of these materials gives a yellow precipitate which explodes when heated or subjected to shock.
*Mellor* **4:** 993 (1946–1947).

**Sulfur**
See SULFUR plus Mercuric Nitrate.

**Unsaturates; Aromatics**
Mercuric nitrate reacts with unsaturates and aromatics with violence if given time to generate enough heat.
J. Ball, *Chem. and Eng. News* **26:** 3300 (1948).

**MERCURIC NITRIDE** $Hg_3N_2$

**(self-reactive)**
Mercuric nitride is said to be very explosive.
*Mellor* **8:** 107 (1946–1947).

**Sulfuric Acid**
Mercuric nitride explodes when brought in contact with sulfuric acid.
*Mellor* **8:** 108 (1946–1947).

**MERCURIC OXIDE** HgO

**Chlorine**
See CHLORINE plus Mercuric Oxide.

**Hydrazine Hydrate**
When hydrazine hydrate is dropped on mercuric oxide, an explosion may occur.
*Mellor* **8:** 318 (1946–1947).

**Hydrogen Peroxide**
See LEAD DIOXIDE plus Hydrogen Peroxide.

**Hypophosphorous Acid**
Hypophosphorous acid reduces mercuric oxide explosively to the metal.
*Mellor* **4:** 778 (1946–1947).

**Iodine, Methyl Alcohol, and Ethyl Alcohol**
See IODINE plus Ethyl Alcohol, Methyl Alcohol, and Mercuric Oxide.

**Magnesium**
See MAGNESIUM plus Beryllium Oxide.

**Phospham**
See PHOSPHAM plus Cupric Oxide.

**Phosphorus**
See PHOSPHORUS plus Mercuric Oxide.

**Sodium-Potassium Alloy**
See SODIUM-POTASSIUM plus Mercuric Oxide.

**Sulfur**
See SULFUR plus Mercuric Oxide.

**MERCURIC SULFATE** $HgSO_4$

**Hydrogen Chloride**
Absorption of gaseous hydrogen chloride on mercuric sulfate becomes violent at 125°C.
*Mellor* **2, Supp. 1:** 462 (1956).

**MERCURIC SULFIDE** HgS

**Chlorine**
See CHLORINE plus Mercuric Sulfide.



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**Chlorine Monoxide**
See CHLORINE MONOXIDE plus Calcium Phosphide.

**Silver Oxide**
See SILVER OXIDE plus Antimony Trisulfide.

**MERCUROUS AZIDE** $HgN_3$

**(self-reactive)**
Mercurous azide decomposes at 210°C. It is explosively unstable.
*Mellor* **8, Supp. 2:** 43 (1967).

**MERCUROUS CHLORIDE** HgCl

**Potassium**
See POTASSIUM plus Aluminum Bromide.

**Sodium**
See SODIUM plus Ferrous Chloride.

**MERCUROUS HYPOPHOSPHATE** $Hg_4P_2O_6$

**(self-reactive)**
Mercurous hypophosphate decomposes explosively.
*Mellor* **8, Supp. 3:** 651 (1971).

**MERCUROUS NITRATE** $HgNO_3$

**Carbon**
See CARBON plus Mercurous Nitrate.

**Phosphorus**
See PHOSPHORUS plus Mercurous Nitrate.

**MERCUROUS OXIDE** $Hg_2O$

**Hydrogen Peroxide**
Mixture reacts with explosive violence.
V. Autropoff, *J. Prakt. Chem.* **77:** 316 (1908).

**Hydrogen Sulfide, Barium Oxide and Air**
See HYDROGEN SULFIDE plus Soda Lime.

**Potassium**
See POTASSIUM plus Mercurous Oxide.

**Sodium**
See POTASSIUM plus Mercurous Oxide.

**Sulfur**
See SULFUR plus Mercurous Oxide.

**MERCURY** Hg

**Acetylene**
Insoluble, explosive acetylide is formed with mercury.
*Von Schwartz*, p. 142 (1918).

**Ammonia**
Mercury and ammonia can produce explosive compounds. A residue resulting from such a reaction exploded when an attempt was made to clean out the residue with a steel rod.
C. Van Brunt, *Science* **65:** 63–4 (1927). L. M. Henderson, *Ind. & Eng. Chem. News* **10:** 73 (1932). *Chem. and Eng. News* **25:** 2138 (1947).
See also GOLD plus Ammonia.

**Boron Phosphodiiodide**
When thrown into mercury vapor, boron phosphodiiodide ignites at once.
*Mellor* **8:** 845 (1946–1947).

**Chlorine**
Flame forms with chlorine jet over mercury surface at 200°–300°C.
*Mellor* **2, Supp. 1:** 381 (1956).

**Chlorine Dioxide**
Chlorine dioxide and liquid mercury explode violently.
*Mellor* **2:** 288 (1946–1947). *Von Schwartz*, p. 142 (1918).

**Methyl Azide**
Methyl azide in the presence of mercury was shown to be potentially explosive.
C. L. Currie and B. Darwent, *Can. J. Chem.* **41:** 1048 (1963).

**Sodium Carbide**
Ground mixtures of sodium carbide and mercury, aluminum, lead, or iron can react vigorously.
*Mellor* **5:** 848 (1946–1947).

**MERCURY SALTS**

**Acetylene**
Mercury salts and silver salts give acetylides from ammoniacal solutions in the same way copper salts do. The dried acetylides are extremely sensitive and violent.
G. Benson, *Comp. Gas Bull.* (Oct. 18, 1950); J. K. Luchs, *Phot. Sci. Eng.* 10:334–7 (1966).

**Butynediol and Acid**
See BUTYNEDIOL plus Hydroxides.

**Nitromethane**
See COPPER SALTS plus Nitromethane.

**MERCURY TETRAPHOSPHIDE** $Hg_3P_4$

**Air**
Mercury tetratriphosphide ignites when warmed in air, or in chlorine at ordinary temperatures. Mixed with potassium chlorate, it explodes by percussion.
*Comp. Rend.* **115:** 230.

**Chlorates**
See MERCURY TETRATRIPHOSPHIDE plus Air.

**Chlorine**
See MERCURY TETRATRIPHOSPHIDE plus Air.

**Potassium Chlorate**
See MERCURY TETRATRIPHOSPHIDE plus Air.

**MESITYLENE** $C_6H_3(CH_3)_3$

**Nitric Acid**
See NITRIC ACID plus Mesitylene.

**MESITYL OXIDE** $(CH_3)_2C{=}CHCOCH_3$

**2-Aminoethanol**
Mixing mesityloxide and 2-aminoethanol in a closed container caused the temperature and pressure to increase.
*Flynn and Rossow* (1970). See Note under complete reference.

**Chlorosulfonic Acid**
Mixing mesityl oxide and chlorosulfonic acid in a closed container caused the temperature and pressure to increase.
*Flynn and Rossow* (1970). See Note under complete reference.


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**Ethylene Diamine**
Mixing mesityl oxide and ethylene diamine in a closed container caused the temperature and pressure to increase.
*Flynn and Rossow* (1970). See Note under complete reference.

**Nitric Acid**
Mixing mesityl oxide and nitric acid in a closed container caused the temperature and pressure to increase.
*Flynn and Rossow* (1970). See Note under complete reference.

**Oleum**
Mixing mesityl oxide and oleum in a closed container caused the temperature and pressure to increase.
*Flynn and Rossow* (1970). See Note under complete reference.

**Sulfuric Acid**
Mixing mesityl oxide and 96% sulfuric acid in a closed container caused the temperature and pressure to increase.
*Flynn and Rossow* (1970). See Note under complete reference.

## METALLIC HALIDES

**Bromine Pentafluoride**
See BROMINE PENTAFLUORIDE plus Metal Oxides.

## METAL OXIDES

**Bromine Pentafluoride**
See BROMINE PENTAFLUORIDE plus Metal Oxides.

**Performic Acid**
Metal oxides catalyze the decomposition of performic acid, resulting in an explosion.
*Grignard* **11:** 179 (1935–1954).

## METALS

**Ammonium Nitrate**
See AMMONIUM NITRATE plus Metals (powdered).

**Bromine Pentafluoride**
Very violent reactions may occur between bromine pentafluoride and powdered or warmed metals.
*Mellor* **2, Supp. 1:** 172 (1956).

**Bromine Trifluoride**
Halogen fluorides appear to react with all metals. The reaction is vigorous when no film forms.
*Mellor* **2, Supp. 1:** 163 (1956).

**Chlorates**
See CHLORATES plus Metals (powdered).

**Performic Acid**
Metals catalyze the decomposition of performic acid and can make it explosive.
*Grignard* **11:** 179 (1935–1954).

## METAL SULFIDES

**Bromates**
A combination of finely divided metal sulfides with finely divided bromates (also chlorates and iodates) of barium, calcium, magnesium, potassium, sodium, and zinc can be exploded by heat, percussion and, sometimes, light friction.
*Mellor* **2:** 310 (1946–1947).

**Chlorates**
See METAL SULFIDES plus Bromates. See COPPER SULFIDE plus Cadmium Chlorate.

**Chloric Acid**
See COPPER SULFIDE plus Cadmium Chlorate. See ANTIMONY SULFIDE plus Chloric Acid.

**Hydrazine Mononitrate**
See ZINC plus Hydrazine Mononitrate.

**Iodates**
See METAL SULFIDES plus Bromates.

**Silver Oxide**
See SILVER OXIDE plus Antimony Trisulfide.

## METHANE $CH_4$

**Bromine Pentafluoride**
See BROMINE PENTAFLUORIDE plus Acetic Acid.

**Chlorine**
See CHLORINE plus Methane.

**Chlorine Dioxide**
See CHLORINE DIOXIDE plus Butadiene.

**Nitrogen Trifluoride**
See HYDROGEN plus Nitrogen Trifluoride.

**Oxygen (Liquid)**
See OXYGEN (LIQUID) plus Methane.

**Oxygen Difluoride**
See HYDROGEN plus Oxygen Difluoride.

## METHANOL $CH_3OH$

**Chromic Anhydride**
See CHROMIC ANHYDRIDE plus Methyl Alcohol.

**Iodine, Ethyl Alcohol and Mercuric Oxide**
See IODINE plus Ethyl Alcohol, Methyl Alcohol, and Mercuric Oxide.

**Lead Perchlorate**
See LEAD PERCHLORATE plus Methyl Alcohol.

**Perchloric Acid**
See PERCHLORIC ACID plus Ethyl Alcohol.

**Phosphorus Trioxide**
See DIMETHYL FORMAMIDE plus Phosphorus.

**Potassium Hydroxide and Chloroform**
See SODIUM HYDROXIDE plus Chloroform and Methyl Alcohol.

**Sodium Hydroxide and Chloroform**
See SODIUM HYDROXIDE plus Chloroform and Methyl Alcohol.

## p-METHOXYBENZYL FORMATE $CH_3OC_6H_4CH_2OCHO$

**Phosgene**
In the formation of p-methoxybenzyl formate by the addition of phosgene to alcohols followed by the addition of sodium nitride or hydrazoic acid in the presence of pyridine, reaction of phosgene with the azide can cause the formation of explosive carbazide. To prevent the reaction, complete removal of excess phosgene is advocated

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by passing nitrogen into the solution prior to addition of the azide.
*Chem. Abst.* **73:** 14099h (1970). *Chem. Phar. Bull.* **18** (4): 850–851 (1970).

**2-METHOXYETHANOL** $HOCH_2CH_2OCH_3$

**Air**
Ethylene glycol monomethyl ether forms peroxides that are highly explosive.
*Wischmeyer* (1969).

**2(2-METHOXYETHOXY) ETHANOL**
$CH_3OCH_2CH_2OCH_2CH_2OH$

**Calcium Hypochlorite**
See CALCIUM HYPOCHLORITE plus Methyl Carbitol.

**Chlorosulfonic Acid**
Mixing diethylene glycol monomethyl ether and chlorosulfonic acid in a closed container caused the temperature and pressure to increase.
*Flynn and Rossow* (1970). See Note under complete reference.

**Oleum**
Mixing diethylene glycol monomethyl ether and oleum in a closed container caused the temperature and pressure to increase.
*Flynn and Rossow* (1970). See Note under complete reference.

**BIS(2-METHOXYETHYL)ETHER** $(CH_3OCH_2CH_2)_2O$

**Lithium Aluminum Puthene Hydride**
See LITHIUM ALUMINUM HYDRIDE plus Diethylene Glycol Dimethyl Ether.

**METHYL AZIDE** $CH_3N_3$

**(self-reactive)**
Methyl and ethyl azides are stable at room temperatures but are likely to detonate upon rapid heating.
J. H. Bover and F. C. Canter, *Chem. Reviews* **54:** 32–3 (1954).

**Dimethyl Malonate and Sodium Methylate**
A serious explosion occurred in the condensation of methyl azide with dimethyl malonate in the presence of sodium methylate.
Ch. Grundmann and H. Haldenwanger, *Angew Chem.* **62A:** 410 (1950).

**Mercury**
See MERCURY plus Methyl Azide.

**METHYL 2-AZIDOBENZOATE** $CH_3OCOC_6H_4$-2-NNN

**(self-reactive)**
During distillation of this material the apparatus exploded.
*Wischmeyer* (1972).

**METHYL BROMIDE** $CH_3Br$

**Aluminum**
See ALUMINUM plus Methyl Bromide.

**Dimethyl Sulfoxide**
A reaction between methyl bromide and dimethyl sulfoxide resulted in an explosion that shattered the apparatus.
*Scaros and Serauskas* (1973).

**METHYL CARBITOL** $CH_3OCH_2CH_2OCH_2CH_2OH$

**Calcium Hypochlorite**
See CALCIUM HYPOCHLORITE plus Methyl Carbitol.

**METHYL CHLORIDE** $CH_3Cl$

**Aluminum**
See ALUMINUM plus Methyl Chloride.

**Magnesium**
See MAGNESIUM plus Chloroform.

**Potassium**
See POTASSIUM plus Chloroform.

**Sodium**
See POTASSIUM plus Chloroform.
See SODIUM plus Methyl Chloride.

**Sodium-Potassium Alloy**
See SODIUM-POTASSIUM ALLOY plus Carbon Tetrachloride.

**METHYLCOPPER** $CH_3Cu$

**Air**
Methyl copper explodes violently when allowed to dry in air.
*Coates,* p. 172 (1956).

**4-METHYLCYCLOHEXANONE**
$CH_2COCH_2CH_2CH(CH_3)CH_2$

**Nitric Acid Puthene**
See NITRIC ACID plus 4-Methylcyclohexanone.

**METHYL-bis (DIETHYLBORYL) AMINE**
$((C_2H_5)_2B)_2NCH_3$

**Air**
n-Methyl n,n-bis diethylborinicimide is spontaneously flammable in air.
*Buls, Bimonthly Rept. 6,* p. 3 (1953).

**METHYLENE CHLORIDE** $ClCH_2Cl$

**(See also DICHLOROMETHANE)**

**Lithium**
See LITHIUM plus Bromoform.

**N-Methyl-N-Nitroso Urea and Potassium Hydroxide**
See N-METHYL-N-NITROSO UREA plus Potassium Hydroxide and Methylene Chloride.

**Potassium Tert.-Butoxide**
See ACETONE plus Potassium Tert.-Butoxide.

**Sodium-Potassium Alloy**
See SODIUM-POTASSIUM ALLOY plus Methyl Dichloride.


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**METHYLENE DIISOCYANATE** $OCN\text{-}CH_2\text{-}NCO$

**Dimethyl Formamide**
See DIMETHYL FORMAMIDE plus Methylene Diisocyanate.

**METHYLENE IODIDE** $ICH_2I$

**Lithium**
See LITHIUM plus Bromoform.

**METHYL FORMAMIDE** $CH_3NHCHO$

**Benzenesulfonyl Chloride**
See METHYL ISONITRILE (self-reactive).

**METHYLHYDRAZINE** $CH_3NHNH_2$

**Air**
Exposure of monomethylhydrazine in air on a large surface may result in spontaneous ignition.
*Def. Res. and Eng.*, p. 27 (1963).

**METHYL HYPOCHLORITE** $CH_3OCl$

**(self-reactive)**
Methyl hypochlorite decomposes explosively when exposed to light and rapidly even in its absence.
*Mellor* **2, Supp. 1:** 550 (1956).
See also ALCOHOLS plus Hypochlorus Acid.

**METHYLLITHIUM** $CH_3Li$

**Air**
Methyllithium is spontaneously flammable in air.
*Douda* (1966).
*Mellor* **2, Supp. 2:** 91 (1961).

**METHYL METHACRYLATE** $CH_2=C(CH_3)COOCH_3$

**Benzoyl Peroxide**
See BENZOYL PEROXIDE plus Methyl Methacrylate.

**METHYL METHACRYLATE POLYMER**

**Fluorine**
See FLUORINE plus Solid Nonmetals and Oxygen.

**N-METHYL-N-NITROSO UREA** $ON\text{-}N(CH_3)CONH_2$

**Potassium Hydroxide and Methylene Chloride**
Diazomethane was being prepared by portion-wise additions of N-methyl-N-nitroso urea to a flask containing 40% potassium hydroxide and methylene chloride. At the fourth addition a loud detonation occurred.
*MCA Guide for Safety*, p. 301 (1972).

**METHYL PARATHION** $(CH_3O)_2P(S)OC_6H_4NO_2$

**(self-reactive)**
When a sample was heated in a small test tube it decomposed and in a few minutes the residue exploded.
J. B. McPherson and G. A. Johnson, *Agri. Food Chem.* **4** (1): 42 (1956).

**2-METHYL-3-PHENYL-1-PROPANOL**
$C_6H_5CH_2CH(CH_3)CH_2OH$

**Hydrogen Peroxide and Sulfuric Acid**
See ALCOHOLS plus Hydrogen Peroxide and Sulfuric Acid.

**METHYL PERCHLORATE** $CH_3ClO_4$

**(self-reactive)**
Methyl, ethyl, and propyl perchlorates are oily liquids of extraordinary explosive power, extremely sensitive to heat, shock, and friction.
*ACS* **146:** 214. *Berichte* **42:** 4390–4 (1909).
*Z. Anorg. Chemie* **228:** 341–51 (1936).

**METHYLPHOSPHINE** $CH_3PH_2$

**Air**
Methyl phosphine is spontaneously flammable in air.
*Hurd*, p. 128 (1952).

**METHYLSILYLAMINO DIBORANE** $(B_2H_5)N(CH_3)(SiH_3)$

**Air**
Methyl silyamino diborane is spontaneously flammable in air.
*Douda* (1966).

**METHYLSODIUM** $CH_3Na$

**Air**
Methyl sodium is spontaneously flammable in air.
*Douda* (1966).

**METHYL(TRIFLUOROPROPYL)POLYSILOXANE**

**Fluorine**
See FLUORINE plus Solid Nonmetals and Oxygen.

**MOLYBDENUM** Mo

**Bromine Trifluoride**
Powdered molybdenum, powdered titanium, and powdered vanadium all react with bromine trifluoride, producing incandescence.
*Mellor* **2, Supp. 1:** 164 (1956).
Reaction between molybdenum or tungsten and bromine trifluoride is vigorous. No protective film forms with the volatile hexafluoride of the metal.
*Mellor* **2, Supp. 1:** 163 (1956).

**Chlorine Trifluoride**
Chlorine trifluoride acts on powdered molybdenum with incandescence.
*Z. Anorg. Chemie* **190:** 270.
*Mellor* **2, Supp. 1:** 156 (1956).

**Fluorine**
Fluorine acts on powdered molybdenum with incandescence. Other interhalogen compounds containing fluorine may act similarly.
*Z. Anorg. Chemie* **190:** 270.

**Lead Dioxide**
Powdered molybdenum or tungsten mixed with lead dioxide becomes incandescent when heated.
*Mellor* **7:** 691 (1946–1947).

**MOLYBDENUM DISULFIDE** $MoS_2$

**Hydrogen Peroxide**
See ANTIMONY TRISULFIDE plus Hydrogen Peroxide.



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**MOLYBDENUM TRIOXIDE** $MoO_3$

**Chlorine Trifluoride**
Chlorine trifluoride attacks molybdenum trioxide with incandescence.
*Z. Anorg. Chemie* **190:** 270.
See also CHLORINE TRIFLUORIDE plus Aluminum Oxide.

**Lithium**
See LITHIUM plus Molybdenum Trioxide.

**Magnesium**
See MAGNESIUM plus Molybdenum Trioxide.

**Potassium**
See POTASSIUM plus Molybdenum Trioxide.

**Sodium**
See POTASSIUM plus Molybdenum Trioxide.

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**Fluorine**
See FLUORINE plus Metals.

**MONOAMMONIUM PHOSPHATE** $NH_4H_2PO_4$

**Sodium**
See SODIUM plus Monoammonium Phosphate.

**Sodium Bicarbonate**
See SODIUM BICARBONATE plus Monoammonium Phosphate.

**MORPHOLINE** $OCH_2CH_2NHCH_2CH_2$

**Cellulose Nitrate**
Cellulose nitrate of high surface area (dry or alcohol-wet guncotton or scrap) spontaneously ignited in contact with morpholine used as a curing agent for epoxide resins.
*ABCM Quarterly Safety Summary* (1956); *Bretherick* (1979).

**NAPHTHALENE** $C_{10}H_8$

**Chromic Anhydride**
See CHROMIC ANHYDRIDE plus Naphthalene.

**NEODYMIUM** Nd

**Air**
See RARE EARTH METALS plus Air.

**Halogens**
See RARE EARTH METALS plus Halogens.

**Nitrogen**
Neodymium and nitrogen react vigorously.
*Mellor* **8, Supp. 1:** 164 (1964).

**Phosphorus**
Neodymium and phosphorus react vigorously at 400°–500°C.
*Mellor* **8, Supp. 3:** 347 (1971).

**NEODYMIUM PHOSPHIDE** NdP

**Nitric Acid**
Neodymium phosphide and nitric acid react violently.
*Mellor* **8, Supp. 3:** 348 (1971).

**Water**
See CEROUS PHOSPHIDE plus Water.

**NEOPRENE** $(CH_2{=}CClCH{=}CH_2)_x$

**Fluorine**
See FLUORINE plus Solid Nonmetals and Oxygen.

**Fluorine (liquid)**
See FLUORINE plus Neoprene.

**NICKEL** Ni

**Ammonium Nitrate**
See AMMONIUM NITRATE plus Metals (powdered).

**Fluorine**
See FLUORINE plus Metals.

**Hydrazine**
The catalytic decomposition of hydrazine in the presence of Raney nickel may be vigorous at room temperature.
*Mellor* **8, Supp. 2:** 83 (1967).

**Hydrazoic Acid**
Raney nickel and hydrazoic acid undergo a vigorous decomposition.
*Mellor* **8, Supp. 2:** 4 (1967).

**Hydrogen and Dioxane**
See HYDROGEN plus Dioxane and Nickel (Raney).

**Performic Acid**
Powdered nickel can decompose performic acid violently.
*Berichte* **48:** 1139 (1915).

**Phosphorus**
See COPPER plus Phosphorus.

**Selenium**
When powdered nickel is heated with selenium or sulfur, the elements unite with incandescence.
*Berichte* **14:** 2823. *Comp. Rend.* **131:** 557. G. Little, *Ann. Chem.* **112:** 211 (1859).

**Sulfur**
See SULFUR plus Nickel.

**Titanium and Potassium Perchlorate**
Mixtures containing potassium perchlorate with nickel and titanium powders and infusorial earth gave severe explosions during a friction test. Very small sparks — less than those available from static electricity on the human body — can ignite the mixture.
*ACS* **146:** 210. *BM Info. Circ.* **7349** (1945).

**NICKEL ALLOYS**

**Lithium**
See LITHIUM plus Cobalt Alloys.

**NICKEL BROMIDE** $NiBr_2$

**Potassium**
See POTASSIUM plus Aluminum Bromide.

**NICKEL CARBONYL** $Ni(CO)_4$

**Air**
In the presence of air, nickel carbonyl forms a deposit which becomes peroxidized. This tends to decompose and ignite. See also NICKEL CARBONYL plus n-Butane and Oxygen.
Edgerton & Radra-Kanchana, *Proc. Roy. Soc.* **A225:** 427 (1954).

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**Bromine**
See BROMINE plus Nickel Carbonyl.

**n-Butane and Oxygen**
Nickel carbonyl vapor explodes in air or oxygen at 20°C. and a partial pressure of 15 mm. Addition of nickel carbonyl to an n-butane-oxygen mixture causes explosion at 20–40°C. E. J. Badin, P. C. Hunter, R. N. Pease, *J. Am. Chem. Soc.* **70:** 2055-6 (1948).

**Oxygen**
See NICKEL CARBONYL plus n-Butane and Oxygen.

## NICKEL CHLORIDE $NiCl_2$

**Potassium**
See POTASSIUM plus Aluminum Bromide.

## NICKEL CHLORITE $Ni(ClO_2)_2$

**(self-reactive)**
The dihydrate of nickel chlorite explodes when heated to 100°C.
*Mellor* **2, Supp. 1:** 574 (1956).

## NICKEL CYANIDE $Ni(CN)_2$

**Magnesium**
See MAGNESIUM plus Cadmium Cyanide.

## NICKEL FLUORIDE $NiF_2$

**Potassium**
See POTASSIUM plus Ammonium Bromide.

## NICKEL-HEXAMMINE CHLORATE $Ni(NH_3)_6(ClO_3)_2$

**(self-reactive)**
This compound detonates when struck.
*Mellor* **2, Supp. 1:** 592 (1956)

## NICKEL-HEXAMMINE PERCHLORATE $Ni(NH_3)_6(ClO_4)_2$

**(self-reactive)**
This compound detonates when struck but is less sensitive than hexamminonickel chlorate.
*Mellor* **2, Supp. 1:** 592 (1956).

## NICKEL HYPOPHOSPHITE $Ni(PH_2O_2)_2$

**(self-reactive)**
Nickel hypophosphite liberates spontaneously flammable phosphine above 100°C.
*Mellor* **8:** 890 (1946–1947).

## NICKEL IODIDE $NiI_2$

**Potassium**
See POTASSIUM plus Aluminum Bromide.

## NICKEL MONOXIDE NiO

**Fluorine**
See FLUORINE plus Nickel Monoxide.

**Hydrogen Sulfide, Barium Oxide and Air**
See HYDROGEN SULFIDE plus Soda Lime.

## NICKEL NITRIDE $Ni_3N$

**Acids**
The reaction of nickel nitride and acids may be explosive with high acid concentrations and heat.
*Mellor* **8, Supp. 1:** 238 (1964).

## NICKEL PERCHLORATE $Ni(ClO_4)_2$

**2,2-Dimethoxypropane**
When nickel perchlorate and 2,2-dimethoxypropane were heated, a violent reaction occurred.
*Chem. and Eng. News* **48** (28): 7–8 (Oct. 26, 1970).
See also 2,2-DIMETHOXYPROPANE plus Manganese Perchlorate and Ethyl Alcohol.

**Hydrazine**
The blue precipitate formed from nickel perchlorate and hydrazine in water exploded violently when a glass stirring rod was introduced into the suspension.
*ACS* **146:** 209. *Helv. Chim. Acta.* **34:** 2084–5 (1951).

## NICKEL-TRIHYDRAZINE CHLORATE $Ni(N_2H_4)_3(ClO_3)_2$

**(self-reactive)**
This compound detonates when struck.
*Mellor* **2, Supp. 1:** 592 (1956).

## NICKEL-TRIHYDRAZINE NITRATE $Ni(NO_3)3H_2NNH_2$

**(self-reactive)**
A small amount of thoroughly washed, dry trihydrazine nickel nitrate exploded about ten minutes after exposure to the atmosphere.
H. Ellern and D. E. Olander, *J. Chem. Edu.* **32:**24 (1955).

## NIOBIUM (COLUMBIUM) Nb

**Bromine Trifluoride**
Niobium and tantalum each reacts with bromine trifluoride with incandescence.
*Mellor* **2, Supp. 1:** 164 (1956).

**Chlorine**
Powdered niobium reacts energetically with chlorine.
*Mellor* **2, Supp. 1:** 381 (1956).
See NIOBIUM plus Fluorine.

**Fluorine**
At ordinary temperatures, niobium (columbium) becomes incandescent in the presence of fluorine. It ignites when gently heated in chlorine.
*Mellor* **9:** 849 (1946–1947).

## NIOBIUM PENTOXIDE $Nb_2O_5$

**Aluminum and Sulfur**
See ALUMINUM plus Niobium Oxide and Sulfur.

**Bromine Trifluoride**
See BROMINE TRIFLUORIDE plus Bismuth Pentoxide.

**Lithium**
See LITHIUM plus Niobium Pentoxide.

## NITRATE-NITRITE

**Aluminum**
See ALUMINUM plus Nitrate-Nitrite and Organic Matter.

**Organic Matter**
See ALUMINUM plus Nitrate-Nitrite and Organic Matter.



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## NITRATES

**(See also specific nitrates as primary entries or under other reactants)**

**Aluminum**
See ALUMINUM plus Nitrates.

**Boron Phosphide**
See BORON PHOSPHIDE plus Nitric Acid.

**Cyanides**
Addition of cyanides to a molten nitrate bath (or vice versa) will result in an explosion.
*NBFU Research Report* **2** (1950).

**Esters**
A mixture of the two may cause an explosion.
*Pieters,* p. 30 (1957).

**Phospham**
A mixture of phospham and a nitrate explodes when heated.
H. Rose, *Ann. Phys.* **24:** 308 (1832).

**Phosphorus**
See PHOSPHORUS plus Nitrates.

**Sodium Cyanide**
See NITRATES plus Cyanides.

**Sodium Hypophosphite**
See CHLORATES plus Sodium Hypophosphite.

**Stannous Chloride**
A mixture of the two may cause an explosion.
*Pieters,* p. 30 (1957).

**Thiocyanates**
See THIOCYANATES plus Chlorates.

## NITRIC ACID $HNO_3$

**Acetic Acid**
Acetic acid or acetic anhydride can explode with nitric acid if not kept cold.
*Von Schwartz,* p. 321 (1918). *Comp Rend.* **269** (15):1114–1116 (1968).

**Acetic Anhydride**
See NITRIC ACID plus Acetic Acid.
See ACETIC ANHYDRIDE plus Nitric Acid.
Experiments demonstrate that mixtures containing more than 50% by weight of nitric acid in acetic anhydride may act as detonating explosives under certain conditions. An indication is given of the percentage mixtures of acetic anhydride-nitric acid which could be detonated using a priming charge and detonator.
*BCISC* **42** (166): 2 (1971).

**Acetone and Acetic Acid**
An etching reagent of equal parts of acetone, concentrated nitric acid, and 75 per cent acetic acid exploded four hours after it was prepared and placed in a closed bottle. A correspondent pointed out that this formulation is similar to the method of preparing tetranitromethane, a sensitive explosive.
*Chem. and Eng. News* **38** (43): 56 (1960); **38** (46): 5 (1960).

**Acetone and Sulfuric Acid**
Acetone will decompose violently when brought in contact with mixed sulfuric-nitric acids. This will occur especially if the reaction is in a confined or a narrow-mouthed container.
*Ind. Eng. Chem.* **51:** 59A (April 1959).

**Acetylene**
Concentrated nitric acid on acetylene gives trinitromethane, which melts at 15°C and is explosive in the liquid state.
*Kirk and Othmer* **9:** 430-2 (1947).

**Acrolein**
See ACROLEIN plus Nitric Acid.

**Acrylonitrile**
See ACRYLONITRILE plus Nitric Acid.

**Allyl Alcohol**
See ALLYL ALCOHOL plus Nitric Acid.

**Allyl Chloride**
See ALLYL CHLORIDE plus Nitric Acid.

**2-Aminoethanol**
See 2-AMINOETHANOL plus Nitric Acid.

**Ammonia**
Ammonia gas burns in an atmosphere of nitric acid vapor.
*Mellor* **8:** 219 (1946–1947).
See NITRIC ACID plus Diborane.

**Ammonium Hydroxide**
Mixing 70% nitric acid and 28% ammonium hydroxide in a closed container caused the temperature and pressure to increase.
*Flynn and Rossow* (1970). See Note under complete reference.
*Mellor* **8, Supp. 1:** 349 (1964).

**Aniline**
Aniline ignites spontaneously in the presence of red fuming nitric acid.
*Kit and Evered,* pp. 238–42 (1960).
A self-flammable fuel is prepared by adding a hydrocarbon to a mixture of concentrated nitric acid and an oxidation catalyst. The hydrocarbon contains a combustion initiator made up of aniline, dimethyl aniline, xylidene, and iron pentacarbonyl.
*Aniline,* p. 85 (1964).
Aromatic amines (e.g., aniline or toluidine) in triethylamine solution are ignited rapidly by red fuming nitric acid at temperatures of minus 76° or lower.
*Aero. Tech. Note* **3884** (1956).
*Brennstoff-Chem.* **46** (4): 117–24 (1965). *Chem. Abst.* **51:** 3961d (1957); **63:** 4067h (1965).
See also NITRIC ACID plus Diborane.

**Anion Exchange Resins**
If hydroxyl-form anion exchange resins are contacted by nitric acid solutions of excessive strength (e.g. 6 molar), rapid heating and resulting gaseous degradation products can pressurize and damage the ion-exchange vessel.
*Van Slyke* (1967). *Reactor Fuel Process.* **7** (4): 297–303 (Fall 1964). *AEC Research and Devel. Report, B N WL-476* (January 1967).

**Anion Exchange Resins and Dichromate**
Dichromate loadings as low as 0.05 grams per cubic centimeter of resin in contact with 7 molar nitric acid can cause a runaway reaction.

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Ignition temperature is 92°C and decreases with increasing dichromate loading.
*AEC Research and Devel. Report BNWL-***144** (August 1965).

**Antimony**
See ANTIMONY plus Nitric Acid.

**Arsine**
Fuming nitric acid reacts explosively with arsine.
*Mellor* **9:** 56 (1946–1947).

**Bismuth**
See BISMUTH plus Nitric Acid.

**Boron**
See BORON plus Nitric Acid.

**Boron Decahydride**
See BORON DECAHYDRIDE plus Nitric Acid.

**Boron Phosphide**
See BORON PHOSPHIDE plus Nitric Acid.

**Bromine Pentafluoride**
See BROMINE PENTAFLUORIDE plus Nitric Acid.

**n-Butyraldehyde**
See n-BUTYRALDEHYDE plus Nitric Acid.

**Calcium Hypophosphite**
See CALCIUM HYPOPHOSPHITE plus Nitric Acid.

**Carbon**
See CARBON plus Nitric Acid.

**Cesium Carbide**
See CESIUM CARBIDE plus Nitric Acid.

**4-Chloro-2-Nitroaniline**
See 4-CHLORO-2-NITROANILINE plus Nitric Acid.

**Chlorine Trifluoride**
See CHLORINE TRIFLUORIDE plus Nitric Acid.

**Chlorosulfonic Acid**
See CHLOROSULFONIC ACID plus Nitric Acid.

**Cresol**
See CRESOL plus Nitric Acid.

**Cumene**
See CUMENE plus Nitric Acid.

**Cupric Nitride**
See CUPRIC NITRIDE plus Nitric Acid.

**Cuprous Nitride**
See CUPROUS NITRIDE plus Sulfuric Acid.

**Cyanides**
This mixture produces an explosive reaction.
*Scott* (1967).

**Cyclic Ketones**
The cyclic ketones are far more susceptible to violent reaction than are the corresponding cyclic alcohols.
*Chem. and Eng. News* **37** (35): 48 (Aug. 31, 1959).

**Cyclohexanol**
Cyclohexanol and nitric acid can react at room temperature to form a violently explosive material.
*Chem. & Ind.* **1971:** (19) (1971).

**Cyclohexanone**
Acid burns resulted from the violent reaction of nitric acid with cyclohexanone.
*Dept. of Commerce PB Report* **73591.**

**Diborane**
Mixtures of fuming nitric acid and any of the following are self-igniting: diborane, aniline, terpenes, furfuryl alcohol, and ammonia.
*Mellor* **8, Supp. 2:** 341 (1967).

**2,6-Di-t-Butylphenol**
These ingredients, reacted in a medium of acetic acid, form 2,6-di-t-butyl-4-nitrophenol. Two grams of this nitro compound exploded violently after warming on a steam bath for 2-3 minutes. (Possibly a polynitro derivative was the explosive.)
*ASESB Expl. Report* **24** (1961).

**Diisopropyl Ether**
See DIISOPROPYL ETHER plus Nitric Acid.

**Epichlorohydrin**
See EPICHLOROHYDRIN plus Nitric Acid.

**Ethyl Alcohol**
Stirring a mixture of concentrated nitric acid and ethyl alcohol results in a reaction that starts slowly and accelerates to an explosion.
*Becker* (1965).
A solution of 190-proof ethyl alcohol plus nitric acid (15 per cent), being used to etch bismuth, decomposed vigorously and sprayed the surrounding area.
*Chem. and Eng. News* **27:** 1396 (1949).
See SILVER plus Ethyl Alcohol and Nitric Acid.

**m-Ethylaniline**
m-Ethylaniline ignites spontaneously in the presence of red fuming nitric acid.
*Kit and Evered,* pp. 238–42 (1960).

**Ethylene Diamine**
See ETHYLENE DIAMINE plus Nitric Acid.

**Ethyleneimine**
See ETHYLENEIMINE plus Nitric Acid.

**5-Ethyl-2-Methyl Pyridine**
These materials were placed in a small auto-clave and heated and stirred for 40 minutes. The emergency vent was opened due to a sudden pressure rise. A violent explosion occurred 90 seconds later.
R. L. Frank, *Chem. and Eng. News* **30:** 3348 (1952).

**5-Ethyl-2-Picoline**
See 5-ETHYL-2-PICOLINE plus Nitric Acid.

**Ethyl Phosphine**
See BROMINE plus Ethyl Phosphine.

**Ferrous Oxide**
See FERROUS OXIDE plus Nitric Acid.

**Fluorine**
See FLUORINE plus Nitric Acid.

**Furfuryl Alcohol**
Furfuryl alcohol is ignited immediately by concentrated nitric acid.
*MCA Case History* **193** (1952).
See also NITRIC ACID plus Diborane.

**Germanium**
See GERMANIUM plus Nitric Acid.

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**Glyoxal**
Mixing 70% nitric acid and glyoxal in a closed container caused the temperature and pressure to increase.
*Flynn and Rossow* (1970). See Note under complete reference.

**Hydrazine**
See HYDRAZINE plus Air.
See HYDRAZINE plus Nitric Acid.

**Hydrazoic Acid**
See HYDRAZOIC ACID plus Nitric Acid.

**Hydrogen Iodide**
See HYDROGEN IODIDE plus Nitric Acid.

**Hydrogen Peroxide**
See HYDROGEN PEROXIDE plus Nitric Acid.

**Hydrogen Selenide**
See HYDROGEN SELENIDE plus Nitric Acid.

**Hydrogen Sulfide**
See HYDROGEN SULFIDE plus Nitric Acid.

**Hydrogen Telluride**
Cold fuming nitric acid ignites hydrogen telluride, sometimes explosively.
*Pascal* **10:** 505 (1931–1934).

**Indane and Sulfuric Acid**
See INDANE plus Nitric Acid and Sulfuric Acid.

**Isoprene**
See ISOPRENE plus Nitric Acid.

**Ketones and Hydrogen Peroxide**
See KETONES plus Nitric Acid and Hydrogen Peroxide.

**Lactic Acid and Hydrofluoric Acid**
A mixture of 5 parts lactic acid, 5 parts nitric acid, 2 parts water, and 1 part hydrofluoric acid being stored in a plastic bottle ruptured with explosive force.
*Scott* (1967). *NSC Newsletter Aero. Sec.* (May 1967).

**Lithium**
See LITHIUM plus Nitric Acid.

**Lithium Silicide**
See LITHIUM SILICIDE plus Nitric Acid.

**Magnesium**
See MAGNESIUM plus Nitric Acid.

**Magnesium Phosphide**
See MAGNESIUM PHOSPHIDE plus Nitric Acid.

**Magnesium-Titanium Alloy**
See TITANIUM-MAGNESIUM ALLOY plus Nitric Acid.

**Manganese**
See MANGANESE plus Nitric Acid.

**Mesitylene**
During oxidation of mesitylene with nitric acid in an autoclave at 115°C to give 3,5-dimethyl benzoic acid a violent explosion occurred. The reaction was attributed to local overheating, formation of a trinitro compound 1,3,5-tri(nitromethyl) benzene, and to violent decomposition of the latter. Smaller scale preparations with better temperature control were uneventful.
Wilma et al, *Angew. Chem. Intern, Ed. Engl.* **74:** 465 (1962).

**Mesityl Oxide**
See MESITYL OXIDE plus Nitric Acid.

**2-Methyl-5-Ethylpyridine**
*Chem. and Eng. News* **51** (34) 142 (1973).

**4-Methylcyclohexanone**
The oxidation by nitric acid of 4-methylcyclohexanone to form a dicarboxylic acid resulted in a violent explosion. The methylcyclohexanone was added gradually to the mixture held at 69 to 77°C. After an hour of this procedure, the mixture exploded.
*Chem. and Eng. News* **37** (35): 48 (1959).

**Neodymium Phosphide**
See NEODYMIUM PHOSPHIDE plus Nitric Acid.

**Nitrobenzene**
Mixtures of nitric acid and nitrobenzene are detonable, depending on the amount of water present.
*Chem. and Eng. News* **41** (37):89 (1963).
A series of mixtures of nitric acid with one or more of mono- and di-nitrobenzenes have been shown to possess high explosive properties.
*Urbanski* (1967).

**Oleum**
See OLEUM plus Nitric Acid.

**Organic Matter**
Nitric acid ignites spontaneously with some organic compounds, such as furfuryl alcohol and butyl mercaptan.
S. V. Gunn, *J. Am. Rocket Soc.* **22:** 33 (1952).
Barrere & Moutet, *Symposium Comb.* **(Fifth):** 170–81 (1954).

**Phosphine**
See PHOSPHINE plus Nitric Acid.

**Phosphonium Iodide**
See PHOSPHONIUM IODIDE plus Nitric Acid.

**Phosphorus**
See PHOSPHORUS plus Nitric Acid.

**Phosphorus Tetratriiodide**
See PHOSPHORUS TETRATRIIODIDE plus Nitric Acid.

**Phosphorus Trichloride**
See PHOSPHORUS TRICHLORIDE plus Nitric Acid.

**Phthalic Acid**
See PHTHALIC ANHYDRIDE plus Nitric Acid.

**Phthalic Anhydride**
See PHTHALIC ANHYDRIDE plus Nitric Acid.

**Potassium Hypophosphite**
See POTASSIUM HYPOPHOSPHITE plus Nitric Acid.

**Propiolactone (BETA-)**
See PROPIOLACTONE (BETA-) plus Nitric Acid.

**Propylene Oxide**
See PROPYLENE OXIDE plus Nitric Acid.

**Pyridine**
See PYRIDINE plus Nitric Acid.

**Rubidium Carbide**
See RUBIDIUM CARBIDE plus Nitric Acid.

**Selenium**
See SELENIUM plus Nitric Acid.

**Selenium Iodophosphide**
See SELENIUM IODOPHOSPHIDE plus Nitric Acid.


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**Silver and Ethyl Alcohol**
See SILVER plus Ethyl Alcohol and Nitric Acid.

**Sodium**
See SODIUM plus Nitric Acid.

**Sodium Azide**
See SODIUM AZIDE plus Nitric Acid.

**Sodium Hydroxide**
See SODIUM HYDROXIDE plus Nitric Acid.

**Stibine**
See STIBINE plus Nitric Acid.

**Sulfamic Acid**
See SULFAMIC ACID plus Nitric Acid.

**Sulfuric Acid and Glycerides**
Sulfuric acid, nitric acid and fat were placed in a tightly closed container. Within 10 minutes, the container exploded.
*Chem. and Eng. News* **51** (31): 32 (1973).

**Terpenes**
See NITRIC ACID plus Diborane.

**Tetraboron Decahydride**
See TETRABORON DECAHYDRIDE plus Nitric Acid.

**Thiocyanates**
See THIOCYANATES plus Nitric Acid.

**Thiophene**
See THIOPHENE plus Nitric Acid.

**Titanium**
See TITANIUM plus Nitric Acid.

**Titanium Alloy**
See TITANIUM ALLOY plus Nitric Acid.

**Titanium-Magnesium Alloy**
See TITANIUM-MAGNESIUM ALLOY plus Nitric Acid.

**Toluene and Sulfuric Acid**
If conditions are not properly controlled, the reaction of toluene with nitric acid is extremely violent especially in the presence of sulfuric acid, which takes up the water formed. Part of the hazard is from the formation of nitrocresols, which react and decompose violently on further nitration.
*Urbanski* **1:** 139, 931 (1964).

**Toluidine**
See NITRIC ACID plus Aniline.

**Triazine**
Nitrolysis of triazine with 99% nitric acid in a trifluoroacetic anhydride solvent caused a violent explosion at 36°C.
*Rolston* (1972).

**Unsymmetrical Dimethyl Hydrazine**
See UNSYMMETRICAL DIMETHYL HYDRAZINE plus Hydrogen Peroxide.
Also see UNSYMMETRICAL DIMETHYL-HYDRAZINE plus Nitric Acid, Nitrogen Tetroxide, and Sulfuric Acid.

**Uranium**
See URANIUM plus Nitric Acid.

**Uranium-Neodymium Alloy**
See URANIUM-NEODYMIUM ALLOY plus Nitric Acid.

**Uranium-Neodymium-Zirconium Alloy**
See URANIUM-NEODYMIUM-ZIRCONIUM ALLOY plus Nitric Acid.

**Vinyl Acetate**
See VINYL ACETATE plus Nitric Acid.

**Vinylidene Chloride**
See VINYLIDENE CHLORIDE plus Nitric Acid.

**Zinc**
See ZINC plus Nitric Acid.

**Zirconium-Uranium Alloys**
See ZIRCONIUM-URANIUM ALLOYS plus Nitric Acid.

## NITRIC OXIDE NO

**Aluminum**
See ALUMINUM plus Carbon Disulfide.

**Boron**
See BORON plus Nitrous Oxide.

**Carbon Disulfide**
A mixture of nitric oxide with the vapor of carbon disulfide gives a green luminous flame.
*Mellor* **8:** 436 (1946–1947).
These compounds react explosively with emission of light.
*Mellor* **8, Supp. 2:** 232 (1967).

**Chlorine Monoxide**
See CHLORINE MONOXIDE plus Nitric Oxide.

**Chromium**
See CHROMIUM plus Nitric Oxide.

**Fluorine**
See FLUORINE plus Nitric Oxide.

**Fuels**
Nitric oxide will burn with nearly all fuels which will burn with air.
*Symposium Comb.* **(Fourth):** 420 (1952).

**Hydrocarbons**
See NITRIC OXIDE plus Fuels.

**Nitrogen Trichloride**
See NITROGEN TRICHLORIDE plus Ammonia.

**Ozone**
See OZONE plus Nitric Oxide.

**Phosphine**
See PHOSPHINE plus Nitric Oxide.

**Phosphorus**
See PHOSPHORUS plus Nitric Oxide.

**Rubidium Carbide**
See RUBIDIUM CARBIDE plus Sulfur Dioxide.

**Sodium Monoxide**
See SODIUM MONOXIDE plus Nitric Oxide.

**Unsymmetrical Dimethylhydrazine**
This mixture ignites on sparking.
*Mellor* **8, Supp. 2:** 234 (1967).

**Uranium**
See URANIUM plus Nitric Oxide.



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## NITRILES

**Lithium Aluminum Hydride and Water**
See LITHIUM ALUMINUM HYDRIDE plus Nitriles and Water.

## NITRITES

**(See also specific nitrites as primary entries or see under other reactants)**

**Ammonium Salts**
A violent explosion occurs if an ammonium salt is melted with a nitrite salt.
*Von Schwartz,* p. 299 (1918).

**Cyanides**
See CYANIDES plus Chlorates.

**Potassium Cyanide**
A mixture of the two may cause an explosion.
*Pieters,* p. 30 (1957).
A molten salt bath containing nitrite salts was carefully cleaned before reuse with cyanide-containing salts. However, when the furnace was reheated, a violent reaction and eruption took place. Presumably a residue of nitrite had remained.
*Scott* (1966).

## o-NITROANILINE DIAZONIUM SALT
$O_2NC_6H_3(NO_2)NNX$

**Sodium Bisulfide**
See SODIUM SULFIDE plus Diazonium Salts and Diazonium Chloride Salts.

**Sodium Polysulfide**
See SODIUM SULFIDE plus Diazonium Salts and Diazonium Chloride Salts.

**Sodium Sulfide**
See SODIUM SULFIDE plus Diazonium Salts and Diazonium Chloride Salts.

## NITROANILINES

**Sulfuric Acid**
A series of o- and p-nitroaniline derivatives and analogues when heated with sulfuric acid to above 200°C undergo a vigorous reaction. o-Nitroaniline reacts almost explosively.
J. F. Hodgson, *Chem. & Ind.* (1968); *Bretherick* (1978).

## NITROANISOLE $O_2NC_6H_4OCH_3$

**(self-reactive)**
The explosion of 400 grams of o-nitroanisole during reduction using nickel as a catalyst has been reported.
*J. Am. Chem. Soc.* **53:** 2808 (1931).

**Hydrogen**
See HYDROGEN plus Nitroanisole.

## NITROAROMATIC COMPOUNDS

**Chlorine Trifluoride**
Solutions of nitroaromatic compounds in chlorine trifluoride are extremely sensitive to shock.
*Mellor* **2, Supp. 1:** 156 (1956).

## NITROBENZENE $C_6H_5NO_2$

**Aluminum Chloride and Phenol**
See ALUMINUM CHLORIDE plus Nitrobenzene and Phenol.

**Aniline and Glycerine**
See ANILINE plus Nitrobenzene and Glycerine.

**Nitric Acid**
See NITRIC ACID plus Nitrobenzene.

**Nitrogen Tetroxide**
See NITROGEN TETROXIDE plus Nitrobenzene.

**Silver Perchlorate**
See SILVER PERCHLORATE plus Acetic Acid.

## NITROBENZENESULFONIC ACID $O_2NC_6H_4SO_3H$

**(self-reactive)**
Nitrobenzene sulfonic acid is known to decompose violently at about 200°C.
*MCA Case History* 1482 (1968).

## o-NITROBENZOYLACETIC ACID
$O_2NC_6H_4COCH_2COOH$

**Thionyl Chloride**
See THIONYL CHLORIDE plus o-Nitrobenzoylacetic Acid.

## N-NITRO-N'2,4-DINITROPHENYLUREA
$(NO_2)_2C_6H_3NHCONHNO_2$

**(self-reactive)**
This compound is an explosive of less power than picric acid, but of greater sensitivity to friction and impact.
*Chem. and Eng. News* **18:** 72 (1940).

## NITROETHANE $C_2H_5NO_2$

**Calcium Hydroxide**
See CALCIUM HYDROXIDE plus Nitroethane.

**Hydrocarbons**
Nitroethane and other nitro compounds are mild oxidizers and should not be heated with easily oxidized hydrocarbons under confinement.
*Chem. and Eng. News* **30:** 2344 (1952).

**Hydroxides**
See CALCIUM HYDROXIDE plus Nitroethane.

**Inorganic Bases**
See CALCIUM HYDROXIDE plus Nitroethane.

**Potassium Hydroxide**
See CALCIUM HYDROXIDE plus Nitroethane.

**Sodium Hydroxide**
See CALCIUM HYDROXIDE plus Nitroethane.

## NITROFORM $CH(NO_2)_3$

**Isopropyl Alcohol**
Solutions of 90% nitroform in 10% isopropyl alcohol in polyethylene bottles exploded. Nitroform, especially when the concentration is 50% or greater, dissolves with evolution of heat. This heat is sufficient to initiate the reaction.
*ASESB Expl. Report* **175.** *MCA Case History* **1010** (1964).


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**NITROGEN** $N_2$

**Lithium**
See LITHIUM plus Oxygen.
See LITHIUM plus Nitrogen.

**Neodymium**
See NEODYMIUM plus Nitrogen.

**Titanium**
See TITANIUM plus Nitrogen.

**NITROGEN DIOXIDE** $NO_2$; $N_2O_4$

**(See also NITROGEN PEROXIDE)**

**Cyclohexane**
See CYCLOHEXANE plus Nitrogen Dioxide.

**Fluorine**
See FLUORINE plus Nitrogen Dioxide.

**Formaldehyde**
See FORMALDEHYDE plus Nitrogen Dioxide.

**NITROGEN IODIDE** $NI_3$

**Ozone**
See OZONE plus Nitrogen Iodide.

**NITROGEN IODIDES**

**(self-reactive)**
See IODINE plus Ammonium Hydroxide.

**NITROGEN PENTOXIDE** $N_2O_5$

**Sodium Carbide**
See SODIUM CARBIDE plus Nitrogen Pentoxide.

**NITROGEN PEROXIDE** $NO_2$; $N_2O_4$

**(See also NITROGEN TETROXIDE)**

**Acetic Anhydride**
This reaction in the attempt to synthesize tetranitromethane resulted in a violent explosion.
*Van Dolah* (1967).

**Aluminum**
See ALUMINUM plus Carbon Disulfide.

**Ammonia**
Solid nitrogen tetroxide reacts explosively with liquid ammonia. With gaseous ammonia, slow reactions start even when cold.
*Comp. Rend.* **116:** 756. Parker & Wolfhard, *Symposium Comb.* **(Fourth):** 420 (1952).
See NITRIC OXIDE plus Ammonia.

**Barium Oxide**
When nitrogen dioxide is passed over barium oxide (at 200°C.) the oxide becomes red-hot and fumes.
*Ann. Chim. et Phys.* (2) **2:** 317.

**Boron Trichloride**
See BORON TRICHLORIDE plus Nitrogen Peroxide.

**Carbon Disulfide**
Explosives can be prepared from nitrogen dioxide plus carbon disulfide. They can be heated to 200°C. without explosion, but can be detonated with mercury fulminate.
E. Turpin, *German Pat.* 19,676 (1881).

**Cesium Acetylene Carbide**
See CESIUM ACETYLENE CARBIDE plus Nitrogen Dioxide.

**Chloroform**
See NITROGEN TETROXIDE plus 1,2-Dichloroethane.

**1,2-Dichloroethane**
Nitrogen tetroxide forms explosive mixtures with incompletely halogenated hydrocarbons.
*Turley* (1964). *Chem. and Eng. News* **42** (47): 53 (1964).

**Dichloroethylene**
See NITROGEN TETROXIDE plus 1,2-Dichloroethane.

**Ethylene**
See NITROGEN TETROXIDE plus Olefins.

**Fuels**
Nitrogen dioxide burns readily with all fuels which burn in air.
Parker & Wolfhard, *Symposium Comb.* **(Fourth)**: 420 (1952).
See NITROGEN TETROXIDE plus Organic Matter.

**Hydrocarbons**
See NITROGEN TETROXIDE plus Fuels.

**Iron**
See IRON plus Nitrogen Dioxide.

**Magnesium**
See MAGNESIUM plus Nitrogen Dioxide.

**Manganese**
See MANGANESE plus Nitrogen Dioxide.

**Methylene Chloride**
See NITROGEN TETROXIDE plus 1,2-Dichloroethane.

**Olefins**
Nitrogen dioxide and olefins form extremely unstable nitrosates or nitrosites. Sabatier & Senderens, *Comp. Rend.* **116:** 756 (1893).

**Organic Matter**
Mixtures of nitrogen tetroxide and hydrocarbons are high explosives and some combinations are very hazardous.
*Damon* (1965).
See NITROGEN TETROXIDE plus Fuels.
See NITROGEN TETROXIDE plus Organic Matter.

**Ozone**
See OZONE plus Nitrogen Dioxide.

**Phospham**
See PHOSPHAM plus Nitrogen Dioxide.

**Phosphorus**
See MAGNESIUM plus Nitrogen Dioxide.

**Potassium**
See MANGANESE plus Nitrogen Dioxide.

**Propylene**
During an experiment to produce lactic acid by oxidizing propylene with nitrogen tetroxide, a violent explosion occurred. See also NITROGEN TETROXIDE plus Olefins.
*Fawcett* (1966). B. B. Brandt, et al., *Khim. Prom. SSSR* **3:** 204–10 (1961).

**Sodium**
See SODIUM plus Nitrogen Peroxide.

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**Sulfur**
See MAGNESIUM plus Nitrogen Dioxide.

**Tetrachloroethane (Asymmetrical)**
See NITROGEN TETROXIDE plus 1,2-Dichloroethane.

**1,1,1-Trichloroethane**
See NITROGEN TETROXIDE plus 1,2-Dichloroethane.

**Trichloroethylene**
See NITROGEN TETROXIDE plus 1,2-Dichloroethane.

**Tungsten Carbide**
See TUNGSTEN CARBIDE plus Nitrogen Dioxide.

## NITROGEN TETROXIDE $N_2O_4$

**Alcohols**
An explosion of these materials killed a research worker in a 1955 accident.
*Mellor* **8, Supp. 2:** 264 (1967).

**Nitrobenzene**
Mixtures of nitrogen tetroxide and nitrobenzene qualify as military explosives.
*Mellor* **8, Supp. 2:** 264 (1967).

**Petroleum**
An explosion of these materials killed 17 workers and devastated a plant in Bodio, Switzerland.
*Mellor* **8, Supp. 2:** 264 (1967).

**Toluene**
A mixture of these chemicals caused an explosion at an industrial plant in Zschornewitz.
*Mellor* **8, Supp. 2:** 264 (1967).

## NITROGEN TRIBROMIDE $NBr_3$

**Arsenic**
See ARSENIC plus Nitrogen Tribromide.

**Phosphorus**
See ARSENIC plus Nitrogen Tribromide.
See PHOSPHORUS plus Nitrogen Bromide.

## NITROGEN TRICHLORIDE $NCl_3$

**Ammonia**
Nitrogen trichloride explodes on contact with concentrated ammonia, arsenic, hydrogen sulfide, nitric oxide, organic matter, ozone, phosphine, phosphorus, potassium cyanide, potassium hydroxide, or selenium.
H. Davy, *Phil. Trans. Roy. Soc. London* **103:** 242 (1813). *Comp. Rend.* **70:** 539. E. Schneider, *Report Anal. Chem.* **1:** 54 (1881).

**Arsenic**
See ARSENIC plus Nitrogen Trichloride. See HYPOCHLORITES plus Urea.

**Dibutyl Ether**
During preparation of nitrogen trichloride by bubbling chlorine into an aqueous solution of ammonium sulfate and 100 ml. of the ether, 50 ml. of the ether-$NCl_3$ mixture over ammonium sulfate solution was stored in a refrigerator. Five minutes later, the mixture exploded violently.
*Chem. and Eng. News* **44** (31): 46 (1966).

**Grease**
Nitrogen trichloride is an explosive substance. Even grease from fingers can cause explosion.
*Ann. Chim. et Phys.* (1) **86:** 37.

**Hydrogen Sulfide**
See NITROGEN TRICHLORIDE plus Ammonia.

**Nitric Oxide**
See NITROGEN TRICHLORIDE plus Ammonia.

**Organic Matter**
See NITROGEN TRICHLORIDE plus Ammonia.

**Ozone**
See NITROGEN TRICHLORIDE plus Ammonia.
See OZONE plus Nitrogen Trichloride.

**Phosphine**
See NITROGEN TRICHLORIDE plus Ammonia.

**Phosphorus**
See NITROGEN TRICHLORIDE plus Ammonia.

**Potassium Cyanide**
See NITROGEN TRICHLORIDE plus Ammonia.

**Potassium Hydroxide**
See NITROGEN TRICHLORIDE plus Ammonia.

**Selenium**
See NITROGEN TRICHLORIDE plus Ammonia.

## NITROGEN TRIFLUORIDE $NF_3$

**Ammonia**
See HYDROGEN plus Nitrogen Trifluoride.

**Carbon Monoxide**
See HYDROGEN plus Nitrogen Trifluoride.

**Diborane**
Studies of nitrogen trifluoride and diborane revealed no interaction at room temperature and 1–8 atmospheres pressure. When the mixtures were handled as liquids at low temperatures, violent explosions occurred, even when precautions were made to eliminate $OF_2$ impurities.
*Lawless and Smith,* pp. 34–35 (1968).

**Hydrogen**
See HYDROGEN plus Nitrogen Trifluoride.

**Hydrogen Sulfide**
See HYDROGEN plus Nitrogen Trifluoride.

**Methane**
See HYDROGEN plus Nitrogen Trifluoride.

**Tetrafluorohydrazine**
Several hundred grams of a crude reaction mixture involving nitrogen trifluoride and tetrafluorohydrazine had been collected in a small stainless steel cylinder. During opening of valves to measure cylinder pressure, the cylinder exploded, killing one man and injuring another.
*MCA Case History* **683** (1966).

## NITROGEN TRIIODIDE $NH_3NI_3$

**(self-reactive)**
Nitrogen triiodide explodes under very slight shock.
Van Dolah (1966). *Chem. and Eng. News* **46** (9): 38 (1968). *Latimer and Hildebrand,* p. 202 (1951).

**Acids**
Addition of concentrated acids causes nitrogen triiodide to explode.
*Ann. Chim. et Phys.* (2) **69:** 88. *J. Am. Chem. Soc.* **10:** 332. *Comp. Rend.* **97:** 526.

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**Bromine**
See BROMINE plus Nitrogen Triiodide.

**Chlorine**
See BROMINE plus Nitrogen Triiodide.

**Hydrogen Sulfide**
See BROMINE plus Nitrogen Triiodide.

**Ozone**
See BROMINE plus Nitrogen Triiodide.

## NITROGEN TRIOXIDE $N_2O_3$

**Phosphine**
Phosphine gas ignites spontaneously if a trace of nitrogen trioxide is added.
T. Graham, *Edin. Roy. Soc.* **13:** 88 (1835).

## NITROGLYCERIN $C_3H_5(ONO_2)_3$

**Ozone**
See OZONE plus Nitroglycerin.

## NITROMETHANE $O_2NCH_3$

**Aluminum Chloride and Organic Matter**
See ALUMINUM CHLORIDE plus Nitromethane and Organic Matter.

**Calcium Hydroxide**
See CALCIUM HYDROXIDE plus Nitroethane.

**Calcium Hypochlorite**
See CALCIUM HYPOCHLORITE plus Nitromethane.

**Hexamethylbenzene**
See HEXAMETHYLBENZENE plus Nitromethane.

**Hydrocarbons**
See NITROETHANE plus Hydrocarbons.

**Hydroxides**
See CALCIUM HYDROXIDE plus Nitroethane.

**Inorganic Bases**
See CALCIUM HYDROXIDE plus Nitroethane.

**Organic Amines**
Nitromethane plus organic amines forms sensitive explosive mixtures.
*Van Dolah* (1966).

**Potassium Hydroxide**
See CALCIUM HYDROXIDE plus Nitroethane.

**Sodium Hydroxide**
See CALCIUM HYDROXIDE plus Nitroethane.

## NITROPARAFFINS

**Aluminum Chloride and Organic Matter**
See ALUMINUM CHLORIDE plus Nitromethane and Organic Matter.

**Calcium Hydroxide**
See CALCIUM HYDROXIDE plus Nitroethane.

**Hydrocarbons**
See NITROETHANE plus Hydrocarbons.

**Hydroxides**
See CALCIUM HYDROXIDE plus Nitroethane.

**Inorganic Bases**
See CALCIUM HYDROXIDE plus Nitroethane.

**Potassium Hydroxide**
See CALCIUM HYDROXIDE plus Nitroethane.

**Sodium Hydroxide**
See CALCIUM HYDROXIDE plus Nitroethane.

## o-NITROPHENOL $HO\text{-}C_6H_4\text{-}2NO_2$

**Potassium Hydroxide**
See POTASSIUM HYDROXIDE plus o-Nitrophenol.

## o-NITROPHENYLACETIC ACID $O_2NC_6H_4CH_2COOH$

**Thionyl Chloride**
See THIONYL CHLORIDE plus o-Nitrobenzoylacetic Acid.

## o-NITROPHENYLACETYL CHLORIDE $O_2NC_6H_4CH_2COCl$

**(self-reactive)**
Two explosions are reported: In one case, the solvent-free residue decomposed violently, generating black smoke and a red flame. In the other case, the residue exploded as soon as the chloroform solvent was evaporated. A similar finding with o-nitrobenzoyl chloride is referenced.
*Chem. and Eng. News* **42** (13):39 (1964).
*Chem. and Eng. News* **23:** 2394 (1945).
*J. Am. Chem. Soc.* **68:** 344 (1946).
May and Baker Ltd., *Chem. and Ind.* **39** (1946).

## m-NITROPHENYLDIAZONIUM PERCHLORATE $NO_2C_6H_4N(\equiv N)ClO_4$

**(self-reactive)**
This compound is very sensitive to heat and shock.
*ACS* **146:** 205. *Davis* (1943).

## NITROPROPANE $CH_3CH_2CH_2NO_2$

**Calcium Hydroxide**
See CALCIUM HYDROXIDE plus Nitroethane.

**Hydrocarbons**
See NITROETHANE plus Hydrocarbons.

**Hydroxides**
See CALCIUM HYDROXIDE plus Nitroethane.

**Inorganic Bases**
See CALCIUM HYDROXIDE plus Nitroethane.

**Potassium Hydroxide**
See CALCIUM HYDROXIDE plus Nitroethane.

**Sodium Hydroxide**
See CALCIUM HYDROXIDE plus Nitroethane.

## 2-NITROPROPANE $CH_3CHNO_2CH_3$

**Chlorosulfonic Acid**
See CHLOROSULFURIC ACID plus 2-Nitropropane.

**Oleum**
See OLEUM plus 2-Nitropropane.

## NITROSOPHENOL $ONC_6H_4OH$

**Acids**
Nitrosophenol explodes on heating or on addition of concentrated acids.
*Beilstein,* p. 600 (1909).



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## NITROSYL AZIDE ONNNN

**(self-reactive)**

This unstable yellow compound decomposes even at minus 50°C.
*Mellor* **8, Supp. 2:** 22 (1967).

## NITROSYL CHLORIDE ONCl

**Acetone**

Nitrosyl chloride sealed in a tube with a residue of acetone in the presence of platinum catalyst gave an explosive reaction.
*Chem. and Eng. News* **35** (43): 60 (1957).

**Aluminum**

See ALUMINUM plus Nitrosyl Chloride.

## NITROSYL FLUORIDE ONF

**Boron**

See BORON plus Nitrosyl Fluoride.

**Halogenated Olefin**

Excessive quantities of the two reactants in a reaction vessel caused the vessel to explode.
*MCA Case History* **928** (1963).

**Phosphorus**

See BORON plus Nitrosyl Fluoride.

**Silicon**

See BORON plus Nitrosyl Fluoride.

**Sodium**

See SODIUM plus Nitrosyl Fluoride.

## NITROSYL PERCHLORATE $ONOClO_3$

**(self-reactive)**

Decomposition of nitrosyl perchlorate begins just below 100°C. Above 100°C (115–120°C) a low order explosion occurs.
H. Gerding and W. F. Haak, *Chem. Weekblad* **52:** 282–3 (1956).

**Acetone**

Nitrosyl perchlorate ignites and explodes with acetone.
Hoffman & Zedtwitz, *Ann. Chem.* **42:** 2031 (1909).

**Amines**

Explosions occur with mixtures of nitrosyl perchlorate and primary amines. Hoffman & Zedtwitz, *Ann. Chem.* **42:** 2031 (1909).

**Cobalt Pentammine Triazo Perchlorate and Phenyl Isocyanate**

See PHENYL ISOCYANATE plus Cobalt Pentammine Triazo Perchlorate and Nitrosyl Perchlorate.

**Diethyl Ether**

Nitrosyl perchlorate ignites and explodes with diethyl ether.
Hoffman & Zedtwitz, *Ann. Chem.* **42:** 2031 (1909).

**Metal Salts**

The hot reaction of nitrosyl perchlorate with metal salts, which is a way to prepare perchorates, forms salts that are very explosive.
*Kirk and Othmer, Second Ed.* **5:** 69 (1963).

## NITROSYLSULFURIC ACID $O{=}NOSO_2OH$

**Dinitroaniline Hydrochloride**

An explosion occurred during the diazotization using nitrosylsulfuric acid which resulted in several fatalities. Subsequent tests have shown that this was due to the high concentration of reactants in the mixture.
*MCA Case History* **1763** (1971).

## NITROTOLUENES

**Nitric Acid**

A series of mixtures of nitric acid with one or more of di- and tri-nitrotoluenes have been shown to possess high explosive properties.
*Urbanski* (1967).

## p-NITROTOLUENE $O_2NC_6H_4CH_3$

**Sulfuric Acid**

para-Nitrotoluene and sulfuric acid exploded at 80°C.
*Chem. and Eng. News* **27:** 2504.

## NITROUS ACID $HNO_2$

**Phosphine**

See PHOSPHINE plus Nitrous Acid.

**Phosphorus Trichloride**

See PHOSPHORUS TRICHLORIDE plus Nitric Acid.

## NITROUS OXIDE $N_2O$

**(self-reactive)**

This compound decomposes explosively at high temperatures.
*Mellor* **8, Supp. 2:** 207 (1967).

**Aluminum**

See ALUMINUM plus Carbon Disulfide.

**Boron**

See BORON plus Nitrous Oxide.

**Hydrazine**

See NITROUS OXIDE plus Lithium Hydride.

**Lithium Hydride**

Spontaneous ignition occurs when nitrous oxide and lithium hydride or hydrazine are mixed.
*Mellor* **8, Supp. 2:** 214 (1967).

**Phenyl-Lithium**

See PHENYL-LITHIUM plus Nitrous Oxide.

**Phosphine**

See PHOSPHINE plus Nitrous Oxide.

**Sodium**

See SODIUM plus Nitrogen Peroxide.

**Tungsten Carbide**

See TUNGSTEN CARBIDE plus Nitrogen Dioxide.

## NITRYL CHLORIDE $O_2NCl$

**Ammonia**

Liquid ammonia reacts violently with nitryl chloride, even at minus 75°C.
*J. Am. Chem. Soc.* **74:** 3408–10 (1952).
*Mellor* **8, Supp. 1:** 331 (1964).

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**Stannic Bromide**
The reaction between nitryl chloride and stannic bromide or stannic iodide occurs with violence.
*J. Am. Chem. Soc.* **74:** 3408 (1952).

**Stannic Iodide**
See NITRYL CHLORIDE plus Stannic Bromide.

**Sulfur Trioxide**
Liquid sulfur trioxide reacts violently with nitryl chloride, even at 75°C.
*J. Am. Chem. Soc.* **74:** 3409 (1952).

## NITRYL FLUORIDE $O_2NF$

**Phosphorus**
See PHOSPHORUS plus Nitryl Fluoride.

**Potassium**
See POTASSIUM plus Nitryl Fluoride.

## NITRYL PERCHLORATE $O_2NOClO_3$

**Acetone**
See NITRYL PERCHLORATE plus Benzene.

**Benzene**
Nitronium perchlorate reacts with benzene, giving a slight explosion and flash. With acetone and diethyl ether, the reaction produces a sharper explosion.
*Chem. and Eng. News* **38** (15):5 (1960).

**Diethyl Ether**
See NITRYL PERCHLORATE plus Benzene.

**Organic Matter**
Nitryl perchlorate reacts with organic matter with a violence ranging from slight explosions to sharp detonations accompanied by fire.
*ACS* **146:**210. *Can. J. Research* **18** (B):358–62 (1940).

## NYLON

**Fluorine**
See FLUORINE plus Solid Nonmetals and Oxygen.

## OLEUM $H_2SO_4SO_3$

**Acetic Acid**
See ACETIC ACID plus Oleum.

**Acetic Anhydride**
See ACETIC ANHYDRIDE plus Oleum.

**Acetonitrile**
See ACETONITRILE plus Oleum.

**Acrolein**
See ACROLEIN plus Oleum.

**Acrylic Acid**
See ACRYLIC ACID plus Oleum.

**Acrylonitrile**
See ACRYLONITRILE plus Oleum.

**Allyl Alcohol**
See ALLYL ALCOHOL plus Oleum.

**Allyl Chloride**
See ALLYL CHLORIDE plus Oleum.

**2-Aminoethanol**
See 2-AMINOETHANOL plus Oleum.

**Ammonium Hydroxide**
Mixing oleum and 28% ammonium hydroxide in a closed container caused the temperature and pressure to increase.
*Flynn and Rossow* (1970). See Note under complete reference.

**Aniline**
See ANILINE plus Oleum.

**n-Butyraldehyde**
See n-BUTYRALDEHYDE plus Oleum.

**Cresol**
See CRESOL plus Oleum.

**Cumene**
See CUMENE plus Oleum.

**Dichloroethyl Ether**
See DICHLOROETHYL ETHER plus Oleum.

**Diethylene Glycol Monomethyl Ether**
See DIETHYLENE GLYCOL MONOMETHYL ETHER plus Oleum.

**Diisobutylene**
See DIISOBUTYLENE plus Oleum.

**Epichlorohydrin**
See EPICHLOROHYDRIN plus Oleum.

**Ethyl Acetate**
See ETHYL ACETATE plus Oleum.

**Ethylene Cyanohydrin**
Mixing oleum and ethylene cyanohydrin in a closed container caused the temperature and pressure to increase.
*Flynn and Rossow* (1970). See Note under complete reference.

**Ethylene Diamine**
See ETHYLENE DIAMINE plus Oleum.

**Ethylene Glycol**
See ETHYLENE GLYCOL plus OLEUM.

**Ethylene Glycol Monoethyl Ether Acetate**
See ETHYLENE GLYCOL MONOETHYL ETHER ACETATE plus Oleum.

**Ethyleneimine**
Mixing oleum and ethyleneimine in a closed container caused the temperature and pressure to increase.
*Flynn and Rossow* (1970). See Note under complete reference.

**Glyoxal**
See GLYOXAL plus Oleum.

**Hydrochloric Acid**
Mixing oleum and 36% hydrochloric acid in a closed container caused the temperature and pressure to increase.
*Flynn and Rossow* (1970). See Note under complete reference.

**Hydrofluoric Acid**
Mixing oleum and 48.7% hydrofluoric acid in a closed container caused the temperature and pressure to increase.
*Flynn and Rossow* (1970). See Note under complete reference.



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**Isoprene**
See ISOPRENE plus Oleum.

**Isopropyl Alcohol**
Mixing oleum and isopropyl alcohol in a closed container caused the temperature and pressure to increase. *Flynn and Rossow* (1970). See Note under complete reference.

**Mesityl Oxide**
See MESITYL OXIDE plus Oleum.

**Methyl Ethyl Ketone**
See METHYL ETHYL KETONE plus Oleum.

**Nitric Acid**
Mixing oleum and 70% nitric acid in a closed container caused the temperature and pressure to increase. *Flynn and Rossow* (1970). See Note under complete reference.

**2-Nitropropane**
Mixing oleum and 2-nitropropane in a closed container caused the temperature and pressure to increase. *Flynn and Rossow* (1970). See Note under complete reference.

**Propiolactone (BETA-)**
Mixing oleum and propiolactone (BETA-) in a closed container caused the temperature and pressure to increase. *Flynn and Rossow* (1970). See Note under complete reference.

**Propylene Oxide**
Mixing oleum and propylene oxide in a closed container caused the temperature and pressure to increase. *Flynn and Rossow* (1970). See Note under complete reference.

**Pyridine**
Mixing oleum and pyridine in a closed container caused the temperature and pressure to increase. *Flynn and Rossow* (1970). See Note under complete reference.

**Sodium Hydroxide**
See SODIUM HYDROXIDE plus Oleum.

**Styrene Monomer**
Mixing oleum and styrene monomer in a closed container caused the temperature and pressure to increase. *Flynn and Rossow* (1970). See Note under complete reference.

**Sulfolane**
Mixing oleum and sulfolane in a closed container caused the temperature and pressure to increase. *Flynn and Rossow* (1970). See Note under complete reference.

**Vinyl Acetate**
Mixing oleum and vinyl acetate in a closed container caused the temperature and pressure to increase. *Flynn and Rossow* (1970). See Note under complete reference.

**Vinylidene Chloride**
Mixing oleum and vinylidene chloride in a closed container caused the temperature and pressure to increase. *Flynn and Rossow* (1970). See Note under complete reference.

## ORGANIC MATTER

**Acetyl Peroxide**
See ACETYL PEROXIDE plus Solvents.

**Aluminum Chloride and Nitromethane**
See ALUMINUM CHLORIDE plus Nitromethanes and Organic Matter.

**Ammonium Nitrate**
See AMMONIUM NITRATE plus Organic Matter.

**Ammonium Perchlorate**
See SULFUR plus Ammonium Perchlorate.

**Barium Peroxide**
See BARIUM PEROXIDE plus Organic Matter.

**Benzoyl Peroxide**
See BENZOYL PEROXIDE plus Organic Matter.

**Boron Trichloride**
See BORON TRICHLORIDE plus Nitrogen Peroxide.

**Bromates**
See BROMATES plus Organic Matter.

**Bromine Monofluoride**
See BROMINE MONOFLUORIDE plus Water.

**Bromine Pentafluoride**
See BROMINE PENTAFLUORIDE plus Acetic Acid.

**Bromine Trifluoride**
See BROMINE MONOFLUORIDE plus Water.

**t-Butyl Peracetate**
See t-BUTYL PERACETATE plus Organic Matter.

**t-Butyl Perbenzoate**
See t-BUTYL PERBENZOATE plus Organic Matter.

**Calcium Hypochlorite**
See CALCIUM HYPOCHLORITE plus Organic Matter.

**Chlorates**
See BROMATES plus Organic Matter.

**Chloric Acid**
See CHLORIC ACID plus Organic Matter.
See ANTIMONY plus Chloric Acid.

**Chlorine**
See BROMINE MONOFLUORIDE plus Water.

**Chlorine Dioxide**
See CHLORINE DIOXIDE plus Organic Matter.

**Chlorine Monoxide**
See POTASSIUM plus Chlorine Monoxide.
See CHLORINE MONOXIDE plus Organic Matter.

**Chlorine Trifluoride**
See CHLORINE TRIFLUORIDE plus Organic Matter.
See also BROMINE MONOFLUORIDE plus Water.

**Chlorine Trioxide**
See CHLORINE TRIOXIDE plus Organic Matter.

**Chlorosulfonic Acid**
See CHLOROSULFURIC ACID plus Organic Matter.

**Chromic Anhydride**
See CHROMIC ANHYDRIDE plus Organic Matter.

**Diazomethane**
See DIAZOMETHANE (self-reactive).

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**Diisopropyl Peroxydicarbonate**
See DIISOPROPYL PEROXYDICARBONATE plus Organic Matter.

**Dioxygen Difluoride**
See DIOXYGEN DIFLUORIDE plus Organic Matter.

**Fluorine**
See FLUORINE plus Neoprene.
See FLUORINE plus Organic Matter.

**Fluorine Perchlorate**
See FLUORINE PERCHLORATE plus Organic Matter.

**Halogen Fluorides**
See BROMINE MONOFLUORIDE plus Water; see individual fluoride plus organic matter.

**Hydrogen Peroxide**
See HYDROGEN PEROXIDE plus Organic Matter.

**Hydrogen Peroxide and Sulfuric Acid**
See ALCOHOLS plus Hydrogen Peroxide and Sulfuric Acid.

**Iodates**
See BROMATES plus Organic Matter.

**Iodine Heptafluoride**
See BROMINE MONOFLUORIDE plus Water.

**Iodine Monochloride**
See IODINE MONOCHLORIDE plus Organic Matter.

**Iodine Pentafluoride**
See ARSENIC plus Iodine Pentafluoride.
See also BROMINE MONOFLUORIDE plus Water.
See also IODINE PENTAFLUORIDE plus Water.

**Iodine Pentoxide**
See CARBON plus Iodine Pentoxide.

**Liquid Air**
See CHARCOAL plus Liquid Air.

**Lithium**
See LITHIUM plus Organic Matter.

**Magnesium Perchlorate**
See MAGNESIUM PERCHLORATE plus Organic Matter.

**Manganese Heptoxide**
See MANGANESE HEPTOXIDE plus Organic Matter.

**Mercuric Nitrate**
See MERCURIC NITRATE plus Unsaturates; Aromatics.

**Nitrate-Nitrite**
See ALUMINUM plus Nitrate-Nitrite and Organic Matter.

**Nitric Acid**
See NITRIC ACID plus Organic Matter.

**Nitric Oxide**
See NITRIC OXIDE plus Fuels.

**Nitroethane**
See NITROETHANE plus Hydrocarbons.

**Nitrogen Trichloride**
See NITROGEN TRICHLORIDE plus Ammonia; Grease.

**Nitromethane**
See NITROMETHANE plus Hydrocarbons.

**Nitryl Perchlorate**
See NITRYL PERCHLORATE plus Organic Matter.

**Oxygen**
See OXYGEN plus Clothing.

**Ozone**
See OZONE plus Organic Matter.

**Peracetic Acid**
See PERACETIC ACID plus Organic Matter.

**Perchlorates**
See PERCHLORATES plus Organic Matter.

**Perchloric Acid**
See PERCHLORIC ACID plus Organic Fibers.

**Permanganates and Sulfuric Acid**
See PERMANGANATES plus Sulfuric Acid and Benzene.

**Permanganic Acid**
See PERMANGANIC ACID (self-reactive).

**Permonosulfuric Acid**
See PERMONOSULFURIC ACID plus Cotton; Organic Matter.

**Peroxides**
See PEROXIDES plus Organic Matter.

**Phosphoric Anhydride and Water**
See PHOSPHORIC ANHYDRIDE plus Organic Matter and Water.

**Phosphorus Oxychloride**
See PHOSPHORUS OXYCHLORIDE plus Organic Matter.

**Phosphorus Trichloride**
See PHOSPHORUS OXYCHLORIDE plus Organic Matter.

**Potassium Oxides**
See POTASSIUM plus Air.

**Potassium Permanganate**
See POTASSIUM PERMANGANATE plus Organic Matter.

**Sodium Chlorate**
See SODIUM CHLORATE plus Organic Matter.

**Sodium Chlorite**
See SODIUM CHLORITE plus Organic Matter.

**Sodium Peroxide**
See SODIUM PEROXIDE plus Organic Matter.

**Stannous Nitrate**
See STANNOUS NITRATE plus Organic Matter.

**Sulfur Monochloride**
See SULFUR MONOCHLORIDE plus Organic Matter.

## ORGANIC PERCHLORATES

**(self-reactive)**
Almost any organic perchlorate decomposes when heated. The ammoniacal and aminiacal compounds seem more sensitive than the others. The amine perchlorates have explosion temperatures in the range of 250°C to 300°C. None explodes below 200°C.
*ACS* **146:** 204–20 (1960).



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**ORGANIC SULFIDES** RSR

**Calcium Hypochlorite**
See CALCIUM HYPOCHLORITE plus Organic Sulfides.

**OSMIUM** Os

**Chlorine Trifluoride**
See ANTIMONY plus Chlorine Trifluoride.

**Oxygen Difluoride**
See IRIDIUM plus Oxygen Difluoride.

**OSMIUM-AMMINE NITRATES**

**(self-reactive)**
Osmium-ammine nitrates may be impact-sensitive. $Os(NH_3)_4O_2(NO_3)_2$ crystals are very unstable.
*Mellor* **15:** 727 (1946–1947).

**OSMIUM-AMMINE PERCHLORATES**

**(self-reactive)**
Osmium-ammine perchlorates may be impact-sensitive.
*Mellor* **15:** 727 (1946–1947).

**OXALIC ACID** HOCOCOOH

**Furfuryl Alcohol**
See FURFURYL ALCOHOL plus Oxalic Acid.

**Silver**
See SILVER plus Oxalic Acid.

**Sodium Chlorite**
See SODIUM CHLORITE plus Oxalic Acid.

**Sodium Hypochlorite**
See SODIUM HYPOCHLORITE plus Oxalic Acid.

**OXALYL BROMIDE** BrCOCOBr

**Sodium-Potassium Alloy**
See SODIUM-POTASSIUM ALLOY plus Oxalyl Bromide.

**OXALYL CHLORIDE** ClCOCOCl

**Sodium-Potassium Alloy**
See SODIUM-POTASSIUM ALLOY plus Oxalyl Bromide.

**OXIDIZING AGENTS**

**Carbides**
See CARBIDES plus Oxidizing Agents.

**OXODISILANE** $H_3SiSiHO$

**Air**
Oxodisilane is spontaneously flammable in air.
*Z. Anorg. Chemie* **117:** 209. *Hurd,* pp. 36, 73 (1952).

**OXOSILANE** $H_2SiO$

**Air**
Oxosilane is spontaneously flammable in air.
*Z. Anorg. Chemie* **117:** 209.
See also CHLORINE plus Oxomonosilane.

**Chlorine**
See CHLORINE plus Oxomonosilane.

**OXYGEN** $O_2$

**Aluminum**
See ALUMINUM plus Oxygen.

**Aluminum Borohydride**
Explosive reaction occurs at temperatures as low as 20°C. Explosive range: 5% to 90%.
*J. Am. Chem. Soc.* **71:** 2950.

**Aluminum Hydride**
Aluminum hydride is spontaneously flammable in oxygen or air.
*Lockheed,* p. 8 (1960).

**Beryllium Borohydride**
Beryllium borohydride reacts explosively with oxygen or water.
A. J. Stosick, *Acta Crystallogr.* **5** (1): 15 (1952).

**Boron Arsenotribromide**
In contact with air or oxygen, this material is readily oxidized, and in most cases ignites spontaneously.
*Mellor* **9:** 57 (1946–1947).

**Boron Decahydride**
Boron decahydride ignites spontaneously when exposed to air or oxygen.
*Mellor* **5:** 36 (1946–1947).

**Boron Trichloride**
Oxygen and boron trichloride react vigorously on sparking.
*Mellor* **5:** 131 (1946–1947).

**Butane and Nickel Carbonyl**
See NICKEL CARBONYL plus n-Butane and Oxygen.

**Calcium**
See CALCIUM plus Oxygen.

**Calcium Phosphide**
See SULFUR plus Calcium Phosphide.

**Cesium**
See CESIUM plus Oxygen.

**Cesium Hydride**
Cesium hydride ignites in oxygen at room temperature.
*Brauer* (1965).

**Chlorotrifluoroethylene and Bromine**
See CHLOROTRIFLUOROETHYLENE plus Oxygen and Bromine.

**Clothing**
The normal 2–3 per cent oxygen enrichment of air supplied to an air-supplied suit was upset by failure of the air-oxygen mix valve so that the enrichment was 68–76 per cent. A worker who had disconnected supply and exhaust lines removed his helmet and lighted a cigarette. Apparently a spark from the cigarette lighted his oxygen-saturated underwear and also the pressure suit.
*MCA Case History* **884** (1963).

**Decaborane**
Decaborane is spontaneously flammable in oxygen.
*Chem. Safety Data Sheet* **SD 84** (1961).

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**Diborane**
Oxygen and diborane form spontaneously explosive mixtures.
A. T. Whately and R. N. Pease, *J. Am. Chem. Soc.* **76:** 1997–1999 (1954).

**Diethyl Ether**
See OXYGEN plus Ethers.

**Diphenylethylene**
An explosion was observed at the auto-oxidation of diphenylethylene with oxygen under high pressure at low temperature.
H. Staudinger, *Z. Electrochem.* **31:** 549-52 (1925).

**Disilane**
Disilane, trisilane, or tetrasilane, when mixed with oxygen or air at ordinary temperatures, ignites or explodes.
*Mellor* **6:** 232–4 (1946–1947).

**Ethers**
In the presence of oxygen or air, ethers form peroxides which may explode spontaneously or when heated.
*Haz. Chem. Data* (1966). *MCA Case History* **616** (1960).
Ethyl ether forms peroxides which may explode when heated to about 100°C.
*Chem. Safety Data Sheet* **SD-29** (1965).
Isopropyl ether, which had stood on the shelf a long time, exploded when the stuck cap on the bottle was freed.
*MCA Case History* **603** (1960).

**Germanium**
See GERMANIUM plus Oxygen.

**Hydrazine**
Oxygen and hydrazine form explosive mixtures.
*Mellor* **8, Supp. 2:** 72 (1967).

**Hydrogen**
See HYDROGEN plus Air; Oxygen.

**Isopropyl Ether**
Isopropyl ether tends to react with oxygen from the air to form unstable peroxides which may detonate with extreme violence. Several incidents are cited.
*NSC Newsletter, Chem. Sec.* (May 1966).
See also OXYGEN plus Ethers.

**Lithium**
See LITHIUM plus Oxygen.

**Nickel Carbonyl and Butane**
See NICKEL CARBONYL plus n-Butane and Oxygen.

**Organic Materials**
See OXYGEN plus Clothing.

**Oxygen Difluoride and Water**
Violent explosions resulted when a spark was discharged in a mixture containing 25–70% oxygen difluoride in oxygen over water.
*Mellor* **2, Supp. 1:** 191 (1956).

**Phosphine**
This reaction is explosive at ordinary temperatures.
*Mellor* **8, Supp. 3:** 281 (1971).

**Phosphorus**
See PHOSPHORUS plus Oxygen.

**Phosphorus Trifluoride**
Phosphorus trifluoride does not burn in air, but if it is mixed with oxygen, the gases explode.
*Comp. Rend.* **138:** 789. *Mellor* **8:** 995 (1946–1947).

**Phosphorus Trioxide**
See PHOSPHORUS TRIOXIDE plus Air.

**Polyurethane**
In the form of foam, polyurethane, and also polyvinyl chloride, have exploded when saturated with liquid oxygen.
*Ind. Saf. Equip.*, p. 54 (June 1964).

**Polyvinyl Chloride**
See OXYGEN plus Polyurethane.

**Potassium and Carbon Monoxide**
See POTASSIUM plus Carbon Monoxide and Oxygen.

**Potassium Peroxide**
The reaction of oxygen and potassium peroxide is violent at pressures of oxygen as low as 10 mm.
*Mellor* **2, Supp. 3:** 1626 (1963).

**Rubidium**
See RUBIDIUM plus Oxygen.

**Selenium**
See SELENIUM plus Oxygen.

**Sodium Hydride**
Sodium hydride in oxygen ignites at 230°C.
*Mellor* **2:** 483 (1946–1947).

**Teflon®(Polytetrafluoroethylene)**
Teflon®ignited at 1,300°F. in a 5 psia pure oxygen atmosphere, when used as a 20 AWG wire insulation. Polyolefin insulation ignites at about 1,100°F. under the same conditions.
*N.A. Aviation* (1964).
The combustion of Teflon®in oxygen to give carbonyl fluoride is highly exothermic but a large ignition source is required. The minimum ignition temperature is 465°C even under 7500 psi of oxygen gas.
The ignition of Teflon® tubing at –61°C in supercritical oxygen at 900 psi required a hot nickel-chromium wire as an initiator.
*Chem. and Eng. News*, p. 2 (October 7, 1991).

**Tetrafluorohydrazine**
An explosive reaction of these two chemicals is likely in the presence of organic matter.
*Mellor* **8, Supp. 2:** 113 (1967).

**Tetrasilane**
See OXYGEN plus Disilane.

**Titanium Alloy**
See TITANIUM ALLOY plus Oxygen.

**1,1,1-Trichloroethane**
The sides of a 5,000 psi autoclave were bulged by an explosive reaction between oxygen and 1,1,1-trichloroethane when the pressurized mixture was brought up to 100°C. and 790 psi and allowed to stand for three hours.
*Chem. and Eng. News* **35** (43): 60 (1957).

**Trichloroethylene**
The explosion of an oxygen pipe under pressure (400 psi) in a metallurgical factory was apparently due to the remains of trichloroethylene which was used for the previ-



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ous cleaning of the pipes. Tests showed it was possible to make a stoichiometric mixture of trichloroethylene and oxygen vapors explode.
U. Weber, *Chim. Ind. (Paris)* **90** (3): 178–83 (1963).

**Trisilane**
See OXYGEN plus Disilane.

## OXYGEN (LIQUID) $O_2$

**Aluminum**
See ALUMINUM plus Oxygen.

**Asphalt**
During transfer of liquid oxygen from a factory reservoir to a tanker truck, some of the liquid leaked from a coupling to the asphalt surface below. When the trucker dropped a hammer on this surface, a violent explosion formed a crater 20 inches square by 4 inches deep in the asphalt and broke windows nearby.
U. Weber, *Chim. Ind. (Paris)* **90** (3); 178–83 (1963).

**Benzene**
*Liquid* oxygen (LOX) gives an explosive mixture when combined with benzene.
*Kirschenbaum* (1956).

**Carbon Monoxide**
*Liquid* oxygen gives an explosive mixture when combined with *liquid* carbon monoxide.
*Kirschenbaum* (1956).

**Carbon Tetrachloride**
See OXYGEN (LIQUID) plus Chlorinated Hydrocarbons.

**Chlorinated Dye Penetrants**
See OXYGEN (LIQUID) plus Chlorinated Hydrocarbons.

**Chlorinated Hydrocarbons**
Several halogenated solvents reacted explosively with liquid oxygen when ignited with a high energy source: 1,1,1-trichloroethane, methylene chloride, trichloroethylene, chlorinated dye penetrants, and carbon tetrachloride. The carbon tetrachloride exploded only mildly. Behavior of these chemicals is similar with nitrogen tetroxide.
*Chem. and Eng. News* **43** (24): 41 (1965).
*BM Report Invest.* **6766** (1966)

**Cyanogen**
*Liquid* oxygen gives an explosive mixture when combined with *liquid* cyanogen.
*Kirschenbaum* (1956).

**Fuels**
Liquid oxygen plus ordinary fuels, hydrocarbons, and many other organic compounds are powerful explosives.
*BM Bull.* **472** (1949). *Kirschenbaum* (1956).
*MCA Case Histories* **824** (1962) and **865** (1963).
*Houghton* (1966).

**Hydrazine**
Spontaneous ignition occurs when these chemicals are mixed.
*Mellor* **8, Supp. 2:** 95 (1967).

**Hydrocarbons**
See OXYGEN (LIQUID) plus Fuels.

**Lithium Hydride**
*Liquid* oxygen gives an explosive mixture when combined with lithium hydride.
*Kirschenbaum* (1956).

**Magnesium**
See MAGNESIUM plus Oxygen.

**Methane**
*Liquid* oxygen gives an explosive mixture when combined with liquid methane.
*Kirschenbaum* (1956).

**Methylene Chloride**
See OXYGEN (LIQUID) plus Chlorinated Hydrocarbons.

**Oil**
Traces of oil on the ball bearing of a centrifugal pump reacted with liquid oxygen being transferred by the pump. The heat of reaction vaporized the oxygen and the pump burst from pressurization.
U. Weber, *Chim. Ind. (Paris)* **90** (3): 178–83 (1963).

**Paraformaldehyde**
*Liquid* oxygen gives an explosive mixture when combined with paraformaldehyde.
*Kirschenbaum* (1956).

**Titanium**
See TITANIUM plus Oxygen.

**1,1,1-Trichloroethane**
See OXYGEN (LIQUID) plus Chlorinated Hydrocarbons.

**Trichloroethylene**
See OXYGEN (LIQUID) plus Chlorinated Hydrocarbons.

**Wood and Charcoal**
In a plant manufacturing liquid and gaseous oxygen, spruce wood flooring encased in iron sheeting was charred by an undetected, smoldering fire started by a welding spark. Subsequent leakage of liquid oxygen saturated the charred wood and a violent explosion resulted.
U. Weber, *Chim. Ind. (Paris)* **90** (3): 178–83 (1963).

## OXYGEN DIFLUORIDE $OF_2$

**Aluminum Chloride**
A vigorous reaction occurs between oxygen difluoride and aluminum chloride, arsenic trioxide, chronic oxide, or phosphorus pentoxide.
*Mellor* **2, Supp. 1:** 192 (1956).

**Ammonia**
Oxygen difluoride and ammonia react immediately with white fumes.
*Mellor* **2, Supp. 1:** 192 (1956).

**Arsenic Trioxide**
See OXYGEN DIFLUORIDE plus Aluminum Chloride.

**Bromine**
See BROMINE plus Oxygen Difluoride.

**Carbon Monoxide**
See HYDROGEN plus Oxygen Difluoride.

**Chlorine**
See CHLORINE plus Oxygen Difluoride.



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**Chlorine and Copper**
See CHLORINE plus Oxygen Difluoride.

**Chromic Oxide**
See OXYGEN DIFLUORIDE plus Aluminum Chloride.

**Hydrogen**
See HYDROGEN plus Oxygen Difluoride.

**Hydrogen Sulfide**
Oxygen difluoride and hydrogen sulfide explode on mixing.
*Mellor* **2, Supp. 1:** 192 (1956).

**Iodine**
See BROMINE plus Oxygen Difluoride.

**Iridium**
See IRIDIUM plus Oxygen Difluoride.

**Methane**
See HYDROGEN plus Oxygen Difluoride.

**Osmium**
See IRIDIUM plus Oxygen Difluoride.

**Oxygen and Water**
See OXYGEN plus Oxygen Difluoride and Water.

**Palladium**
See IRIDIUM plus Oxygen Difluoride.

**Phosphorus Pentoxide**
See OXYGEN DIFLUORIDE plus Aluminum Chloride.

**Platinum**
See IRIDIUM plus Oxygen Difluoride.

**Rhodium**
See IRIDIUM plus Oxygen Difluoride.

**Ruthenium**
See IRIDIUM plus Oxygen Difluoride.

**Silica**
Liquid oxygen difluoride and 60/80 mesh silica gel at about 254 mm. pressure and –196°C. exploded. The presence of moisture was suspected.
A. G. Streng, *Chem. Rev.* **63** (6):607–624 (1963).
*Chem. and Eng. News* **43** (7):41 (1965); **43** (15):41 (1965).

## OZONE $O_8$

**Aniline**
Aniline in an atmosphere of ozone forms as one of the products a white, gelatinous explosive compound, ozobenzene.
*Mellor* **1:** 911 (1946–1947).

**Benzene**
Benzene in an atmosphere of ozone forms formic, acetic, oxalic, and other acids as well as a white gelatinous explosive compound called ozobenzene.
*Mellor* **1:** 911 (1946–1947). R.W. Murray, *Acc. Chem. Res.* **1**(10): 313 (1968).

**Bromine**
Severe explosions occur in attempts to form tribromine octoxide from these reactants.
*Mellor* **2, Supp. 1:** 748 (1956).

**Diallyl Methyl Carbinol and Acetic Acid**
See DIALLYL METHYL CARBINOL plus Ozone and Acetic Acid.

**Diethyl Ether**
A mixture of ether and ozone forms aldehyde and acetic acid and a heavy liquid, ethyl peroxide, which is explosive.
*Mellor* **1:** 911 (1946–1947).

**Dinitrogen Pentoxide**
Mixtures of ozone and dinitrogen pentoxide are flammable or explosive.
*Mellor* **8, Supp. 2:** 276 (1967).

**Ethylene**
Ozone and ethylene react explosively.
*Berichte* **38:** 3837.
*Mellor* **1:** 911 (1946–1947).

**Hydrogen Bromide**
These chemicals react instantaneously, exploding except at low pressure of 2–3 mm mercury.
*Mellor* **2, Supp. 1:** 736 (1956).

**Hydrogen Iodide**
The reaction between these chemicals is even more energetic than between ozone and hydrogen bromide.
*Mellor* **2, Supp. 1:** 736 (1956).

**Nitric Oxide**
Mixtures of nitric oxide and ozone explode even when the quantity of ozone is small.
*Mellor* **8:** 432 (1946–1947).
Mixtures of ozone and nitric oxide explode violently at liquid-air temperatures.
*Mellor* **8, Supp. 2:** 164 (1967).

**Nitrogen Dioxide**
Nitrogen dioxide and ozone react with the evolution of light, and often explode.
Pinkus & Schulthess, *J. Chem. Phys.* **18:** 366 (1920).

**Nitrogen Trichloride**
See NITROGEN TRICHLORIDE plus Ammonia.
A mixture of ozone and nitrogen trichloride will explode.
*Mellor* **1:** 911 (1946–1947).

**Nitrogen Triiodide**
See BROMINE plus Nitrogen Triiodide.
Ozone and nitrogen triiodide form an explosive mixture.
*Mellor* **1:** 911 (1946–1947).

**Nitroglycerin**
Ozone and nitroglycerin explode on mixing.
*Mellor* **1:** 911 (1946–1947).

**Organic Liquids**
When some organic liquids are dropped into liquid ozone, explosions sometimes result. This phenomenon was observed in ozone that was formed by neutron or gamma-ray excitation of liquid oxygen. Also ozone itself was observed to decompose with small explosions in such an environment.
F. E. Adley, *Nucl. Sci. Abstr.* **17:** 18 (1962).

**Organic Matter**
Liquid ozone is particularly likely to explode when it reaches the boiling point of the ozone or when brought in contact with oxidizable substances.
*Mellor* **1:** 894 (1946–1947).

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**Stibine**
Stibine and ozone explode at 90°C.
*Berichte* **38:** 3837.
*Mellor* **1:** 907 (1946–1947).

## PALLADIUM Pd

**Aluminum**
See ALUMINUM plus Palladium.

**Hydrogen and Isopropyl Alcohol**
See HYDROGEN plus Palladium and Isopropyl Alcohol.

**Oxygen Difluoride**
See IRIDIUM plus Oxygen Difluoride.

**Sulfur**
Sulfur and palladium react with incandescence.
J. J. Berzelius, *Acad. Handl.* **33:** 175 (1813).

## PALLADIUM-AMMINE NITRATES

**(self-reactive)**
Palladium-ammine nitrates may be impact-sensitive. $Pd(NH_3)_2(NO_3)_2$ and Pd $(NH_3)_4(NO_3)_2$ detonate violently when heated.
*Mellor* **15:** 685 (1946–1947).

## PALLADIUM-AMMINE PERCHLORATES

**(self-reactive)**
Palladium-ammine perchlorates may be impact-sensitive.
*Mellor* **15:** 684 (1946–1947).

## PARAFORMALDEHYDE $(HCHO)_n$

**Oxygen**
See OXYGEN (LIQUID) plus Paraformaldehyde.

## PARALDEHYDE

**Nitric Acid**
Oxidation of paraldehyde to glyoxal by action of nitric acid is subject to an induction period, and the reaction can become violent if the paraldehyde is added too fast. Presence of nitrous acid eliminates the induction period.
*Bretherick* (1978).

## PARATHION $(C_2H_5O)_2P(S)OC_6H_4NO_2$

**(self-reactive)**
When a sample was heated in a small test tube it decomposed and in a few minutes the residue exploded.
J. B. McPherson and G. A. Johnson, *Agri. Food Chem.* **4** (1): 42 (1956).

**Endrin**
While a mixture of parathion and endrin were being blended into a petroleum solvent an exothermic reaction occurred which caused some of the solvent to vaporize. The solvent vapor-air mixture exploded. Overheating, possibly caused by mechanical agitation, started the exothermic reaction.
*Doyle* (1973).

## PENTABORANE (9) $B_5H_9$

**Air**
Pentaborane is spontaneously flammable in air.
*Handbook Chem. Phys.* (1958). *Sevegin* (1963).

## PENTACHLOROETHANE $C_2HCl_5$

**Sodium-Potassium Alloy**
See SODIUM-POTASSIUM ALLOY plus Bromoform.

## PENTAMETHYLDIALUMINUM HYDRIDE $(CH_3)_3Al_2H(CH_3)_2$

**Air**
Pentamethyl aluminum hydride is spontaneously flammable in air.
*Hurd*, p. 98 (1952).

## PENTOL (3-METHYL-2-PENTEN-4YN-1-OL) $CH{\equiv}CC(CH_3){=}CHCH_2OH$

**Hydrogen**
See HYDROGEN plus 1-Pentol.

**Sodium Hydroxide**
See SODIUM HYDROXIDE plus Pentol.

## "PER" ACIDS (PERFORMIC, PERACETIC, etc.)

**Olefins**
Reactions between "per" acids and olefins are vigorously exothermic. Means should be provided for dissipation of heat.
*Chem. and Eng. News* **28:** 418, 3067 (1950).
See also "PEROXY" ACIDS

## PERCHLORATES

**(See also specific perchlorates as primary entries or under other reactants)**

**Benzene**
Certain metal perchlorates recrystallized from benzene or ethyl alcohol can explode spontaneously.
*J. Am. Chem. Soc.* **62** (10): 3524 (October 1940).

**Calcium Hydride**
See BROMATES plus Calcium Hydride.

**Charcoal**
Perchlorates explode when melted with reducing agents or when projected into red-hot charcoal.
*Berichte* **39:** 3146.

**Ethyl Alcohol**
See PERCHLORATES plus Benzene.

**Metals**
When perchlorates are mixed with finely divided metals, the mixture may be explosive.
*ACS* **146:** 188. *Lab. Govt. Chemist* (1965).

**Organic Matter**
Perchlorates will render organic matter easily flammable. When perchlorates are mixed with finely divided organic matter, they may be explosive.
*ACS* **146:** 188. *Lab. Govt. Chemist* (1965).

**Reducing Agents**
See PERCHLORATES plus Charcoal.

**Strontium Hydride**
See BROMATES plus Strontium Hydride.

**Sulfur**
See SULFUR plus Perchlorates.


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**Sulfuric Acid**
A mixture of the two may cause an explosion.
*Pieters,* p. 30 (1957).

## PERCHLORIC ACID $HClO_4$

**(self-reactive)**
Anhydrous perchloric acid can decompose explosively at atmospheric pressure. On storage even in the dark, the anhydrous acid becomes discolored owing to decomposition products, e.g. chlorine dioxide, and may explode spontaneously.
*ACS* **146:** 190.
After an animal carcass was dissolved in nitric acid, fat was skimmed off and 125 milliliters of perchloric acid was added. The sample was heated on a hot plate to dryness in a 1-liter beaker after which two samples were placed on a stainless steel steam tray (steam off). When the samples were touched, they exploded.
*Chem. and Eng. News.* **51** (6): 29 (Feb. 5, 1973).

**Acetic Acid**
Explosions involving these materials have occurred in electrolytic polishing baths. The violence in some cases approached that of a true high explosive.
*ACS* **146:** 193. *Rev. Met.* **46:** 549–60 (1949).
*Mem. Poudres* **32:** 179–96 (1950). *Report L.A. Fire Department. NFPA Quarterly* **40** (4): 275–78 (April 1947).

**Acetic Acid and Acetic Anhydride**
Mixtures of these three ingredients have varying degrees of sensitivity to shock. Vapors above the heated mixtures are flammable.
*ACS* **146:** 193–4. *Rev Met.* **46:** 549–60 (1949).
*Mem. Poudres* **32:** 179–96 (1950).

**Acetic Anhydride**
An electropolishing mixture of 170 gallons of 68–72% perchloric acid and 70 gallons of acetic anhydride exploded with devastating effect some time after the refrigerative temperature control of the tank had been turned off. A plastic holder had been inserted into the solution just before the explosion.
*ACS* **146:** 187. *BM Explos. Div. Rep.* **3034-C-443** (1947).
The addition of acetic anhydride to an aqueous solution of perchloric acid causes the formation of acetic acid which can react violently with the perchloric acid.
*Rev. Met.* **46** (8): 549–560 (1949).
*Mem. Poudres* **32:** 179–196 (1950).

**Alcohols**
The contact of hot, concentrated perchloric acid with alcohols or cellulose is particularly dangerous.
*ACS* **146:** 189, 195. E. M. Harris, *Chem. Eng. 56* (1):116–7 (1949).

**Aniline and Formaldehyde**
Aniline treated with perchloric acid, then formaldehyde, gives a resinous condensation product which burns with explosive violence.
*Aniline,* p. 85 (1964). *U.S. Pat.* 2,871,224.

**Antimony Compounds (trivalent)**
See ANTIMONY COMPOUNDS (trivalent) plus Perchloric Acid.

**Bismuth**
See BISMUTH plus Perchloric Acid.

**Cellulose**
See PERCHLORIC ACID plus Alcohols.

**Charcoal**
A drop of anhydrous perchloric acid on charcoal causes a violent explosion.
*ACS* **146:** 188.

**Dibutyl Sulfoxide**
A 70% perchloric acid solution reacts instantly and explosively on contact with dibutyl sulfoxide.
*Wischmeyer* (1973).

**Diethyl Ether**
A drop of anhydrous perchloric acid in ether causes a violent explosion.
*ACS* **146:** 188. *Am. Chem. J.* **23:** 444 (1900).

**Dimethyl Sulfoxide**
See DIMETHYL SULFOXIDE plus Perchloric Acid.

**Ethyl Alcohol**
In mineral analysis the potassium cation is sometimes identified by adding perchloric acid in the presence of ethyl alcohol concentration. Explosions frequently occur that are due to the spontaneous decomposition of ethyl perchlorate formed during concentration and of residual perchloric acid. With methyl alcohol, the reaction is identical except that the methyl perchlorate that is formed is very explosive.
*Analyst* **80:** 10 (1955).

**Fluorine**
See FLUORINE plus Perchloric Acid.

**Glycerine and Lead Oxide**
See LEAD OXIDE plus Glycerine and Perchloric Acid.

**Glycol Ethers**
Glycol ethers, glycols, ketones, and alcohols undergo violent decomposition in contact with 68–72% perchloric acid.
*ACS* **146:** 195. *U.S. Patent* 2,504,119.

**Glycols**
See PERCHLORIC ACID plus Glycol Ethers.

**Hydriodic Acid**
Perchloric acid ignites with hydriodic acid.
*Am. Chem. J.* **23:** 444 (1900).

**Hydrochloric Acid**
See HYDROCHLORIC ACID plus Perchloric Acid.

**Hydrogen**
The explosion temperature of hydrogen-perchloric acid vapor mixtures is lowered from 400 to 215°C by the presence of steel particles.
*ACS* **146:** 189. *Angew. Chem.* **52:** 616–18 (1939).

**Hypophosphites**
See HYPOPHOSPHITES plus Perchloric Acid.

**Ketones**
See PERCHLORIC ACID plus Glycol Ethers.

**Methyl Alcohol**
See PERCHLORIC ACID plus Ethyl Alcohol.

**Nitrogen Iodide**
See NITROGEN TRIIODIDE plus Acids.

**Nitrosophenol**
See NITROSOPHENOL plus Acids.



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**Organic Matter**

Perchloric acid can cause fire or explosion in most organic materials. Example: When bis(2-hydroxyethyl)-terephthalate, being refluxed with 5% perchloric acid in ethyl alcohol, was allowed to go to dryness, there was a violent explosion. A similar mixture, containing also ethylene glycol, flashed brightly after 18 hours refluxing. See also the other organic entries under perchloric acid.
*Wheeler* (1969).

**Paper**

A drop of anhydrous perchloric acid on paper can cause a violent explosion.
*ACS* **146:** 188.

**Phosphorus Pentoxide**

See PERCHLORIC ACID plus Sulfuric Acid.

**Phosphorus Pentoxide and Chloroform**

See PHOSPHORUS PENTOXIDE plus Perchloric Acid and Chloroform.

**Sodium Iodide**

See SODIUM IODIDE plus Perchloric Acid.

**Steel**

Explosions may occur when 72 percent perchloric acid is used for determination of chromium in steel. These explosions are apparently due to the formation of mixtures of perchloric acid vapor and hydrogen, catalyzed by the presence of steel particles. The presence of steel burnings lowered the explosion temperatures of such mixtures to 215°C. Addition of a little water to keep their boiling temperature at 150 to 160°C prevented the formation of explosive gas mixtures.
*ACS* **146,** p. 189 (1960).

**Sulfoxides**

See SULFOXIDES plus Perchloric Acid.

**Sulfuric Acid**

It is fairly easy to produce the dangerous anhydrous perchloric acid from either its salts or its aqueous solutions by heating with high-boiling acids and dehydrating agents such as sulfuric acid and phosphorus pentoxide.
*NSC Data Sheet* **D-311.** *ACS* **146:** 71.
*Pascal* **16:** 298 (1931–1934).

**Sulfur Trioxide**

The reaction of anhydrous perchloric acid with sulfur trioxide is violent and accompanied by the evolution of considerable heat, even when diluted with an inert solvent such as chloroform.
*Pascal* **16:** 300–303 (1931–1934).

**Wood**

A drop of anhydrous perchloric acid on wood fibers or dust causes a violent explosion. See also PERCHLORIC ACID plus Cellulose or plus Paper.
*ACS* **146:** 188.
Gordon, Young & Campbell, *Science* **104:** 353 (1946).

## PERCHLORYL FLUORIDE $FClO_3$

**Benzene and Aluminum Chloride**

During the synthesis of perchloryl benzene by the action of perchloryl fluoride on benzene in the presence of aluminum chloride, there also forms a hazardous nitration product which may explode. The product is apparently nitrochlorobenzene, which is shock-sensitive.
*Chem. and Eng. News* **38** (4): 62 (1960).

**Sodium Methylate**

Sodium methylate, as it was being added to a mixture of perchloryl fluoride and methyl alcohol, underwent an explosive reaction with perchloryl fluoride in the vapor phase above the liquid. When the sodium methylate and methyl alcohol were mixed before the addition of perchloryl fluoride, no explosion occurred.
*Chem. and Eng. News* **37** (28): 60 (1959).

## PERCHROMATES

**Aniline**

A mixture of aniline and a perchromate gives rise to an explosive reaction as the temperature is increased.
*Rüst and Ebert,* p. 297 (1948).

**Pyridine**

Heating a mixture of pyridine and a perchromate can lead to an explosion.
*Rüst and Ebert,* p. 297 (1948).

**Quinoline**

Heating a mixture of quinoline and perchromate can produce an explosion.
*Rüst and Ebert,* p. 297 (1948).

## PERFLUOROPROPIONYL FLUORIDE $F_3CCF_2COF$

**Fluorine**

An explosion occurred during the investigation of a new method of forming perfluoropropionyl hypofluorite. The method involved cooling the reactor to minus 50°C after which a 50–50 fluorine-nitrogen mixture was added to perfluoropropionyl fluoride. It is possible that a small amount of water, which may have been introduced due to the low temperature, converted some of the perfluoropropionyl fluoride to the perfluoropropionic acid, a precursor for the formation of one of the acyl hypofluorites. The latter are known to be explosive.
*MCA Case History* **1045** (1966).
See FLUORINE plus Perfluropropionyl Fluoride.

## PERFLUOROSUCCINAMIDE $F_2NCOCF_2CF_2CONF_2$

**Lithium Aluminum Hydride and Water**

See LITHIUM ALUMINUM HYDRIDE plus Perfluorosuccinamide and Water.

## PERFLUOROTOLUENE $C_6H_5CH_3F_4$

Perfluorotoluene has been reported to explode when heated with oxygen at a pressure of 2000 psig and 200°C.
*Chem. and Eng. News,* p. 2 (Sept. 23, 1991); p. 2 (October 7, 1991); p. 2 (Dec. 16, 1991); and p. 2 (March 30, 1992).

## PERIODATES $MeIO_4$

**(self-reactive)**

The metaperiodates ($MeIO_4$) in some cases decompose with explosive violence when strongly heated. Ammonium periodate may explode even on gentle friction, e.g., when touched with a spatula.
*Ellern,* p. 288 (1968). *Remy* **1:** 814 (1956).

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**PERIODIC ACID** $HIO_4$

**Dimethyl Sulfoxide**
See DIMETHYL SULFOXIDE plus Periodic Acid.

**PERMANGANATES**

**(See also specific permanganates as primary entries or see under other reactants)**

**Acetic Acid**
Acetic acid or acetic anhydride can explode with permanganates if not kept cold.
*Von Schwartz,* p. 34 (1918).

**Acetic Anhydride Sulfuric Acid and Benzene**
See PERMANGANATES plus Acetic Acid.
Explosions can occur when permanganates that have been treated with sulfuric acid come in contact with benzene, carbon disulfide, diethyl ether, ethyl alcohol, petroleum, or organic matter.
*Von Schwartz,* p. 327 (1918).

**PERMANGANIC ACID** $HMnO_4$

**(self-reactive)**
Above 3°C permanganic acid is unstable and decomposes explosively. It is a violent oxidant and the following classes of organic chemicals explode into flame on contact with it: alcohols, alkanes, aryl hydrocarbons, greases, cycloalkanes, alkylamines, amides, and ethers. Carbon tetrachloride, chloroform and dichloromethane do not burn.
*J. Am. Chem. Soc.* **91** (22): 6200–6201 (1969).
*Chem. Abst.* **72:** 17982f (1970).

**Ethyl Alcohol**
Alcohols should not be mixed with permanganic acid, as they may spontaneously explode.
*Bahme,* p. 9 (1961).

**Organic Matter**
See PERMANGANIC ACID (self-reactive).

**PERMONOSULFURIC ACID (CARO'S ACID)** $H_2SO_5$

**Acetone**
Inadvertent addition of acetone to a solution containing permonosulfuric acid resulted in a violent explosion. The permonosulfuric acid had been formed by reaction between hydrogen peroxide and sulfuric acid during an analytical procedure.
*Wood* (1966). *NSC Newsletter, Chem. Sec.* (1961). *J. Am. Chem. Soc.* **59:** 552–7 (1937).

**Alcohols**
Permonosulfuric acid in contact with primary or secondary alcohols often produces explosions.
*J. Am. Chem. Soc.* **59:** 552 (1937).

**Cotton**
If 92% permonosulfuric acid is brought in contact with cotton, in a few seconds there is a violent reaction accompanied by a yellow flame.
*Z. Angew. Chem.* **22:** 1713.

**Hydrogen Peroxide**
See HYDROGEN PEROXIDE plus Sulfuric Acid.

**Manganese Dioxide**
The decomposition of 92% permonosulfuric acid is explosive in the presence of smooth or finely divided manganese dioxide or silver.
*Z. Angew. Chem.* **22:** 1713.

**Organic Matter**
Too concentrated permonosulfuric acid in any organic medium may prove dangerous.
*J. Am. Chem. Soc.* **59:** 552 (1937).

**Platinum**
See PLATINUM plus Permonosulfuric Acid.

**Silver**
See PERMONOSULFURIC ACID plus Manganese Dioxide.

**PEROXIDES** ROOR

**(See also specific peroxides or see under other reactants)**

**Organic Matter**
Peroxides may cause ignition of organic materials.
*Lab. Govt. Chemist* (1965).

**Thiocyanates**
See THIOCYANATES plus Oxidizing Agents.

**PEROXYACETIC ACID** $CH_3COOOH$

**Acetic Anhydride**
Acetic anhydride and peracetic acid react readily to form acetyl peroxide which is an extremely sensitive explosive.
*MCA Case History* **1795** (1971).
See also HYDROGEN PEROXIDE plus Acetic Anhydride.

**Olefins**
See "PER" ACIDS plus Olefins.

**Organic Matter**
Upon contact with peracetic acid, organic materials can ignite or result in explosions.
*Haz. Chem. Data,* p. 214 (1973); *Chem. and Eng. News*(March 11, 1991).

**"PEROXY" ACIDS (PERFORMIC, PERACETIC, etc.)**

**(self-reactive)**
Peracids should be handled only in small quantities and with extreme care when pure or very concentrated. Organic peracids, such as peracetic acid, are so unstable that they may explode during distillation, even under reduced pressure.
*Kirk and Othmer, Second Ed.* **14:** 809 (1963).
*Grignard* **11:** 90 (1935–1954).

**PEROXYCAMPHORIC ACID** $C_9H_{14}(COOOH)_2$

**(self-reactive)**
Percamphoric acid explodes when heated rapidly from 80 to 100°C.
*Chem. Reviews* **45:** 15 (1949).

**PEROXYTRICHLOROACETIC ACID** $Cl_3CCOOOH$

**(self-reactive)**
Pertrichloroacetic acid is very unstable. Decomposition products include phosgene, chlorine, hydrochloric acid and carbon monoxide.
*Chem. Reviews* **45** (1): 10 (1949).

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**PEROXYFORMIC ACID** OCHOOH

**(self-reactive)**
Performic acid is an unstable compound capable of undergoing rapid, spontaneous exothermal decomposition at room temperature, even in the absence of foreign substances. It is shock sensitive.
*Chem. and Eng. News* **28:** 3067 (Sept. 4, 1950).
*Chem. Reviews* **45:** 4, 7 (1949).
*Chem. and Eng. News* **30:** 3041 (1952).

**Aluminum**
See ALUMINUM plus Performic Acid.

**Aniline**
Aniline is oxidized violently by performic acid when the acid strength is more than 60% by weight.
*Berichte* **48:** 1139 (1915).

**Benzaldehyde**
Benzaldehyde is oxidized violently by performic acid.
*Berichte* **48:** 1139 (1915).

**Formaldehyde**
Formaldehyde is oxidized violently by concentrated performic acid.
*Berichte* **48:** 1139 (1915).

**Lead Dioxide**
A concentrated solution of performic acid can explode upon contact with powdered lead dioxide.
*Berichte* **48:** 1139 (1915).

**Magnesium**
See MAGNESIUM plus Performic Acid.

**Metal Oxides**
See METAL OXIDES plus Performic Acid.

**Metals**
See METAL plus Performic Acid.

**Nickel**
See NICKEL plus Performic Acid.

**Olefins**
See "PER" ACIDS plus Olefins.

**Phosphorus**
See PHOSPHORUS plus Performic Acid.

**Sodium Nitride**
Sodium nitride can decompose performic acid explosively.
*Berichte* **48:** 1139 (1915).

**Zinc**
See ZINC plus Performic Acid.

**PETROLEUM**

**Nitrogen Tetroxide**
See NITROGEN TETROXIDE plus Petroleum.

**PHENOL** $C_6H_5OH$

**Aluminum Chloride and Nitrobenzene**
See ALUMINUM CHLORIDE plus Nitrobenzene and Phenol.

**Butadiene**
Reaction of the two ingredients, catalyzed by boron trifluoride diethyletherate, and in a petroleum ether solution, pressurized the capped bottle, causing the bottle to explode.
*MCA Case History* **790** (1962).

**Calcium Hypochlorite**
See CALCIUM HYPOCHLORITE plus Phenol.

**PHENOL-FORMALDEHYDE RESIN**

**Fluorine**
See FLUORINE plus Solid Nonmetals and Oxygen.

**PHENOLS**

**Acetaldehyde**
See ACETALDEHYDE plus Acid Anhydrides.

**b-PHENYLBORACYCLOPENTANE** $C_6H_5B(CH_2)_4$

**Air**
Phenyl cyclotetramethylene borine is spontaneously flammable in air.
*Douda* (1966).

**p-PHENYLENEDIAMINE PERCHLORATE**
$C_6H_4(NH_2)_2 \cdot ClO_4$

**(self-reactive)**
This compound was believed in 1910 to be the most powerful explosive substance known.
*ACS* **146:** 213. *Berichte* **43:** 2624–30 (1910).

**PHENYLHYDRAZINE** $C_6H_5NHNH_2$

**Lead Dioxide**
See LEAD DIOXIDE plus Phenylhydrazine.

**n-PHENYLHYDROXYLAMINE HYDROCHLORIDE**
$C_6H_5NHOH \cdot HCl$

**(self-reactive)**
In an attempt to stabilize some phenylhydroxylamine for safekeeping, 700 grams were made into the hydrochloride, but after it had been in the laboratory about two weeks, it exploded with considerable force.
*Wallace* (1966).

**PHENYL ISOCYANATE** $C_6H_5NCO$

**Cobalt Pentammine Triazo Perchlorate and Nitrosyl Perchlorate.**
The reaction mixture was stirred and proceeded normally for 2–3 minutes. When stirring was interrupted, the mixture exploded.
*Chem. and Eng. News* **46** (8): 39 (1968).

**PHENYLLITHIUM** $C_6H_5Li$

**Air**
Phenyl lithium is spontaneously flammable in air.
*Ellern* (1961).

**Nitrous Oxide**
The reaction of phenyl-lithium produces unstable lithium phenylazoxide as a product.
*Mellor* **2, Supp. 2:** 93 (1961).


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**PHENYLSILVER** $C_6H_5Ag$

**(self-reactive)**
Phenyl silver is explosive at room temperature.
*Coates,* p. 173 (1956).

**PHENYL SULFIDE SALTS**

**Diazonium Salts**
See DIAZONIUM SALTS plus Thiophenates.

**PHENYLVANADOCENE** $(C_5H_5)_2VC_6H_5$

**Air**
Phenyl dicyclopentadienyl vanadium is spontaneously flammable in air.
*Zeiss,* p. 234 (1960).

**PHOSGENE** $OCCl_2$

**Aluminum**
See ALUMINUM plus Phosphorus Trichloride.

**tert-Butyl Azidoformate**
See tert-BUTYL AZIDOFORMATE plus Phosgene.

**2, 4-Hexadiyn-1, 6-Diol**
Phosgene and 2, 4-hexadiyn-1, 6-diol react to form 2, 4-hexadiyn-1, 6-bischloroformate, which is a shock-sensitive compound.
P. E. Driedger and H. V. Isaacson, *Chem. and Eng. News* **50** (12): 51 (1972).

**Isopropyl Alcohol**
See ISOPROPYL ALCOHOL plus Phosgene.

**Potassium**
See POTASSIUM plus Phosgene.

**Sodium**
See SODIUM plus Phosgene.

**PHOSPHAM** $PN_2H$

**Air**
Phospham ignites in air at slightly elevated temperatures and burns with a white flame.
H. Rose, *Ann. Phys.* **52:** 62 (1841).

**Cupric Oxide**
A mixture of phospham and cupric oxide or mercuric oxide decomposes with incandescence.
Wohler & Liebig, *Ann. Chem.* **11:** 139 (1834).

**Mercuric Oxide**
See PHOSPHAM plus Cupric Oxide.

**Nitrates**
See NITRATES plus Phospham.

**Nitrogen Dioxide**
Phospham ignites in nitrogen dioxide (nitrogen peroxide) vapors.
H. Rose, *Ann. Phys.* **24:** 308 (1832).

**PHOSPHATES**

**Magnesium**
See MAGNESIUM plus Phosphates.

**PHOSPHINE** $PH_3$

**Air**
Dry phosphine is spontaneously flammable in cold air.
H. Rose, *Ann. Phys.* **14:** 183 (1828). *Z. Anorg. Chemie* **180:** 32. *Handbook Chem. Phys.* **40:** 582 (1958). *MCA Case History* **1066** (1965).
See also PHOSPHINES plus Air.

**Boron Trichloride**
See BORON TRICHLORIDE plus Nitrogen Peroxide.

**Bromine**
See BROMINE plus Phosphine.

**Chlorine**
See BROMINE plus Phosphine.

**Chlorine Monoxide**
See CHLORINE MONOXIDE plus Phosphine.

**Mercuric Nitrate**
See MERCURIC NITRATE plus Phosphine.

**Nitric Acid**
Phosphine is violently decomposed by concentrated nitric acid, and flame is produced.
Warm fuming nitric acid, dropped in a container of phosphine gas, produces an explosion.
T. Graham, *Edin. Roy. Soc.* **13:** 88 (1835).

**Nitric Oxide**
Phosphine plus nitric oxide can be ignited by the addition of oxygen.
*Berzelius* **1, i:** 485 (1825).

**Nitrogen Trichloride**
See NITROGEN TRICHLORIDE plus Ammonia.

**Nitrogen Trioxide**
See NITROGEN TRIOXIDE plus Phosphine.

**Nitrous Acid**
Phosphine gas ignites spontaneously if a trace of nitrous acid is added.
T. Graham, *Edin. Roy. Soc.* **13:** 88 (1835).

**Nitrous Oxide**
A mixture of nitrous oxide and phosphine can be exploded by a spark.
*Comp. Rend.* **18:** 652.

**Oxygen**
See OXYGEN plus Phosphine.

**Potassium and Ammonia**
See POTASSIUM plus Phosphine and Ammonia.

**Silver Nitrate**
See SILVER NITRATE plus Phosphine.

**PHOSPHINES** $PH_3$; $P_2H_4$; $(P_2H_4)_3$; PxHy

**(self-reactive)**
The higher phosphines (beyond Diphosphine) decompose rapidly in light at room temperature.
*Mellor* **8, Supp. 3:** 274 (1971).

**Air**
If the $P_2H_4$ is removed by passing the $PH_3$ and $P_2H_4$ through concentrated sulfuric acid, the $P_2H_4$ does not



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catch fire in air below 150°C. The $PH_3$ is spontaneously flammable in cold air. Solid $(P_2H_4)_3$ ignites at 160°C.
*Z. Anorg. Chemie* **180:** 32. *Handbook Chem. Phys.* **40th Ed.:** 582 (1958).

## PHOSPHONITRILE AZIDE-TRIMER

**(self-reactive)**
This is a highly explosive compound, readily detonated by friction.
*Mellor* **8, Supp. 2:** 23 (1967).

## PHOSPHONIUM IODIDE $PH_4I$

**Bromates**
See BROMATES plus Phosphonium Iodide.

**Bromic Acid**
Phosphonium iodide ignites at ordinary temperatures in contact with bromic, chloric or iodic acid.
*Ann. Chim. et Phys.* (2) **47:** 87.

**Chlorates**
See PHOSPHONIUM IODIDE plus Bromates.

**Chloric Acid**
See PHOSPHONIUM IODIDE plus Bromic Acid.

**Iodates**
See PHOSPHONIUM IODIDE plus Bromates.

**Iodic Acid**
See PHOSPHONIUM IODIDE plus Bromic Acid.

**Nitric Acid**
Phosphonium iodide ignites spontaneously when mixed with nitric acid at ordinary temperatures.
*Ann. Chim. et Phys.* (2) **47:** 87.

**Silver Nitrate**
Phosphonium iodide reacts vigorously with dry silver nitrate with development of much heat.
*Ann. Chim. et Phys.* (2) **47:** 87.

## PHOSPHONIUM PERCHLORATE $2PH_3{\cdot}3HClO_4$

**(self-reactive)**
Violent explosions have occurred in spite of every precaution.
*Helv. Chim. Acta* **17:** 222–4 (1934).
This is a very explosive salt and cannot be dried.
*Mellor* **8, Supp. 3:** 274 (1971).

## PHOSPHORUS P

**Air**
White (yellow) phosphorus ignites spontaneously in air — even in a rarefied atmosphere.
A. D. Backe, *Schweigger's Jour.* **63:** 478 (1831).
*Latimer and Hildebrand,* p. 210 (1940).

**Alkaline Hydroxides**
Phosphorus boiled with alkaline hydroxides yields mixed phosphines which may ignite spontaneously in air.
*Z. Anorg. Chemie* **121:** 73. *Sidgwick* **1:** 729 (1950).
See PHOSPHORUS plus Potassium Hydroxide.

**Ammonium Nitrate**
A mixture of white (or yellow) phosphorus and ammonium nitrate can be exploded by percussion.
J. W. Slater, *Chem. Gaz.* **11:** 329 (1853).

**Antimony Pentafluoride**
Phosphorus ignites in contact with antimony pentafluoride.
*Mellor* **9:** 467 (1946–1947).

**Barium Bromate**
See PHOSPHORUS plus Bromates.

**Barium Chlorate**
See PHOSPHORUS plus Bromates.

**Barium Iodate**
See PHOSPHORUS plus Bromates.

**Beryllium**
See BERYLLIUM plus Phosphorus.

**Boron Triiodide**
See BORON TRIIODIDE plus Phosphorus. White or red phosphorus and boron triiodide react with incandescence.
*Mellor* **5:** 136 (1946–1947).

**Bromates**
A combination of finely divided phosphorus with finely divided bromates (also chlorates or iodates) of barium, calcium, magnesium, potassium, sodium, or zinc will explode with heat, percussion, and, sometimes, light friction.
*Mellor* **2:** 310 (1946–1947).

**Bromine**
See BROMINE plus Phosphorus.

**Bromine Trifluoride**
See ANTIMONY plus Bromine Trifluoride.

**Bromoazide**
See ANTIMONY plus Bromoazide.

**Calcium Bromate**
See PHOSPHORUS plus Bromates.

**Calcium Chlorate**
See PHOSPHORUS plus Bromates.

**Calcium Iodate**
See PHOSPHORUS plus Bromates.

**Cerium**
See CERIUM plus Phosphorus.

**Cesium**
Phosphorus reacts vigorously below 250°C with any of the following materials: cesium, lithium, potassium, rubidium, sodium, sulfur.
*Mellor* **8, Supp. 3:** 228 (1971).

**Cesium Acetylene Carbide**
Cesium acetylene carbide becomes incandescent when warmed in contact with phosphorus.
*Mellor 5:* 848–50 (1946–1947).

**Cesium Nitride**
See CESIUM NITRIDE plus Air.

**Charcoal and Air**
Phosphorus sprinkled with animal charcoal ignites at 15.5°C. in the open air.
*Mellor* **8:** 771 (1946–1947).


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**Chlorates**
A mixture of red phosphorus and chlorates bursts into flames after a few moments. Moist chlorates explode on contact with white phosphorus.
*Mellor* **2, Supp. 1:** 584 (1956).
See PHOSPHORUS plus Bromates. See PHOSPHORUS plus Potassium Chlorate.

**Chlorine**
Phosphorus burns spontaneously in gaseous chlorine.
*Mellor* **2:** 92, 95; **9:** 626 (1946–1947).
Phosphorus (white or yellow) burns in chlorine gas with a pale green light. Red phosphorus reacts with chlorine at ordinary temperatures. Finely divided red phosphorus ignites spontaneously in chlorine at ordinary temperatures.
*Moissan,* p. 125 (1900).
The reaction of phosphorus and chlorine, fluorine, or bromine is highly exothermic.
All can explode in contact with white phosphorus.
*Mellor* **8, Supp. 3:** 228 (1971).
The reaction of white phosphorus and liquid chlorine is explosive.
*Mellor* **2, Supp. 1:** 379 (1956).

**Chlorine Dioxide**
Phosphorus ignites spontaneously in chlorine dioxide and may explode.
*Mellor* **2:** 289 (1946–1947).

**Chlorine and Heptane**
Flaming occurs when liquid chlorine in heptane is added to red phosphorus at 0°C.
*Mellor* **2, Supp. 1:** 379 (1956).

**Chlorine Monoxide**
See POTASSIUM plus Chlorine Monoxide.

**Chlorine Trifluoride**
See ANTIMONY plus Chlorine Trifluoride.

**Chlorine Trioxide**
Ordinary phosphorus (white or yellow) reacts explosively with chlorine trioxide.
*Ann. Chim. et Phys.* (3) **7:** 298.

**Chlorosulfonic Acid**
Yellow phosphorus reacts feebly with chlorosulfonic acid if cold. At temperatures from 25° to 30°C., the reaction begins vigorously (with evolution of hydrogen chloride and sulfur dioxide) and ends with an explosion. With red phosphorus a higher temperature is necessary to start the reaction.
*Berichte* **15:** 417.

**Chromic Acid**
See PHOSPHORUS plus Chromium Trioxide.

**Chromic Anhydride**
See PHOSPHORUS plus Chromium Trioxide.

**Chromium Trioxide**
Phosphorus reacts explosively with molten chromium trioxide.
*Ann. Chim. et Phys.* (6) **5:** 468.
*Mellor* **11:** 234 (1946–1947).

**Chromyl Chloride**
Chromyl chloride explodes with moistened phosphorus. (Light is emitted at the same time.)
*Ann. Chim. et Phys.* (2) **31:** 435. *Comp. Rend.* **5:** 753. T. Thomson, *Phil. Trans. Roy. Soc. London* **117:** 195 (1827).

**Copper**
See COPPER plus Phosphorus.

**Cyanogen Iodide**
Phosphorus (molten) plus cyanogen iodide reacts with incandescence to produce phosphorus iodide.
F. Wohler, *Gilbert's Ann.* **69:** 281 (1821).

**Fluorine**
See FLUORINE plus Phosphorus.

**Iodates**
See PHOSPHORUS plus Bromates. See PHOSPHORUS plus Potassium Iodate.

**Iodine**
See IODINE plus Phosphorus.

**Iodine Monobromide**
Phosphorus reacts violently with molten iodine monobromide or iodine monochloride.
*Mellor* **8, Supp. 3:** 264.

**Iodine Monochloride**
See PHOSPHORUS plus Iodine Monobromide.

**Iodine Pentafluoride**
See ARSENIC plus Iodine Pentafluoride.

**Iron**
See COPPER plus Phosphorus.

**Lanthanum**
See CERIUM plus Phosphorus.

**Lead Dioxide**
When lead dioxide and red phosphorus are ground the mass ignites; with yellow phosphorus, there is an explosion.
*Mellor* **7:** 690 (1946–1947).

**Lithium**
See LITHIUM plus Arsenic. See also PHOSPHORUS plus Cesium.

**Lithium Carbide**
A mixture of lithium carbide and phosphorus burns if the mixture is warm.
*Mellor* **5:** 848 (1946–1947).

**Lithium Silicide**
Lithium silicide attacks phosphorus, selenium or tellurium with incandescence.
*Mellor* **6:** 169 (1946–1947).

**Magnesium Bromate**
See PHOSPHORUS plus Bromates.

**Magnesium Chlorate**
See PHOSPHORUS plus Bromates.

**Magnesium Iodate**
See PHOSPHORUS plus Bromates.

**Magnesium Perchlorate**
A student was injured by an explosion when he attempted to mix these two chemicals in the laboratory.
*1965 Sum. Serious Acc.* (1966).

**Manganese**
See MANGANESE plus Phosphorus.



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**Mercuric Oxide**
A mixture of mercuric oxide and phosphorus explodes when struck with a hammer and when boiled with water and phosphorus.
*Mellor* **4:** 778 (1946–1947).

**Mercurous Nitrate**
A mixture of mercurous nitrate and phosphorus explodes violently when struck with a hammer.
*Mellor* **4:** 987 (1946–1947).

**Neodymium**
See NEODYMIUM plus Phosphorus.

**Nickel**
See COPPER plus Phosphorus.

**Nitrates**
A mixture of the two may cause an explosion.
*Pieters,* p. 30 (1957).

**Nitric Acid**
Phosphorus ignites in the vapor of nitric acid and burns with an intense white light.
Berrere & Moutet, *Symposium Comb.* (**Fifth**): 170–81 (1954).

**Nitrogen Bromide**
Nitrogen bromide explodes violently in contact with phosphorus.
*Mellor* **8, Supp. I, Part 2:** 707 (1964).

**Nitrogen Dioxide**
See MAGNESIUM plus Nitrogen Dioxide.

**Nitrogen Tribromide**
See ARSENIC plus Nitrogen Tribromide.

**Nitrogen Trichloride**
See NITROGEN TRICHLORIDE plus Ammonia.

**Nitrosyl Fluoride**
See BORON plus Nitrosyl Fluoride.

**Nitryl Fluoride**
Red phosphorus and nitryl fluoride react at room temperature.
*Mellor* **8, Supp. 3:** 264 (1971).

**Oxygen**
Phosphorus and oxygen or iodine undergo a vigorous reaction at room temperature.
*Mellor* **8, Supp. 3:** 228 (1971).

**Performic Acid**
Red phosphorus is violently oxidized by performic acid.
*Grignard* **11:** 179 (1935–1954).
*Berichte* **48:** 1139 (1915).

**Platinum**
See COPPER plus Phosphorus.

**Potassium**
See PHOSPHORUS plus Cesium.

**Potassium Bromate**
See PHOSPHORUS plus Bromates.

**Potassium Chlorate**
If a drop of solution of phosphorus in carbon disulfide is placed on powdered potassium chlorate, an explosion occurs as the solvent evaporates.
R. Bottger, *Repert. Pharm.* **24:** 725 (1875).
*Ellern,* p. 50 (1968).
See also PHOSPHORUS plus Bromates.

**Potassium Hydroxide**
When phosphorus is boiled with a solution of sodium or potassium hydroxide, phosphine gas is evolved which is spontaneously flammable.
*Mellor* **8:** 804–5 (1946–1947).
See PHOSPHORUS plus Alkaline Hydroxides.

**Potassium Iodate**
If red or white phosphorus is mixed with potassium iodate and moistened with a few drops of water, the mixture reacts violently, sometimes explosively.
*J. Am. Chem. Soc.* **49:** 9 (1927).
See also PHOSPHORUS plus Bromates.

**Potassium Nitride**
Potassium nitride unites with sulfur or phosphorus when heated, forming a highly flammable mixture.
*Mellor* **8:** 99 (1946–1947).

**Potassium Permanganate**
Crystals of potassium permanganate explode vigorously when ground with phosphorus.
*Mellor* **12:** 322 (1946–1947).

**Potassium Peroxide**
A mixture of phosphorus and potassium peroxide causes fire or explosion.
*Mellor* **2:** 490–93 (1946–1947). *Von Schwartz,* p. 328 (1918).

**Rubidium**
See PHOSPHORUS plus Cesium.

**Rubidium Acetylene Carbide**
Rubidium acetylene carbide ignites in contact with molten sulfur. It becomes incandescent when warmed in contact with phosphorus.
*Mellor* **5:** 849 (1946–1947).

**Selenium Monochloride**
White phosphorus mixed with selenium monochloride explodes.
*Mellor* **8, Supp. 3:** 264 (1971).

**Selenium Oxychloride**
Red phosphorus reacts in the cold with selenium oxychloride evolving light and heat; white phosphorus reacts explosively.
*Mellor* **10:** 906 (1946–1947).

**Selenium Oxyfluoride**
This mixture ignites spontaneously.
*Mellor* **8, Supp. 3:** 264 (1971).

**Selenium Tetrafluoride**
This mixture produces a violent reaction.
*Mellor* **8, Supp. 3:** 264 (1971).

**Silver Nitrate**
A mixture of silver nitrate and phosphorus explodes violently when struck with a hammer.
*Mellor* **3:** 470 (1946–1947).

**Silver Oxide**
When amorphous phosphorus is ground with silver oxide, the mixture ignites.
*Mellor* **3:** 377 (1946–1947).

**Sodium**
See PHOSPHORUS plus Cesium.


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**Sodium Bromate**
See PHOSPHORUS plus Bromates.

**Sodium Carbide**
Sodium carbide burns vigorously in phosphorus vapor.
*Mellor* **5:** 848–50 (1946–1947).

**Sodium Chlorate**
See PHOSPHORUS plus Bromates.

**Sodium Chlorite**
Red phosphorus and sodium chlorite react in aqueous suspension in a strongly exothermic manner. The reaction can have a sudden, almost explosive stage.
*Mellor* **8, Supp. 3:** 645 (1971).

**Sodium Hydroxide**
See PHOSPHORUS plus Potassium Hydroxide and PHOSPHORUS plus Alkaline Hydroxides.

**Sodium Iodate**
See PHOSPHORUS plus Bromates.

**Sodium Peroxide**
Phosphorus and sodium peroxide react with flame or explosion.
*Mellor* **2:** 490–93 (1946–1947). *Von Schwartz,* p. 328 (1918).

**Sulfur**
When a mixture of sulfur and yellow phosphorus is warmed, the two elements unite in all proportions with vivid combustion and powerful explosions.
*Ann. Chim. et Phys.* (1) **4:** 1. *Ann. Chim. et Phys.* (2) **67:** 332. *Comp. Rend.* **96:** 1499, 1771. R. Bottger, *J. Prakt. Chem.* (1) **12:** 357 (1837).
See PHOSPHORUS plus Cesium.

**Sulfur Trioxide**
Yellow phosphorus ignites after exposure to the vapor of sulfur trioxide. A piece of phosphorus dropped into liquid sulfur trioxide reduces the latter with violence. When the pieces of phosphorus are large, the heat raises the temperature of the phosphorus sufficiently to cause ignition.
F. C. Vogel, *Schweigger's Jour.* **4:** 121 (1812).

**Sulfuric Acid**
Yellow phosphorus ignites when placed in boiling concentrated sulfuric acid.
A. Oppenheim, *Bull. Soc. Chim.* (2) **1:** 163 (1864).

**Thorium**
When thorium is heated with phosphorus, they unite with incandescence.
J. J. Berzelius, *Svenska Akad.,* p. 1 (1829).

**Vanadium Oxytrichloride**
This mixture produces an explosive reaction below 100°C with more than small amounts.
*Mellor* **8, Supp. 3:** 264 (1971).

**Zinc Bromate**
See PHOSPHORUS plus Bromates.

**Zinc Chlorate**
See PHOSPHORUS plus Bromates.

**Zinc Iodate**
See PHOSPHORUS plus Bromates.

**Zirconium**
Phosphorus and zirconium react with incandescence when heated in a vacuum.
*Mellor* **7:** 114–16 (1946–1947).

## PHOSPHORUS CYANIDE $P_3CN$

**Air**
This very reactive cyanide ignites in air when touched with a warm rod.
*Mellor* **8, Supp. 3:** 583 (1971).

**Water**
Phosphorus cyanide reacts violently with water.
*Mellor* **8, Supp. 3:** 583 (1971).

## PHOSPHORUS HEXAOXYTETRASULFIDE $P_4O_6S_4$

**Water**
This sulfide decomposes rapidly in moist air.
*Mellor* **8, Supp. 3:** 437 (1971).

## PHOSPHORUS ISOCYANATE $P_3OCN$

**Acetaldehyde**
Phosphorus isocyanate and acetaldehyde, acetic acid, silver nitrate, or sulfuric acid react violently.
*Mellor* **8, Supp. 3:** 585 (1971).

**Acetic Acid**
See PHOSPHORUS ISOCYANATE plus Acetaldehyde.

**Chlorine**
See CHLORINE plus Phosphorus Isocyanate.

**Silver Nitrate**
See PHOSPHORUS ISOCYANATE plus Acetaldehyde.

**Sulfuric Acid**
See PHOSPHORUS ISOCYANATE plus Acetaldehyde.

**Water**
The hydrolysis of phosphorus isocyanate is rapid.
*Mellor* **8, Supp. 3:** 585 (1971).

## PHOSPHORUS PENTACHLORIDE $PCl_5$

**Chlorine Trioxide**
See CHLORINE TRIOXIDE plus Phosphorus Pentachloride.

**Fluorine**
See FLUORINE plus Phosphorus Pentachloride.

**Hydroxylamine**
See PHOSPHORUS TRICHLORIDE plus Hydroxylamine.

**Magnesium Oxide**
These materials react with brilliant incandescence.
*Mellor* **8:** 1016 (1946–1947).

**Phosphorus Trioxide**
See PHOSPHORUS TRIOXIDE plus Phosphorus Pentachloride.

**Potassium**
See POTASSIUM plus Boron Tribromide.

**Sodium**
See SODIUM plus Phosphorus Pentachloride.
See SODIUM plus Cobaltous Bromide.

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**Water**
Phosphorus pentachloride reacts violently with water.
*Oldbury Chemicals*, p. 9.

## PHOSPHORUS PENTASULFIDE $P_2S_5$

**Water**
Phosphorus pentasulfide heats spontaneously, and may ignite, in the presence of moisture.
*Haz. Chem. Data* (1969).

## PHOSPHORUS PENTOXIDE $P_2O_5$

**Ammonia**
Reaction of phosphorus pentoxide and ammonia is rapid, contrary to older reports.
*Mellor* **8, Supp. 1:** 331 (1964).
This is a vigorous reaction.
*Mellor* **8, Supp. 3:** 403 (1971).

**Calcium Oxide**
See CALCIUM OXIDE plus Phosphorus Pentoxide.

**Chlorine Trifluoride**
See CHLORINE TRIFLUORIDE plus Arsenic Trioxide.

**Hydrogen Fluoride**
Phosphorus pentoxide unites with hydrogen fluoride vigorously, even at 19.5°C.
G. Gore, *Proc. Roy. Soc.* **17:** 256 (1869).

**Oxygen Difluoride**
See OXYGEN DIFLUORIDE plus Aluminum Chloride.

**Perchloric Acid**
See PERCHLORIC ACID plus Sulfuric Acid.

**Perchloric Acid and Chloroform**
A violent explosion occurs if a solution of perchloric acid in chloroform is poured on phosphorus pentoxide.
*J. Am. Chem. Soc.* **23:** 444 (1901).

**Potassium**
See POTASSIUM plus Phosphorus Pentoxide.

**Propargyl Alcohol**
Addition of phosphorus pentoxide to propargyl alcohol caused the alcohol to burst into flame.
*Monroe* (1966).

**Sodium**
See POTASSIUM plus Phosphorus Pentoxide.

**Sodium Carbonate**
See SODIUM CARBONATE plus Phosphorus Pentoxide.

**Sodium Hydroxide**
See CALCIUM OXIDE plus Phosphorus Pentoxide.

**Water**
Phosphorus pentoxide reacts violently with water.
*Oldbury Chemicals*, p. 9.

**Water and Organic Matter**
Mixed with water and combustible material, phosphoric anhydride produces great heat and often ignites the combustible material.
*Chem. Safety Data Sheet* **SD-23:** 3 (1948).

## PHOSPHORUS TETRAOXYTRISULFIDE $P_4O_4S_3$

**Water**
The sulfide ignites if moistened with a little water.
*Mellor* **8, Supp. 3:** 437 (1971).

## PHOSPHORUS TRIBROMIDE $PBr_3$

**Potassium**
See POTASSIUM plus Boron Tribromide.

**Ruthenium Tetroxide**
See RUTHENIUM TETROXIDE plus Phosphorus Tribromide.

**Sodium**
See SODIUM plus Phosphorus Tribromide.
See SODIUM plus Cobaltous Bromide.

## PHOSPHORUS TRICHLORIDE $PCl_3$

**Acetic Acid**
Several laboratory explosions have occurred using this reaction to form acetyl chloride. Poor heat control probably caused formation of phosphine.
*J. Am. Chem. Soc.* **60:** 488 (1938).

**Aluminum**
See ALUMINUM plus Phosphorus Trichloride.

**Chromyl Chloride**
See CHROMYL CHLORIDE plus Phosphorus Trichloride.

**Diallyl Phosphite and Allyl Alcohol**
See DIALLYL PHOSPHITE plus Allyl Alcohol and Phosphorus Trichloride.

**Dimethyl Sulfoxide**
See DIMETHYL SULFOXIDE plus Acyl Halides.

**Fluorine**
See FLUORINE plus Phosphorus Trichloride.

**Hydroxylamine**
Ignition occurs when hydroxylamine is mixed with phosphorus trichloride or phosphorus pentachloride.
*Mellor* **8:** 290 (1946–1947).

**Iodine Monochloride**
See IODINE MONOCHLORIDE plus Phosphorus Trichloride.

**Lead Dioxide**
See LEAD DIOXIDE plus Phosphorus Trichloride.

**Nitric Acid**
An explosion occurs when phosphorus trichloride is brought in contact with nitric or nitrous acid.
*Comp. Rend.* **28:** 86.

**Nitrous Acid**
See PHOSPHORUS TRICHLORIDE plus Nitric Acid.

**Organic Matter**
See PHOSPHORUS OXYCHLORIDE plus Organic Matter.

**Potassium**
See POTASSIUM plus Phosphorus Trichloride.

**Sodium**
See SODIUM plus Phosphorus Trichloride.

**Water**
The reaction between water and phosphorus trichloride is extremely violent. The reaction may be due to the formation of phosphine or elemental phosphorus. The possible presence of hydrogen may intensify these flashes of fire.
*Chem. Safety Data Sheet* **SD-27** (1948).


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## PHOSPHORUS TRIFLUORIDE $PF_3$

**Diborane**
The reaction product of this combination, borane-phosphorus trifluoride compound, is spontaneously flammable in air.
*Mellor* **8, Supp. 3:** 442 (1971).

**Fluorine**
See FLUORINE plus Phosphorus Trifluo ride.

**Oxygen**
See OXYGEN plus Phosphorus Trifluoride.

## PHOSPHORUS TRIOXIDE $P_4O_6$

**Air**
Melted phosphorus trioxide readily ignites in air. When thrown into oxygen (heated to 50–60°C.), it instantly ignites with a flame of almost blinding brilliance.
W. E. Downey, *J. Chem. Soc.* **125:** 347 (1924).

**Ammonia**
If ammonia is passed over phosphorus trioxide, which has been melted by the warmth of the hand, a somewhat violent reaction occurs and the mass ignites. The reaction is slow if the materials are kept cold.
Thorpe and Tutton, *J. Chem. Soc.* **59:** 1019 (1891).
*Mellor* **8:** 898 (1946–1947).

**Arsenic Trifluoride**
See ARSENIC TRIFLUORIDE plus Phosphorus Trioxide.

**Bromine**
See BROMINE plus Phosphorus Trioxide. See also CHLORINE plus Phosphorus Oxide.

**Chlorine**
See BROMINE plus Phosphorus Trioxide. See also CHLORINE plus Phosphorus Oxide.

**Dimethyl Formamide**
See DIMETHYL FORMAMIDE plus Phosphorus Trioxide.

**Dimethyl Sulfoxide**
See DIMETHYL FORMAMIDE plus Phosphorus Trioxide.

**Dimethyl Sulfite**
See DIMETHYL FORMAMIDE plus Phosphorus Trioxide.

**Methanol**
See DIMETHYL FORMAMIDE plus Phosphorus Trioxide.

**Oxygen**
See PHOSPHORUS TRIOXIDE plus Air.

**Phosphorus Pentachloride**
The reaction between phosphorus trioxide and phosphorus pentachloride is violent at ordinary temperatures.
Thorpe and Tutton, *J. Chem. Soc.* **57:** 545 (1890).

**Sulfur**
See SULFUR plus Phosphorus Trioxide.

**Sulfur Monochloride**
Sulfur monochloride acts with great violence on phosphorus trioxide.
Thorpe and Tutton, *J. Chem. Soc.* **59:** 1019 (1891). *Mellor* **8:** 898 (1946–1947).

**Water**
With quantities of phosphorus trioxide exceeding a couple of grams, hot water produces a violent explosion.
Thorpe and Tutton, *J. Chem. Soc.* **59:** 1019 (1891).
*Mellor* **8:** 897 (1946–1947).

## PHOSPHORYL BROMODIFLUORIDE $POBrF_2$

**Water**
See PHOSPHORYL FLUORIDE plus Water.

## PHOSPHORYL CHLORIDE $POCl_3$

**Boron Triiodide**
Phosphoryl chloride and boron triiodide react vigorously.
*Mellor* **5:** 136 (1946–1947).

**2,5-Dimethylpyrrole and Dimethyl Formamide**
See 2,5-DIMETHYLPYRROLE plus Phosphorus Oxychloride and Dimethyl Formamide.

**Dimethyl Sulfoxide**
See DIMETHYL SULFOXIDE plus Acyl Halides.

**Organic Matter**
Fibrous organic matter (wood, etc.), when dry, readily absorbs phosphorus oxychloride. When thus absorbed, it may constitute a fire hazard. Both phosphorus oxychloride and phosphorus trichloride are strongly corrosive and may set fire to combustible material.
*Chem. Safety Data Sheet* **SD-26** (1948). B. L. Heustis, *Safety Eng.* **54:** 95 (1927).

**Sodium**
See SODIUM plus Phosphoryl Chloride.

**Water**
When water reacts with phosphorus oxychloride, there is little warning; first a little bubbling and then a rapid acceleration and pressure increase. Small quantities of phosphorus oxychloride were emptied into a scrap nickel drum containing about 28 pounds of water. After a delay of 15 to 30 minutes, the drum exploded.
*MCA Task Group, POCl* (Jan. 19, 1967).
*MCA Case History* **1274** (1967). *MCA Case History* **793** (1962). *Chem. Safety Data Sheet* **SD-26** (1948).

## PHOSPHORYL CHLORODIFLUORIDE $POClF_2$

**Water**
See PHOSPHORYL FLUORIDE plus Water.

## PHOSPHORYL DIBROMOFLUORIDE $POBr_2F$

**Water**
See PHOSPHORYL FLUORIDE plus Water.

## PHOSPHORYL DICHLOROFLUORIDE $POCl_2F$

**Water**
See PHOSPHORYL FLUORIDE plus Water.

## PHOSPHORYL FLUORIDE $POF_3$

**Water**
The hydrolysis of phosphoryl fluoride and the halofluorides (phosphoryl chlorodifluoride, phosphoryl dichlorofluoride, phosphoryl bromodifluoride, and phosphoryl dibromofluoride) is a vigorous reaction.
*Mellor* **8, Supp. 3:** 458 (1971).

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**PHTHALIC ACID** $HOCOC_6H_4COOH$

**Nitric Acid**
See PHTHALIC ANHYDRIDE plus Nitric Acid.

**PHTHALIC ANHYDRIDE** $C_6H_4COOCO$

**Nitric Acid**
The exothermic nitration of phthalic acid or phthalic anhydride by a fuming nitric acid — sulfuric acid mixture may give mixtures of the potentially explosive phthaloyl nitrates or nitrites or their nitro derivatives. Formation of these compounds may be avoided if the nitrating mixture is extensively diluted with sulfuric acid and if a small (1.5 mole equivalent) of nitric acid is present.
*Chem. & Ind.* **20:** 790 (1972). *Chem. & Ind.* **17:** 664 (1972).

**PICRATES**

**(See also specific picrates as primary entries and under other reactants.)**

**Sulfuric Acid**
See SULFURIC ACID plus Carbides.

**PICRIC ACID** $(NO_2)_3C_6H_2OH$

**Ammonia**
Ammonia and metals with picric acid give results similar to bases.
*Military Explosives.*
See also PICRIC ACID plus Bases.

**Bases**
Picric acid and bases form explosive salts. The salts with heavy metals (e.g., lead) are very sensitive to primary explosives.
*Davis,* pp. 164–68 (1943).

**Concrete**
Contact between picric acid and concrete floors leads to the formation of more explosion-sensitive salts, such as calcium picrate.
*Urbanski* **1:** 518 (1964).

**Metals**
See PICRIC ACID plus Bases.

**PIPERIDINE** $CH_2CH_2CH_2CH_2CH_2NH$

**Dicyanofurazan**
Contact of dicyanofurazan, or its N-oxide, with piperidine or mixtures of nitrogenous bases is instantaneously explosive.
D. B. Denson, *Chem. Abst.* (1973).

**1-Perchlorylpiperidine**
It has exploded violently on contact with piperidine.
D. L. Gardner, et al., *J. Org. Chem.* (1964).

**N-Nitrosoacetanilide**
The dry anilide exploded on contact with a drop of piperidine.
R. Huisgen, *Ann.* (1951).

**PLATINUM** Pt

**Bromine Trifluoride and Potassium Fluoride**
Platinum is attacked by bromine trifluoride at 280°C in presence of potassium fluoride.
*Mellor* **2, Supp. 1:** 164 (1956).

**Hydrogen and Oxygen**
See HYDROGEN plus Oxygen and Platinum.

**Hydrogen Peroxide**
A little platinum black dropped into a hydrogen peroxide solution may cause an explosion.
*Mellor* **1:** 936 (1946–1947).

**Lithium**
See LITHIUM plus Platinum.

**Oxygen Difluoride**
See IRIDIUM plus Oxygen Difluoride.

**Permonosulfuric Acid**
The decomposition of 92 per cent permonosulfuric acid is explosive in the presence of smooth or finely divided platinum, manganese dioxide or silver.
*Mellor* **10:** 483 (1946–1947).

**Phosphorus**
See COPPER plus Phosphorus.

**PLATINIC BROMIDE** $PtBr_4$

**Bromine Trifluoride**
See BROMINE TRIFLUORIDE plus Platinic Bromide.

**PLATINIC CHLORIDE** $PtCl_4$

**Bromine Trifluoride**
See BROMINE TRIFLUORIDE plus Platinic Bromide.

**PLATINOUS HYPOPHOSPHITE** $Pt(PH_2O_2)_2$

**(self-reactive)**
Platinous hypophosphite liberates spontaneously flammable phosphine above 130°C.
*Mellor* **8:** 890 (1946–1947).

**PLATINUM-AMMINE NITRATES**

**(self-reactive)**
Platinum-amine nitrates may be impact-sensitive. $Pt(NH_3)_2NO_3$ and $Pt(NH_3)_4(OH)_2\ (NO_3)_2$ detonate when heated.
*Mellor* **16:** 412 (1946–1947).

**PLATINUM-AMMINE PERCHLORATES**

**(self-reactive)**
Platinum-ammine perchlorates may be impact-sensitive.
*Mellor* **16:** 412 (1946–1947).

**PLUTONIUM** Pu

**Air**
See PLUTONIUM plus Water.

**Carbon Tetrachloride**
Plutonium metal chips degreased in carbon tetrachloride and allowed to drain for five minutes ignited spontaneously. When the burning chips were inadvertently dropped into the carbon tetrachloride container, an explosion resulted.
*Ser. Acc. Series No.* **246** (1965).

**Water**
Pyrophoric products form on plutonium and particularly on certain alloys if they are stored for long periods in closed containers. When a container is opened, spontaneous ignition may occur. Plutonium corrosion is accel-


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erated by atmospheric moisture and a hydride is formed. This corrosion also occurs in moist inert gases. The corrosion products are frequently pyrophoric.
*Wick*, pp. 148–152, 331–332, 338 (1967).

**PLUTONIUM HYDRIDE** $PuH_2$

**Air**
Plutonium hydride in some forms is spontaneously flammable in air. See also PLUTONIUM plus Carbon Tetrachloride and PLUTONIUM plus Water.
*Chem. and Eng. News* **36** (8): 64 (1958).

**POLYAMIDE**

**Fluorine**
See FLUORINE plus Solid Nonmetals and Oxygen.

**POLYCHLORINATED BIPHENYL**

**Chlorine**
See CHLORINE plus Polychlorinated Biphenyl.

**POLYDIMETHYLSILOXANE** $[-Si(CH_3)_2O-]_x$

**Chlorine**
See CHLORINE plus Polypropylene.

**POLYETHYLENE**

**Fluorine**
See FLUORINE plus Solid Nonmetals and Oxygen.

**POLYISOBUTYLENE** $[CH_2=C(CH_3)_2]_x$

**Silver Peroxide**
See SILVER PEROXIDE plus Polyisobutylene.

**POLYPHOSPHORYL CHLORIDES**

**Water**
These polymers hydrolyze violently.
*Mellor* **8, Supp. 3:** 507 (1971).

**POLYPROPYLENE** $(CH_2=CHCH_3)_x$

**Chlorine**
See CHLORINE plus Polypropylene.

**Potassium Permanganate**
See POTASSIUM PERMANGANATE plus Polypropylene.

**POLYSULFIDE POLYMERS**

**Calcium Peroxide**
See CALCIUM PEROXIDE plus Polysulfide Polymers.

**POLYURETHANE**

**Fluorine and Oxygen**
See FLUORINE plus Solid Nonmetals and Oxygen.

**POTASSIUM** K

**(See also IODINE plus Lithium)**

**Acetylene**
Molten potassium ignites in acetylene.
M. Berthelot, *Bull. Soc. Chim.* (2) **5:** 188 (1866).

**Air**
The oxidation of potassium may proceed so rapidly that the heat generated melts and ignites the metal. This is particularly the case where pressure is applied at ordinary temperatures; the metal then liquefies where the pressure is applied, and takes fire.
*Sidgwick* **1** (1950).
Potassium burns in moist air at room temperature.
*Mellor* **2:** 468 (1946–1947).
Potassium is spontaneously flammable in air at room temperature if the surface of the metal is clean.
*Mellor* **2:** 468 (1946–1947).
The higher oxides of potassium, formed in air, react explosively with pure potassium, sodium, sodium-potassium alloys, and organic matter.
*Mellor* **2, Supp. 3:** 1559 (1963).

**Aluminum Bromide**
A mixture of potassium and any of the following metallic halides produces a strong explosion on impact: aluminum bromide, aluminum chloride, aluminum fluoride, ammonium chlorocuprate, antimony tribromide, antimony trichloride, antimony triiodide, arsenic trichloride, arsenic triiodide, bismuth tribromide, bismuth trichloride, bismuth triiodide, cadmium bromide, cadmium chloride, cadmium iodide, chromium tetrachloride, cupric bromide, cupric chloride, cuprous bromide, cuprous chloride, cuprous iodide, manganous chloride, mercuric bromide, mercuric chloride, mercuric fluoride, mercuric iodide, mercurous chloride, nickel bromide, nickel chloride, nickel iodide, silicon tetrachloride, silver fluoride, stannic chloride, stannic iodide (with sulfur), stannous chloride, sulfur dibromide, thallous bromide, vanadium pentachloride, zinc bromide, zinc chloride, and zinc iodide.
*Mellor* **2, Supp. 3:** 1571 (1963).

**Aluminum Chloride**
See POTASSIUM plus Aluminum Bromide.

**Aluminum Fluoride**
See POTASSIUM plus Aluminum Bromide.

**Ammonium Chlorocuprate**
See POTASSIUM plus Aluminum Bromide.

**Ammonium Bromide**
A mixture of potassium and any of the following compounds produces a weak explosion on impact: ammonium bromide, ammonium iodide, cadmium fluoride, chromium trifluoride, manganous bromide, manganous iodide, nickel fluoride, potassium chlorocuprate, silver chloride, silver iodide, strontium iodide, thallous chloride, and zinc fluoride.
*Mellor* **2, Supp. 3:** 1571 (1963).

**Ammonium Iodide**
See POTASSIUM plus Ammonium Bromide.

**Ammonium Sulfate and Ammonium Nitrate**
A mixture of ammonium sulfate and ammonium nitrate can easily be exploded by potassium or sodium-potassium alloy.
H. Staudinger, *Z. Elektrokem.* **31:** 549–52 (1925).

**Antimony Tribromide**
See POTASSIUM plus Aluminum Bromide.



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**Antimony Trichloride**
See POTASSIUM plus Aluminum Bromide.

**Antimony Triiodide**
See POTASSIUM plus Aluminum Bromide.

**Arsenic Trichloride**
See POTASSIUM plus Aluminum Bromide.

**Arsenic Triiodide**
See POTASSIUM plus Aluminum Bromide.

**Arsine and Ammonia**
Potassium and arsine react vigorously in liquid ammonia at minus 78°C. The product reacts vigorously with air.
*Mellor* **2, Supp. 3:** 1579 (1963).

**Bismuth Tribromide**
See POTASSIUM plus Aluminum Bromide.

**Bismuth Trichloride**
See POTASSIUM plus Aluminum Bromide.

**Bismuth Triiodide**
See POTASSIUM plus Aluminum Bromide.

**Bismuth Trioxide**
Potassium reduces heated bismuth trioxide to the metal and the reaction is accompanied by incandescence. Similar results are obtained with sodium.
*Mellor* **9:** 649 (1946–1947).

**Boric Acid**
A mixture of potassium and any of the following compounds may explode on impact: boric acid, copper oxychloride, lead oxychloride, lead peroxide, lead sulfate, silver iodate, sodium iodate, and vanadium oxychloride.
*Mellor* **2, Supp. 3:** 1571 (1963).

**Boron Tribromide**
A mixture of potassium and any of the following halide compounds produces a very violent explosion on impact: boron tribromide, carbon tetrachloride, cobaltous bromide, cobaltous chloride, ferric bromide, ferric chloride, ferrous bromide, ferrous chloride, ferrous iodide, phosphorus pentachloride, phosphorus tribromide and sulfur dichloride.
*Mellor* **2, Supp. 3:** 1571 (1963).

**Bromine**
See BROMINE plus Potassium.

**Cadmium Bromide**
See POTASSIUM plus Aluminum Bromide.

**Cadmium Chloride**
See POTASSIUM plus Aluminum Bromide.

**Cadmium Fluoride**
See POTASSIUM plus Ammonium Bromide.

**Cadmium Iodide**
See POTASSIUM plus Aluminum Bromide.

**Carbon**
See POTASSIUM plus Graphite and Potassium Superoxide.

**Carbon Dioxide**
Mixture of solid forms of potassium and carbon dioxide (as dry ice) explodes when subjected to shock.
*Mellor* **2, Supp. 3:** 1568 (1963).

**Carbon Disulfide**
Heated potassium ignites in the vapor of carbon disulfide. Potassium and carbon disulfide can be exploded by pressure or friction.
*Von Schwartz*, p. 327. *Ann. Phys.* **6:** 444 (1826).

**Carbon Monoxide and Oxygen**
The reaction of potassium and carbon monoxide forms an explosive carbonyl compound, potassium carbonyl, which reacts violently with oxygen.
*Mellor* **2, Supp. 3:** 1567 (1963).
See also SODIUM CARBONYL plus Air.

**Carbon Tetrachloride**
Potassium and its alloys form explosive mixtures with carbon tetrachloride.
H. N. Gilbert, *Chem. and Eng. News* **26:** 2604 (1948).
See POTASSIUM plus Boron Tribromide.

**Charcoal**
Both charcoal and graphite react vigorously with liquid potassium.
*Mellor* **2, Supp. 3:** 1566 (1963).

**Chlorinated Hydrocarbons**
Potassium and its alloys form explosive mixtures with chlorinated hydrocarbons.
H. N. Gilbert, *Chem. and Eng. News* **26:** 2604 (1948).

**Chlorine**
Potassium burns spontaneously in dry chlorine.
*Mellor* **2:** 469 (1946–1947).

**Chlorine Monoxide**
Mere contact of chlorine monoxide gas with paper, caoutchouc (India rubber), turpentine, sulfur, potassium, phosphorus, charcoal, arsenic, or antimony is attended by a violent explosion.
*Mellor* **2:** 241 (1946–1947).

**Chlorine Trifluoride**
See ANTIMONY plus Chlorine Trifluoride.

**Chloroform**
The alkali metals react explosively with chloroform, dichloromethane, and methyl chloride.
See LITHIUM plus Chloroform.
*Z. Electrochem.* **31:** 549 (1925).

**Chromium Tetrachloride**
See POTASSIUM plus Aluminum Bromide.

**Chromium Trifluoride**
See POTASSIUM plus Ammonium Bromide.

**Chromium Trioxide**
Sodium or potassium reacts with chromium trioxide with incandescence.
*Mellor* **11:** 237 (1946–1947).

**Cobaltous Bromide**
See POTASSIUM plus Boron Tribromide.

**Cobaltous Chloride**
See POTASSIUM plus Boron Tribromide.

**Copper Oxychloride**
See POTASSIUM plus Boric Acid.

**Cupric Bromide**
See POTASSIUM plus Aluminum Bromide.

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**Cupric Chloride**
See POTASSIUM plus Aluminum Bromide.

**Cupric Oxide**
Cupric oxide is reduced to metallic copper when heated with potassium at a temperature below its melting point. The reaction proceeds with vivid incandescence.
*Berichte* **24.**

**Cuprous Bromide**
See POTASSIUM plus Aluminum Bromide.

**Cuprous Chloride**
See POTASSIUM plus Aluminum Bromide.

**Cuprous Iodide**
See POTASSIUM plus Aluminum Bromide.

**Dichloromethane**
See POTASSIUM plus Chloroform.

**Ethylene Oxide**
Ethylene oxide is dangerously reactive with metallic potassium.
*Chem. Safety Data Sheet* **SD-38:** 11 (1951).
See ETHYLENE OXIDE plus Acids and Bases.

**Ferric Bromide**
See POTASSIUM plus Boron Tribromide.

**Ferric Chloride**
See POTASSIUM plus Boron Tribromide.

**Ferrous Bromide**
See POTASSIUM plus Boron Tribromide.

**Ferrous Chloride**
See POTASSIUM plus Boron Tribromide.

**Ferrous Iodide**
See POTASSIUM plus Boron Tribromide.

**Fluorine**
Potassium burns spontaneously in dry fluorine.
*Mellor* **2:** 469 (1946–1947).

**Graphite**
See POTASSIUM plus Charcoal.

**Graphite and Air**
See POTASSIUM plus Graphite and Potassium Superoxide.

**Graphite and Potassium Superoxide**
Potassium superoxide forms on the surface of either solid or molten potassium metal. Attempts to extinguish burning potassium with powdered graphite have resulted in violent explosions.
*Chem. Abst.* **63** (1): 424 (July 5, 1965).
*Mellor* **2, Supp. 3:** 1566 (1963).

**Hydrogen Iodide**
Potassium burns momentarily in hydrogen iodide; the flame then goes out.
M. Ribalkin, *Bull. Acad. St. Petersbourg* (2) **1:** 279 (1889).
A very violent explosion results when a mixture of potassium and hydrogen iodide is struck by a hammer.
*Mellor* **2, Supp. 3:** 1563 (1963).

**Hydrogen Peroxide**
See LEAD DIOXIDE plus Hydrogen Peroxide.

**Iodine**
See IODINE plus Potassium.
See IODINE plus Lithium.

**Iodine Monobromide**
Potassium in contact with molten iodine monobromide creates a strong explosion.
*Mellor* **2, Supp. 3:** 1563 (1963).

**Iodine Monochloride**
Potassium explodes in contact with iodine monochloride, but the reaction of sodium is very slow.
A. Vogel, *Kastner's Arch.* **10:** 119 (1827).
*Berichte* **31:** 892.
*Mellor,* **2, Supp. 1:** 501 (1956).
*Mellor,* **2, Supp. 3:** 1563 (1963).

**Iodine Pentafluoride**
A mixture of iodine pentafluoride and potassium or sodium (molten) will explode.
*Mellor* **2:** 114 (1946–1947).

**Lead Oxychloride**
See POTASSIUM plus Boric Acid.

**Lead Peroxide**
See POTASSIUM plus Boric Acid.

**Lead Sulfate**
See POTASSIUM plus Boric Acid.

**Maleic Anhydride**
See ALKALI METALS plus Maleic Anhydride.

**Manganous Bromide**
See POTASSIUM plus Ammonium Bromide.

**Manganous Chloride**
See POTASSIUM plus Aluminum Bromide.

**Manganous Iodide**
See POTASSIUM plus Ammonium Bromide.

**Mercuric Bromide**
See POTASSIUM plus Aluminum Bromide.

**Mercuric Chloride**
See POTASSIUM plus Aluminum Bromide.

**Mercuric Fluoride**
See POTASSIUM plus Aluminum Bromide.

**Mercuric Iodide**
See POTASSIUM plus Aluminum Bromide.

**Mercurous Chloride**
See POTASSIUM plus Aluminum Bromide.

**Mercurous Oxide**
Molten sodium or potassium decomposes mercurous oxide with slight explosion.
J. B. Senderens, *Bull. Soc. Chim.* (3)**6:** 802 (1891).

**Methyl Chloride**
See POTASSIUM plus Chloroform.

**Molybdenum Trioxide**
Molybdenum trioxide is reduced by either potassium or sodium with incandescence.
*Z. Anorg. Chemie* **190:** 270.

**Nickel Bromide**
See POTASSIUM plus Aluminum Bromide.

**Nickel Chloride**
See POTASSIUM plus Aluminum Bromide.

**Nickel Fluoride**
See POTASSIUM plus Ammonium Bromide.



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**Nickel Iodide**
See POTASSIUM plus Aluminum Bromide.

**Nitrogen Dioxide**
Potassium ignites in nitrogen dioxide at ordinary temperatures.
*Mellor* **8:** 544 (1946–1947).
See also MANGANESE plus Nitrogen Dioxide.

**Nitryl Fluoride**
Heated potassium metal burns with a lilac flame in vapor of nitryl fluoride.
*Mellor* **2, Supp. 3:** 1566 (1963).

**Peroxides**
See ANTIMONY plus Sodium Peroxide.

**Phosgene**
Mixture of potassium and phosgene explodes when subjected to shock.
*Mellor* **2, Supp. 3:** 1568 (1963).

**Phosphine and Ammonia**
Potassium and phosphine react in liquid ammonia to form potassium dihydrophosphide, a spontaneously flammable solid.
*Mellor* **8, Supp. 3:** 283 (1971).

**Phosphorus**
See PHOSPHORUS plus Cesium.

**Phosphorus Pentachloride**
See POTASSIUM plus Boron Tribromide.

**Phosphorus Pentoxide**
When phosphorus pentoxide is warmed with potassium or sodium, the mixture becomes incandescent.
H. Davy, *Phil. Trans. Roy. Soc. London* **102:** 405 (1812).

**Phosphorus Tribromide**
See POTASSIUM plus Boron Tribromide.

**Phosphorus Trichloride**
Potassium burns vigorously in the vapor of phosphorus trichloride.
H. Davy, *Phil. Trans. Roy. Soc. London* **100:** 231 (1810); **101:** 1 (1811).

**Potassium Chlorocuprate**
See POTASSIUM plus Ammonium Bromide.

**Potassium Oxides**
See POTASSIUM plus Air.

**Potassium Ozonide**
Potassium in contact with the following oxides causes an explosive reaction: potassium ozonide, potassium peroxide, potassium superoxide.
*Mellor* **2, Supp. 3:** 1577 (1963).

**Potassium Peroxide**
Potassium peroxide oxidizes many metals with incandescence; e.g., potassium, arsenic, antimony, tin, zinc, and copper.
*Mellor* **2:** 490–3 (1946–1947).
See POTASSIUM plus Potassium Ozonide.

**Potassium Superoxide**
Potassium metal sometimes forms an orange-yellow coating of tetroxide, even under mineral oil. A 2 cc. lump of such potassium, while being sliced with a stainless steel knife, suddenly exploded and burned.
*Short* (1966). *Health & Safety Info.* **257** (March 31, 1967).
Potassium superoxide scale being chipped off metallic potassium was driven into the underlying metal, and caused a violent explosion.
H. N. Gilbert, *Chem. and Eng. News* **26:** 2604 (1948).
See POTASSIUM plus Potassium Ozonide.

**Selenium**
See SELENIUM plus Potassium.

**Selenium Monochloride**
When potassium is added to selenium monochloride at ordinary temperatures, the mixture explodes violently.
*Mellor* **10:** 896 (1946–1947).
*Mellor* **2, Supp. 3:** 1564 (1963).

**Selenium Oxychloride**
When potassium is brought in contact with selenium oxychloride in the cold, a violent explosion occurs.
*Mellor* **10:** 908 (1946–1947).

**Silicon Tetrachloride**
See POTASSIUM plus Aluminum Bromide.

**Silver Bromide**
See SODIUM plus Silver Bromide.

**Silver Chloride**
See SODIUM plus Silver Bromide.
See POTASSIUM plus Ammonium Bromide.

**Silver Fluoride**
See SODIUM plus Silver Bromide.
See POTASSIUM plus Aluminum Bromide.

**Silver Iodate**
See POTASSIUM plus Boric Acid.

**Silver Iodide**
See SODIUM plus Silver Bromide.
See POTASSIUM plus Ammonium Bromide.

**Sodium Iodate**
See POTASSIUM plus Boric Acid.

**Sodium Nitrite and Ammonia**
Solutions of potassium and sodium nitrite in liquid ammonia form disodium nitrite, which is very reactive and easily explosive.
*Mellor* **2, Supp. 3:** 1566 (1963).

**Sodium Peroxide**
Sodium peroxide oxidizes potassium with incandescence.
*Mellor* **2:** 490–93 (1946–1947).

**Stannic Chloride**
See POTASSIUM plus Aluminum Bromide.

**Stannic Iodide and Sulfur**
See POTASSIUM plus Aluminum Bromide.

**Stannic Oxide**
Stannic oxide is reduced by potassium or sodium at gentle heat and the reaction is accompanied by incandescence.
*Mellor* **7:** 401 (1946–1947).

**Stannous Chloride**
See POTASSIUM plus Aluminum Bromide.

**Strontium Iodide**
See POTASSIUM plus Ammonium Bromide.

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**Sulfur**
Vapors of potassium and sulfur react with chemiluminescence at 300°C and low pressures.
*Mellor* **2, Supp. 3:** 1564 (1963).

**Sulfur Dibromide**
See POTASSIUM plus Aluminum Bromide.

**Sulfur Dichloride**
See POTASSIUM plus Boron Tribromide.

**Tellurium**
See TELLURIUM plus Potassium.

**Tetrachloroethane**
See SODIUM plus Tetrachloroethane.

**Thallous Bromide**
See POTASSIUM plus Aluminum Bromide.

**Thallous Chloride**
See POTASSIUM plus Ammonium Bromide.

**Thiophosphoryl Fluoride**
See SODIUM plus Thiophosphoryl Fluoride.

**Titanium Tetrachloride**
During the reduction of titanium tetrachloride to titanium metal with potassium, an explosion occurred. Prior to the explosion, the system was heated to 90°C.
*Waller and Mandell* (1967).

**Vanadium Oxychloride**
See POTASSIUM plus Boric Acid.

**Vanadium Pentachloride**
See POTASSIUM plus Aluminum Bromide.

**Water**
At 20°C. the heat of reaction is adequate to ignite the hydrogen liberated.
*Mellor* **2:** 469 (1946–1947).
*Mellor* **2, Supp. 3:** 1560 (1963).

**Zinc Bromide**
See POTASSIUM plus Aluminum Bromide.

**Zinc Chloride**
See POTASSIUM plus Aluminum Bromide.

**Zinc Fluoride**
See POTASSIUM plus Ammonium Bromide.

**Zinc Iodide**
See POTASSIUM plus Aluminum Bromide.

## POTASSIUM ACETYLIDE KC≡H

**Carbon Dioxide**
When potassium acetylene carbide is warmed with carbon dioxide, the mass becomes incandescent.
*Mellor* **5:** 849–50 (1946–1947).

**Chlorine**
See CHLORINE plus Potassium Acetylene Carbide.

**Sulfur Dioxide**
Potassium acetylene carbide reacts with sulfur dioxide at ordinary temperatures and it becomes incandescent.
*Mellor* **5:** 849 (1946–1947).

## POTASSIUM ACI-NITROACETATE $K_2O_2N$=CHCHO

**Water**
Dipotassium nitroacetate exploded when the dry salt was moistened with a little water.
*Chem. and Eng. News* **27:** 1473.

## POTASSIUM AMIDE $KNH_2$

**Water**
Potassium amide reacts vigorously with water and may be accompanied by ignition.
*Mellor* **8:** 255 (1946–1947).

## POTASSIUM AZIDE $KN_3$

**Carbon Disulfide**
See CARBON DISULFIDE plus Azides.

**Manganese Dioxide**
See MANGANESE DIOXIDE plus Potassium Azide.

## POTASSIUM AZIDODISULFATE $KSO_3OSO_2NNN$

**Water**
This reaction is an explosive one.
*Mellor* **8, Supp. 2:** 36 (1967).

## POTASSIUM BICARBONATE $KHCO_3$

**Monoammonium Phosphate**
See SODIUM BICARBONATE plus Monoammonium Phosphate.

## POTASSIUM BROMATE $KBrO_3$

**Aluminum**
See ALUMINUM plus Bromates.

**Arsenic**
See ARSENIC plus Bromates.

**Carbon**
See CARBON plus Bromates.

**Copper**
See COPPER plus Bromates.

**Lead Acetate**
During an attempt to make lead bromate, an explosion occurred that caused two deaths.
*Mellor* **2, Supp. 1:** 770 (1956).

**Metal Sulfides**
See METAL SULFIDES plus Bromates.

**Organic Matter**
See BROMATES plus Organic Matter.

**Phosphorus**
See PHOSPHORUS plus Bromates.

**Selenium**
See SELENIUM plus Potassium Bromate.

**Sulfur**
See SULFUR plus Bromates.

## POTASSIUM BROMIDE KBr

**Bromine Trifluoride**
See BROMINE TRIFLUORIDE plus Potassium Bromide.



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**POTASSIUM tert.-BUTOXIDE** $KOC(CH_3)_3$

**Acetic Acid**
See ACETONE plus Potassium Tert.-Butoxide.

**Acetone**
See ACETONE plus Potassium Tert.-Butoxide.

**Butyl Acetate**
See ACETONE plus Potassium Tert.-Butoxide.

**Carbon Tetrachloride**
See ACETONE plus Potassium Tert.-Butoxide.

**Chloroform**
See ACETONE plus Potassium Tert.-Butoxide.

**Diethyl Sulfate**
See ACETONE plus Potassium Tert.-Butoxide.

**Dimethyl Carbonate**
See ACETONE plus Potassium Tert.-Butoxide.

**Epichlorohydrin**
See ACETONE plus Potassium Tert.-Butoxide.

**Ethyl Acetate**
See ACETONE plus Potassium Tert.-Butoxide.

**Ethyl Alcohol**
See ACETONE plus Potassium Tert.-Butoxide.

**Isopropyl Alcohol**
See ACETONE plus Potassium Tert.-Butoxide.

**Methyl Alcohol**
See ACETONE plus Potassium Tert.-Butoxide.

**Methylene Chloride**
See ACETONE plus Potassium Tert.-Butoxide.

**Methyl Ethyl Ketone**
See ACETONE plus Potassium Tert.-Butoxide.

**Methyl Isobutyl Ketone**
See ACETONE plus Potassium Tert.-Butoxide.

**Propyl Alcohol**
See ACETONE plus Potassium Tert.-Butoxide.

**Propyl Formate**
See ACETONE plus Potassium Tert.-Butoxide.

**Sulfuric Acid**
See ACETONE plus Potassium Tert.-Butoxide.

**POTASSIUM CARBIDE** $K_2C_2$

**Water**
Potassium carbide may react explosively on contact with water.
*Bahme,* p. 27 (1961).

**POTASSIUM CARBONATE** $K_2CO_3$

**Chlorine Trifluoride**
See CHLORINE TRIFLUORIDE plus Nitric Acid.

**POTASSIUM CARBONYL** KCO

**Air**
See SODIUM CARBONYL plus Air.

**Oxygen**
See POTASSIUM plus Carbon Monoxide and Oxygen.

**Water**
See SODIUM CARBONYL plus Air.

**POTASSIUM CHLORATE** $KClO_3$

**Aluminum**
See ALUMINUM plus Bromates.

**Ammonia**
Gaseous ammonia, mixed with air reacts so vigorously with potassium chlorate that the reaction may become dangerous.
*Mellor* **8:** 217 (1946–1947).

**Ammonium Chloride**
In the manufacture of signaling smokes this combination is hazardous because of metathetical interaction to form unstable ammonium perchlorate.
*Ellern,* p. 155 (1968).
See POTASSIUM CHLORATE plus Ammonium Salts.

**Ammonium Salts**
The reaction of potassium chlorate with ammonium salts is violent.
*Mellor* **2, Supp. 1:** 586 (1956).

**Ammonium Sulfate**
The mixture of potassium chlorate and ammonium sulfate decomposes with incandescence when heated.
*Mellor* **2:** 702 (1946–1947).

**Antimony Trisulfide**
A mixture of potassium chlorate and antimony trisulfide can be exploded by an electric spark.
*Mellor* **9:** 523 (1946–1947).

**Arsenic**
See ARSENIC plus Bromates.

**Barium Hypophosphite**
A mixture of equal parts of these materials, previously dried at 100°C., burns in open air with great rapidity. When the mixture is confined, an explosion will result. The mixture is very sensitive to shock and friction.
*Mellor* **8:** 881 (1946–1947).

**Barium Sulfide**
See BARIUM SULFIDE plus Potassium Chlorate.

**Boron**
See BORON plus Potassium Chlorate.

**Calcium Hypophosphite**
See CALCIUM HYPOPHOSPHITE plus Potassium Chlorate.

**Calcium Sulfide**
See BARIUM SULFIDE plus Lead Dioxide.

**Carbon**
See CARBON plus Bromates.

**Charcoal**
See CHLORATES plus Organic Matter.

**Chromium**
See CHROMIUM plus Potassium Chlorate.

**Copper**
See COPPER plus Bromates.

**Copper Phosphide**
See COPPER PHOSPHIDE plus Potassium Chlorate.

**Gallic Acid**
Gallic acid, potassium chlorate and red gum (Formula 156) is a pyrotechnic whistle composition.
*Ellern,* p. 183 (1968).


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**Germanium**
See GERMANIUM plus Potassium Nitrate.

**Hydrogen Iodide**
Molten potassium chlorate ignites in hydrogen iodide.
*Mellor* **2:** 204 (1946–1947).

**Magnesium**
See MAGNESIUM plus Potassium Chlorate.

**Magnesium, Copper Sulfate (anhydrous), Ammonium Nitrate and Water**
See MAGNESIUM plus Copper Sulfate (anhydrous), Ammonium Nitrate, Potassium Chlorate and Water.

**Manganese Dioxide**
See CHLORATES plus Manganese Dioxide.

**Mercury Tetratriphosphide**
See MERCURY TETRATRIPHOSPHIDE plus Air.

**Metal Sulfides**
See METAL SULFIDES plus Bromates.

**Organic Acids (Dibasic)**
See CHLORATES plus Organic Acids.

**Organic Matter**
See BROMATES plus Organic Matter. See also CHLORATES plus Organic Matter.

**Phosphorus**
See PHOSPHORUS plus Potassium Chlorate.
See PHOSPHORUS plus Bromates.

**Silver Sulfide**
A violent reaction occurs when silver sulfide is heated with potassium chlorate.
*Mellor* **3:** 447 (1946–1947).

**Sodium Amide**
A mixture of sodium amide and potassium chlorate explodes.
*Mellor* **8:** 258 (1946–1947).

**Sulfur**
See SULFUR plus Bromates. See CHLORATES plus Organic Matter.
See SULFUR plus Potassium Chlorate.

**Sulfur Dioxide**
If a drop of a solution of sulfur dioxide in ether or alcohol is added to powdered potassium chlorate, a reaction ensues and the mass explodes.
*Mellor* **2:** 311 (1946–1947).

**Sulfuric Acid**
These materials may react to cause fires and possible explosions.
*Mellor* **2:** 315 (1946–1947).

**Thiocyanates**
See THIOCYANATES plus Chlorates.

**Titanium**
See TITANIUM plus Potassium Chlorate.

**Zinc**
See ZINC plus Chlorates.

**Zirconium**
See ZIRCONIUM plus Potassium Chlorate.

## POTASSIUM CHLORIDE KCl

**Bromine Trifluoride**
See BROMINE TRIFLUORIDE plus Potassium Bromide.

**Potassium Permanganate and Sulfuric Acid**
See POTASSIUM PERMANGANATE plus Sulfuric Acid and Potassium Chloride.

## POTASSIUM CYANIDE KCN

**Chlorates**
See POTASSIUM CYANIDE plus Sodium Chlorate.

**Nitrites**
See NITRITES plus Potassium Cyanide.

**Nitrogen Trichloride**
See NITROGEN TRICHLORIDE plus Ammonia.

**Sodium Chlorate**
Chlorates plus potassium cyanide explode when heated.
*Von Schwartz,* p. 323 (1918). *Pieters,* p. 30 (1957).

## POTASSIUM DICHROMATE $K_2Cr_2O_7$

**Acetone and Sulfuric Acid**
See ACETONE plus Sulfuric Acid and Potassium Dichromate.

**Hydrazine**
Potassium dichromate or sodium dichromate reacts explosively with hydrazine.
*Mellor* **11:** 234 (1946–1947).

**Hydroxylamine**
A drop of anhydrous hydroxylamine on powdered potassium dichromate produces a violent explosion.
*Mellor* **8:** 293 (1946–1947).

## POTASSIUM FERRICYANIDE $K_3Fe(CN)_6$

**Ammonia**
A mixture of the two may cause an explosion.
*Pieters,* p. 30 (1957).

**Chromic Anhydride**
See CHROMIC ANHYDRIDE plus Potassium Ferricyanide.

## POTASSIUM FERROCYANIDE $K_4Fe(CN)_6 \cdot 3H_2O$

**Cupric Nitrate**
See CUPRIC NITRATE plus Potassium Ferrocyanide.

## POTASSIUM FLUORIDE KF

**Platinum and Bromine Trifluoride**
See PLATINUM plus Bromine Trifluoride and Potassium Fluoride.

## POTASSIUM GRAPHITE $KC_8$; $KC_{24}$

**Air**
Potassium graphite is spontaneously flammable in air.
*Brauer* (1965).

## POTASSIUM HEXAHYDROALUMINATE $K_3AlH_6$

**(self-reactive)**
A sample of this hydride over a period of months oxidized or hydrolized. The product of this reaction when scraped with a metal spatula exploded violently. Cesium hexahydroaluminate behaves similarly.
*Chem. and Eng. News* **47** (1): 9 (1969).



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## POTASSIUM HYDRIDE KH

**Air**
Potassium hydride is spontaneously flammable in air.
*Coates,* p. 161 (1956). *Ellern* (1961).

**Chlorine**
See CHLORINE plus Potassium Hydride.

**Fluorine**
See CHLORINE plus Potassium Hydride.

## POTASSIUM HYDROXIDE KOH

**(See also SODIUM HYDROXIDE)**

**Acetic Acid**
See ACETIC ACID plus Potassium Hydroxide.

**Acrolein**
See SODIUM HYDROXIDE plus Acrolein.

**Acrylonitrile**
See SODIUM HYDROXIDE plus Acrylonitrile.

**Calcium Carbide and Chlorine**
See DICHLOROACETYLENE plus Air.

**Chlorine Dioxide**
A piece of potassium hydroxide causes liquid chlorine dioxide to explode.
*Mellor* **2:** 289 (1946–1947).

**Chlorine and Hydrogen Peroxide**
See CHLORINE plus Hydrogen Peroxide and Potassium Hydroxide.

**Chloroform and Methyl Alcohol**
See SODIUM HYDROXIDE plus Chloroform and Methyl Alcohol.

**1,2-Dichloroethylene**
The reaction produces chloroacetylene, which is explosive and spontaneously flammable in air. It is highly toxic.
*Rutledge,* p. 134 (1968).
See also SODIUM plus 1,2-Dichloroethylene.

**Maleic Anhydride**
See SODIUM HYDROXIDE plus Maleic Anhydride.

**N-Methyl-N-Nitroso Urea and Methylene Chloride**
See N-METHYL-N-NITROSO UREA plus Potassium Hydroxide and Methylene Chloride.

**Nitroethane**
See CALCIUM HYDROXIDE plus Nitroethane.

**Nitrogen Trichloride**
See NITROGEN TRICHLORIDE plus Ammonia.

**Nitromethane**
See CALCIUM HYDROXIDE plus Nitroethane.

**Nitroparaffins**
See CALCIUM HYDROXIDE plus Nitroethane.

**o-Nitrophenol**
Molten ortho nitrophenol reacts violently with potassium hydroxide (commercial 85% pellets).
*Pouwels* (1972).

**Nitropropane**
See CALCIUM HYDROXIDE plus Nitroethane.

**N-Nitrosomethylurea**
A reaction between n-nitrosomethylurea and potassium hydroxide in n-butyl ether resulted in an explosion due to the formation of diazomethane.
*Schwab* (1972).

**Nitrosomethyl Urea and Methylene Chloride**
See NITROSOMETHYL UREA plus Potassium Hydroxide and Methylene Chloride.

**Phosphorus**
See PHOSPHORUS plus Alkaline Hydroxides and PHOSPHORUS plus Potassium Hydroxide.

**Potassium Persulfate and Water**
See POTASSIUM PERSULFATE plus Potassium Hydroxide and Water.

**Sodium Azide and Benzoyl Chloride**
See SODIUM AZIDE plus Benzoyl Chloride and Potassium Hydroxide.

**Tetrachloroethane**
When solid potassium hydroxide and tetrachloroethane are heated, a spontaneously flammable gas, chloroacetylene, is formed.
*Bahme,* p. 33 (1961).

**Tetrahydrofuran**
See TETRAHYDROFURAN plus Potassium Hydroxide.

**Trichloroethylene**
See SODIUM HYDROXIDE plus Trichloroethylene.

**Water**
See POTASSIUM OXIDE plus Water.

## POTASSIUM HYPOBORATE $K_4B_2O_4$

**(self-reactive)**
Potassium hypoborate is a stronger, more violent reducing agent than potassium hypophosphite.
*Mellor* **5:** 37 (1946–1947).

## POTASSIUM HYPOPHOSPHITE $KH_2PO_2$

**(self-reactive)**
Potassium hypophosphite decomposes when heated, forming phosphine, a spontaneously flammable gas.
*Mellor* **8:** 881 (1946–1947).

**Nitric Acid**
Potassium hypophosphite explodes when evaporated with nitric acid.
*Mellor* **8:** 882 (1946–1947).

## POTASSIUM IODATE $KIO_3$

**Aluminum**
See ALUMINUM plus Bromates.

**Arsenic**
See ARSENIC plus Bromates.

**Carbon**
See CARBON plus Bromates.

**Copper**
See COPPER plus Bromates.

**Metal Sulfides**
See METAL SULFIDES plus Bromates.

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**Organic Matter**
See BROMATES plus Organic Matter.

**Phosphorus**
See PHOSPHORUS plus Potassium Iodate.

**Sulfur**
See SULFUR plus Bromates.

## POTASSIUM IODIDE KI

**Bromine Trifluoride**
See BROMINE TRIFLUORIDE plus Potassium Bromide.

**Chlorine Trifluoride**
See CHLORINE TRIFLUORIDE plus Nitric Acid.

**Fluorine Perchlorate**
See FLUORINE PERCHLORATE plus Potassium Iodide.

## POTASSIUM NITRATE $KNO_3$

**Antimony**
See ANTIMONY plus Potassium Nitrate.

**Antimony Trisulfide**
A mixture of potassium nitrate and antimony trisulfide explodes at a red heat.
*Mellor* **9:** 524 (1946–1947).

**Arsenic**
See ARSENIC plus Potassium Nitrate.

**Arsenic Disulfide**
Arsenic disulfide forms explosive nixtures when mixed with potassium nitrate.
*Mellor* **9:** 270 (1946–1947).

**Barium Sulfide**
See BARIUM SULFIDE plus Lead Dioxide.

**Boron**
See BORON plus Potassium Nitrate.

**Boron Phosphide**
See BORON PHOSPHIDE plus Nitric Acid.

**Calcium Sulfide**
See BARIUM SULFIDE plus Lead Dioxide.

**Charcoal**
Charcoal and potassium nitrate make a pyrotechnic mixture.
*Ellern,* p. 378 (1968).

**Copper Phosphide**
See COPPER PHOSPHIDE plus Potassium Nitrate.

**Fluorine**
See FLUORINE plus Potassium Nitrate.

**Germanium**
See GERMANIUM plus Potassium Nitrate.

**Germanium Sulfide**
See GERMANIUM SULFIDE plus Potassium Nitrate.

**Sodium Acetate**
A mixture of the two may cause an explosion.
*Pieters,* p. 30 (1957).

**Sodium Hypophosphite**
A mixture of potassium nitrate and sodium hypophosphite constitutes a powerful explosive.
*Mellor* **8:** 881 (1946–1947).

**Sodium Peroxide and Dextrose**
See SODIUM PEROXIDE plus Dextrose and Potassium Nitrate.

**Sulfur and Arsenic Trisulfide**
See SULFUR plus Potassium Nitrate and Arsenic Trisulfide.

**Titanium**
See TITANIUM plus Potassium Chlorate.

**Titanium Disulfide**
See TITANIUM DISULFIDE plus Potassium Nitrate.

**Trichloroethylene**
See TRICHLOROETHYLENE plus Potassium Nitrate.

**Zinc**
See ZINC plus Potassium Nitrate.

**Zirconium**
See ZIRCONIUM plus Potassium Nitrate.

## POTASSIUM p-NITROBENZENE-DIAZOSULFONATE $O_2N\text{-}C_6H_4\text{-}4\text{-}N{=}NSO_3K$

**(self-reactive)**
While a chemist was examining some crystals of potassium p-nitrobenzene-diazosulfonate with a loupe, the entire 10-gram batch, which was on a sheet of filter paper, exploded. The crystals were probably the "labile" form (potassium p-nitrobenzene-syn-diazosulfonate) and would have in time converted to the "stable" form.
*Crucible* **58** (9): 147 (1973).

## POTASSIUM NITRIDE $K_3N$

**Air**
Potassium nitride generally ignites spontaneously when exposed to air.
*Mellor* **8:** 99 (1946–1947).

**Phosphorus**
See PHOSPHORUS plus Potassium Nitride.

## POTASSIUM NITRITE $KNO_2$

**Ammonium Sulfate**
When a little ammonium sulfate is added to fused potassium nitrite, a vigorous reaction occurs attended by flame.
*Mellor* **2:** 702 (1946–1947).

**Boron**
See BORON plus Potassium Nitrite.

## POTASSIUM OXIDE $K_2O$

**Water**
The oxides of sodium or potassium react with water vigorously and with enough evolution of heat to cause boiling and spattering of hot caustic solution.
*Chem. Safety Data Sheets* **SD-9, SD-10** (1947).

## POTASSIUM OXIDES KxOy

**Potassium**
See POTASSIUM plus Air.

**Sodium**
See POTASSIUM plus Air.



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**Sodium-Potassium Alloy**
See POTASSIUM plus Air.

**Organic Matter**
See POTASSIUM plus Air.

## POTASSIUM OZONIDE $KO_3$

**Potassium**
See POTASSIUM plus Potassium Ozonide.

**Sodium**
See SODIUM plus Potassium Ozonide.

**Water**
Both potassium ozonide and potassium superoxide react explosively with water. Both are too unstable to be isolated.
*Mellor* **2, Supp. 3:** 1631 (1963).

## POTASSIUM PERCHLORATE $KClO_4$

**Aluminum and Magnesium**
See ALUMINUM plus Magnesium and Potassium Perchlorate.

**Charcoal**
See PERCHLORATES plus Charcoal.

**Fluorine**
See FLUORINE plus Potassium Perchlorate.

**Magnesium**
See MAGNESIUM plus Potassium Perchlorate.

**Nickel and Titanium**
See NICKEL plus Titanium and Potassium Perchlorate.

**Reducing Agents**
See PERCHLORATES plus Charcoal.

**Sulfur**
See SULFUR plus Potassium Perchlorate.

## POTASSIUM PERMANGANATE $KMnO_4$

**Aluminum Carbide**
See ALUMINUM CARBIDE plus Potassium Permanganate.

**Antimony**
See ANTIMONY plus Potassium Permanganate.

**Arsenic**
See ANTIMONY plus Potassium Permangnate.

**Dimethyl Sulfoxide**
See DIMETHYL SULFOXIDE plus Potassium Permanganate.

**Glycerol**
Contact between the two may produce an explosion.
*Pieters,* p. 30 (1957).

**Hydrogen Peroxide**
Potassium permanganate can produce an explosion when brought into contact with very concentrated hydrogen peroxide.
*Haz. Chem. Data,* p. 230 (1973).

**Hydrogen Trisulfide**
See HYDROGEN TRISULFIDE plus Potassium Permanganate.

**Hydroxylamine**
When solid hydroxylamine is brought into contact with solid potassium permanganate, there is produced immediately a white flame.
*Mellor* **8:** 294 (1946–1947).

**Organic Matter**
An explosive reaction can occur when solid, finely divided potassium permanganate comes in contact with organic substances.
*Pascal* 16: 1041 (1931–1934). *Pieters,* p. 28 (1957). *Haz. Chem. Data,* p. 230 (1973).

**Phosphorus**
See PHOSPHORUS plus Potassium Permanganate.

**Polypropylene**
Potassium permanganate being conveyed through a polypropylene tube ignited the tube.
*MCA Case History* **1842** (1972).

**Sulfur**
See SULFUR plus Potassium Permanganate.

**Sulfuric Acid**
An explosion occurred when concentrated sulfuric acid was mixed with crystalline potassium permanganate in a vessel containing moisture. Manganese heptoxide was formed, which is explosive at 70°C.
*Delhez* (1967).
J. R. Archer, *Chem. and Eng. News* **26:** 205 (1948).
Permanganate anhydride, $Mn_2O_7$, forms in the course of the reaction of concentrated sulfuric acid with crystallized potassium permanganate at low temperature (minus 20°C). An oily liquid forms under the layer of sulfuric acid that is very unstable and detonates when the temperature is increased (70°C).
*Rüst and Ebert,* p. 29 (1948). *Pieters,* p. 28 (1957).
*Gallais,* pp. 696, 697 (1957).

**Sulfuric Acid and Organic Matter**
When potassium permanganate is dissolved in 95% sulfuric acid, a green solution of permanganyl sulfate is formed. This solution will oxidize most organic compounds and, if the solution is strongly concentrated, explosion may accompany the oxidation.
*Waller and Mandell* (1967).

**Sulfuric Acid and Potassium Chloride**
An attempt to prepare permanganyl chloride, $MnO_3Cl$, by adding cautiously, concentrated sulfuric acid to an intimate mixture of potassium permanganate and potassium chloride kept at 0°C in clean all-glass apparatus resulted in a violent explosion.
*Delhez* (1967).

**Titanium**
See TITANIUM plus Potassium Chlorate.

## POTASSIUM PEROXIDE $K_2O_2$

**(See also SODIUM PEROXIDE)**

**Antimony**
See POTASSIUM plus Potassium Peroxide.

**Arsenic**
See POTASSIUM plus Potassium Peroxide.

**Oxygen**
See OXYGEN plus Potassium Peroxide.


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**Potassium**
See POTASSIUM plus Potassium Peroxide and POTASSIUM plus Potassium Tetroxide.

**Water**
Potassium peroxide is very reactive, and can explode in air or water.
*Mellor* **2, Supp. 3:** 1577 (1963).

## POTASSIUM PERSULFATE $K_2S_2O_3$

**Potassium Hydroxide and Water**
Potassium persulfate plus a little potassium hydroxide and water ignited a polythene (polyethylene) liner of a container by simultaneous release of heat and oxygen.
*MCA Case History* **1155** (1955).

## POTASSIUM PHOSPHIDE $K_3P$

**Water**
Potassium phosphide reacts with water to form spontaneously flammable phosphine.
*Van Wazer* (1958).

## POTASSIUM SILICIDE $K_2Si_2$

**Acids**
See POTASSIUM SILICIDE plus Water.

**Air**
Potassium silicide is spontaneously flammable in air and may explode.
*Ellern* (1961).

**Water**
Potassium silicide ignites spontaneously on contact with water or dilute acids.
*Brauer* (1965).
See also CESIUM SILICIDE plus Water.

## POTASSIUM SULFATE $K_2SO_4$

**Aluminum**
See ALUMINUM plus Sulfates.

## POTASSIUM SUPEROXIDE $KO_2$

**Ethyl Alcohol**
To dispose of a piece of sodium-potassium waste, it was placed in a glove box, which was then purged with argon for 10 minutes. When 10 ml of alcohol was added to the waste, an immediate pressure rise caused the glove to burst and flame issued from the port. Also, a highly oxidized sphere of potassium was cut in two and one half was dropped into a dish of alcohol; an immediate explosion shattered the dish. Potassium superoxide was considered the cause of both incidents.
*Health and Safety Inf.* **251** (March 31, 1967).

**Graphite**
Potassium superoxide forms on the surface of either solid or molten potassium metal. Attempts to extinguish burning potassium with powdered graphite have resulted in violent explosions.
*Chem. Abst.* **63:** 424 (1965).

**Oil**
Stainless steel pots containing traces of sodium-potassium alloy were immersed in oil to await cleaning. During removal of the lid from one pot, an explosion occurred that was attributed to long-term formation of potassium superoxide, which reacted with the oil when it was disturbed.
*Health and Safety Inf.* **251** (March 31, 1967).

**Ortho-Amino Phenol**
Mixture of potassium superoxide with ortho-amino phenol resulted in explosions. The explosions occurred after mixing for various periods of time from one hour to several days.
*Chem. and Eng. News* (August 27, 1990).

**Potassium**
See POTASSIUM plus Potassium Superoxide.

**Selenium Monochloride**
See SELENIUM MONOCHLORIDE plus Potassium Superoxide.

**Sodium**
See SODIUM plus Potassium Ozonide.

**Sodium-Potassium Alloy**
See SODIUM-POTASSIUM ALLOY plus Potassium Superoxide.

**Water**
See POTASSIUM OZONIDE plus Water.

## POTASSIUM TETRACHLOROCUPRATE $K_2CuCl_4$

**Potassium**
See POTASSIUM plus Ammonium Bromide.

## POTASSIUM TETRAETHYNYLNICKELATE $K_4[Ni(CCH)_4]$

**Air**
Tetraacetenyl nickel tetrapotassium is spontaneously flammable in air.
*Kaufman* (1961).

## POTASSIUM TETRAHYDROBORATE

**Air**
Potassium borohydride burns quietly in air.
*Lab. Govt. Chemist* (1965).

## POTASSIUM TETRAPEROXYCHROMATE $K_3Cr(OO)_4$

**(self-reactive)**
Potassium triperchromate decomposes explosively at 178°C. The impure salt is explosive.
*Mellor* **11:** 356 (1946–1947).

## POTASSIUM TRICYANOMERCURATE $KHg(CN)_3$

**Ammonia**
A mixture of the two may cause an explosion.
*Pieters,* p. 30 (1957).

## PRASEODYMIUM Pr

**Air**
See RARE EARTH METALS plus Air.

**Halogens**
See RARE EARTH METALS plus Halogens.

## PROPANE $CH_3CH_2CH_3$

**Chlorine Dioxide**
See CHLORINE DIOXIDE plus Butadiene.



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**PROPANE-1,2-DIAMINE PERCHLORATE**
$CH_3CH(NH_2)CH_2NH_2 \cdot (ClO_4)_2$

**(self-reactive)**
This compound is an explosive that exceeds the power and brisance of TNT.
*ACS* **146:** 206. *Chem. Reviews* **44:** 419–45 (1949).

**PROPANE-1,3-DIAMINE PERCHLORATE**
$CH_2(NH_2)CH_2CH_2NH(ClO_4)_2$

**(self-reactive)**
This compound is an explosive that exceeds the power and brisance of TNT.
*ACS* **146:** 206. *Chem. Reviews* **44:** 419–45 (1949).

**1-PROPANETHIOL** $C_3H_7SH$

**Calcium Hypochlorite**
See CALCIUM HYPOCHLORITE plus 1-Propanethiol.
See CALCIUM HYPOCHLORITE plus Mercaptan.

**PROPIOLACTONE** (BETA-) $OCOCH_2CH_2$

**2-Aminoethanol**
See 2-AMINOETHANOL plus Propiolactone.

**Ammonium Hydroxide**
Mixing propiolactone (BETA-) and 28% ammonium hydroxide in a closed container caused the temperature and pressure to increase.
*Flynn and Rossow* (1970). See Note under complete reference.

**Aniline**
See ANILINE plus Propiolactone.

**Chlorosulfonic Acid**
Mixing propiolactone (BETA-) and chlorosulfonic acid in a closed container caused the temperature and pressure to increase.
*Flynn and Rossow* (1970). See Note under complete reference.

**Ethylene Diamine**
See ETHYLENE DIAMINE plus Propiolactone (BETA-).

**Ethyleneimine**
See ETHYLENEIMINE plus Propiolactone (BETA-).

**Hydrochloric Acid**
Mixing propiolactone (BETA-) and 36% hydrochloric acid in a closed container caused the temperature and pressure to increase.
*Flynn and Rossow* (1970). See Note under complete reference.

**Hydrofluoric Acid**
Mixing propiolactone (BETA-) and 48.7% hydrofluoric acid in a closed container caused the temperature and pressure to increase.
*Flynn and Rossow* (1970). See Note under complete reference.

**Nitric Acid**
Mixing propiolactone (BETA-) and 70% nitric acid in a closed container caused the temperature and pressure to increase.
*Flynn and Rossow* (1970). See Note under complete reference.

**Oleum**
See OLEUM plus Propiolactone (BETA-).

**Pyridine**
See PYRIDINE plus Propiolactone (BETA-).

**Sodium Hydroxide**
See SODIUM HYDROXIDE plus Propiolactone (BETA-).

**Sulfuric Acid**
Mixing propiolactone (BETA-) and 96% sulfuric acid in a closed container caused the temperature and pressure to increase.
*Flynn and Rossow* (1970). See Note under complete reference.

**PROPYL ALCOHOL** $CH_3CH_2CH_2OH$

**Potassium Tert.-Butoxide**
See ACETONE plus Potassium Tert.-Butoxide.

**PROPYLENE** $H_3CCH{=}CH_2$

**Nitrogen Dioxide**
See NITROGEN TETROXIDE plus Olefins.

**Nitrogen Tetroxide**
See NITROGEN TETROXIDE plus Propylene.

**Nitrous Oxide**
See NITROUS OXIDE plus Propylene.

**PROPYLENE OXIDE** $CH_3CHCH_2O$

**Ammonium Hydroxide**
Mixing propylene oxide and 28% ammonium hydroxide in a closed container caused the temperature and pressure to increase.
*Flynn and Rossow* (1970). See Note under complete reference.

**Chlorosulfonic Acid**
Mixing propylene oxide and chlorosulfonic acid in a closed container caused the temperature and pressure to increase.
*Flynn and Rossow* (1970). See Note under complete reference.

**Clay Absorbents**
Propylene oxide can undergo runaway self heating and ignition when certain solid spill control materials, such as clay absorbents, are used.
*Haz. Chem. Data* NFPA 49; (1966).

**Hydrochloric Acid**
Mixing propylene oxide and hydrochloric acid in a closed container caused the temperature and pressure to increase.
*Flynn and Rossow* (1970). See Note under complete reference.

**Hydrofluoric Acid**
Mixing propylene oxide and 48.7% hydrofluoric acid in a closed container caused the temperature and pressure to increase.
*Flynn and Rossow* (1970). See Note under complete reference.


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**Nitric Acid**
Mixing propylene oxide and 70% nitric acid in a closed container caused the temperature and pressure to increase.
*Flynn and Rossow* (1970). See Note under complete reference.

**Oleum**
See OLEUM plus Propylene Oxide.

**Sulfuric Acid**
Mixing propylene oxide and 96% sulfuric acid in a closed container caused the temperature and pressure to increase.
*Flynn and Rossow* (1970). See Note under complete reference.

## PROPYL FORMATE $C_3H_7OCHO$

**Potassium Tert.-Butoxide**
See ACETONE plus Potassium Tert.-Butoxide.

## PROPYLLITHIUM $C_3H_7Li$

**Air**
Propyl lithium is spontaneously flammable in air.
*Ellern* (1961).

## PROPYLSILANE $C_3H_7SiH_3$

**Air**
Propyl silane is spontaneously flammable in air.
*Kaufman* (1961).

## PROPYNE $CH_3C{=}CH$

**(self-reactive)**
Methyl acetylene can decompose explosively at 4.5–5.6 atmospheres pressure.
*Rutledge,* p. 13 (1968).

## 2-PROPYN-1-OL $CH{\equiv}CCH_2OH$

**Phosphorus Pentoxide**
See PHOSPHORUS PENTOXIDE plus Propargyl Alcohol.

## PYRIDINE $N{=}CHCH{=}CHCH{=}CH$

**Chlorosulfonic Acid**
Mixing pyridine and chlorosulfonic acid in a closed container caused the temperature and pressure to increase.
*Flynn and Rossow* (1970). See Note under complete reference.

**Chromium Trioxide**
See CHROMIC ANHYDRIDE plus Pyridine.

**Maleic Anhydride**
See MALEIC ANHYDRIDE plus Pyridine.

**Nitric Acid**
Mixing pyridine and 70% nitric acid in a closed container caused the temperature and pressure to increase.
*Flynn and Rossow* (1970). See Note under complete reference.

**Oleum**
See OLEUM plus Pyridine.

**Perchromates**
See PERCHROMATES plus Pyridine.

**Propiolactone (BETA-)**
Mixing pyridine and propiolactone (BETA-) in a closed container caused the temperature and pressure to increase.
*Flynn and Rossow* (1970). See Note under complete reference.

**Silver Perchlorate**
See SILVER PERCHLORATE plus Acetic Acid.
See SILVER PERCHLORATE plus Toluene.

**Sulfuric Acid**
Mixing pyridine and 96% sulfuric acid in a closed container caused the temperature and pressure to increase.
*Flynn and Rossow* (1970). See Note under complete reference.

## PYRIDINIUM PERCHLORATE $(C_5H_6N)ClO_4$

**(self-reactive)**
This salt may explode violently in contact with metals.
*Mellor* **2, Supp. 1:** 603 (1956).
Pyridine perchlorate decomposes or explodes when heated above 335°C. The kindling temperature is lowered by the addition of ammonium perchlorate.
*ACS* **146:** 213 (1960). *Chemiker.Ztg.* **74:** 139–40 (1950).

## 3-PYRIDYLDIAZONIUM FLUOROBORATE $NC_5H_4N(\equiv N)BF_4$

**(self-reactive)**
Following a procedure described in the literature for the preparation of this salt, several grams were spread on aluminum foil to dry. A small portion was removed to determine its decomposition point in a glass capillary. It exploded at 47°C. The remaining material exploded while sitting on the aluminum foil.
*Chem. and Eng. News* **45** (41): 44 (1967); **45** (51):**8** (1967).

## QUINOLINE $CHCHCHCHCCNCHCHCH$

**Perchromates**
See PERCHROMATES plus Quinoline.

## RARE EARTH HYDRIDES

**Air and Water**
The hydrides of the rare earths are stable in dry air, but ignite in moist air.
*Hampel,* pp. 407–8 (1961).

## RARE EARTH METALS

**Air**
The rare earth metals ignite in air at 302 to 356°F., but lanthanum ignites at 824 to 860°F. With oxide impurities present, however, the rare earth metals are pyrophoric on cutting and filing.
*Hampel,* pp. 407–8 (1961).

**Halogens (Vapor)**
Rare earth metals burn vigorously in halogen vapors above 392°F.
*Hampel,* pp. 407–8 (1961).



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**RHENIUM** Re

**Flourine**
Rhenium and fluorine react readily at 125°C.
*Mellor* **2, Supp. 1:** 64 (1956).

**RHODIUM** Rh

**Chlorine Trifluoride**
See ANTIMONY plus Chlorine Trifluoride.

**Oxygen Difluoride**
See IRIDIUM plus Oxygen Diflouride.

**RHODIUM-AMMINE NITRATES**

**(self-reactive)**
Rhodium-ammine nitrates may be impact-sensitive. $Rh(NH_3)_5I(NO_3)_2$ crystals explode when heated.
*Mellor* **15:** 590 (1946–1947).

**RHODIUM-AMMINE PERCHLORATES**

**(self-reactive)**
Rhodium-ammine perchlorates may be impact-sensitive.
*Mellor* **15:** 590 (1946–1947).

**RHODIUM TETRABROMIDE** $RhBr_4$

**Bromine Trifluoride**
See BROMINE TRIFLUORIDE plus Potassium Bromide.

**RUBBER**

**Chlorine**
See CHLORINE plus Rubber.

**Chlorine Trifluoride**
See CHLORINE TRIFLUORIDE plus Rubber.

**Iodine Monochloride**
See IODINE MONOCHLORIDE plus Organic Matter.

**Lithium**
See LITHIUM plus Organic Matter.

**RUBBER (LS-53 and LS-63)**

**Fluorine**
See FLUORINE plus Solid Nonmetals and Oxygen.

**RUBIDIUM** Rb

**Air**
Rubidium is spontaneously flammable in air at room temperature if the surface of the metal is clean.
*Mellor* **2:** 468 ff. (1946–1947).

**Chlorine**
See CESIUM plus Chlorine.

**Oxygen**
Rubidium burns spontaneously in dry oxygen.
*Mellor* **2:** 468 (1946–1947).

**Phosphorus**
See PHOSPHORUS plus Cesium.

**Water**
At 20°C., the heat of reaction is adequate to ignite the hydrogen liberated.
*Mellor* **2:** 469 (1946–1947). Bahme, p. 11 (1961).

**RUBIDIUM ACETYLIDE** $RbC{\equiv}CH$

**Arsenic**
See ARSENIC plus Rubidium Acetylene Carbide.

**Bromine**
See BROMINE plus Rubidium Acetylene Carbide.

**Chlorine**
See BROMINE plus Rubidium Acetylene Carbide.

**Cupric Oxide**
Cupric oxide is reduced vigorously and with incandescence by rubidium acetylene carbide.
*Mellor* **5:** 850 (1946–1947).

**Fluorine**
See BROMINE plus Rubidium Acetylene Carbide.

**Hydrochloric Acid**
Rubidium acetylene carbide burns with slightly warm hydrochloric acid or with molten sulfur.
*Mellor* **5:** 849 (1946–1947).

**Iodine**
See BROMINE plus Rubidium Acetylene Carbide.

**Lead Oxide**
Rubidium acetylene carbide explodes on contact with lead oxide (at 350°C.).
*Mellor* **5:** 849 (1946–1947).

**Manganese Dioxide**
Manganese dioxide is reduced by rubidium acetylene carbide at elevated temperatures with incandescence and sometimes explosively.
*Mellor* **5:** 850 (1946–1947).

**Phosphorus**
See PHOSPHORUS plus Rubidium Acetylene Carbide.

**Sulfur**
See RUBIDIUM ACETYLENE CARBIDE plus Hydrochloric Acid.

**Sulfuric Acid**
Rubidium acetylene carbide burns with sulfuric acid.
*Mellor* **5:** 849 (1946–1947).

**RUBIDIUM AZIDE** $RbN_3$

**(self-reactive)**
Rubidium azide decomposes at 321°C.
*Mellor* **8, Supp. 2:** 43 (1967).

**Carbon Disulfide**
See CARBON DISULFIDE plus Azides.

**RUBIDIUM CARBIDE** $Rb_2C_2$

**Arsenic**
See ARSENIC plus Rubidium Carbide.

**Arsenic Oxide**
If warmed, rubidium carbide will burn with arsenic oxide.
*Mellor* **5:** 848 (1946–1947).

**Boron**
See SILICON plus Rubidium Carbide.

**Bromine**
See BROMINE plus Rubidium Carbide.

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**Hydrochloric Acid**
Rubidium carbide ignites in contact with hydrochloric acid unless the acid is dilute.
*Mellor* **5:** 848 (1946–1947).

**Iodine**
See IODINE plus Cesium Carbide.

**Lead Oxide**
If warmed, rubidium carbide will burn with lead oxide.
*Mellor* **5:** 848 (1946–1947).

**Nitric Acid**
A mixture of nitric acid and rubidium carbide will explode.
*Mellor* **5:** 848 (1946–1947).

**Nitric Oxide**
See RUBIDIUM CARBIDE plus Sulfur Dioxide.

**Selenium**
See SELENIUM plus Rubidium Carbide.

**Silicon**
See SILICON plus Rubidium Carbide.

**Sulfur Dioxide**
Rubidium carbide ignites on warming in sulfur dioxide or nitric oxide vapor.
*Mellor* **5:** 848 (1946–1947).

## RUBIDIUM CHLORIDE RbCl

**Bromine Trifluoride**
See BROMINE TRIFLUORIDE plus Barium Chloride.

## RUBIDIUM HYDRIDE RbH

**Acetylene**
If moisture is present, rubidium hydride reacts vigorously with acetylene, even at minus 60°C.
*Mellor* **2:** 483 (1946–1947).

**Water**
Rubidium hydride ignites on contact with moist air.
*Hurd,* pp. 36–37 (1952).

## RUBIDIUM NITRIDE $Rb_3N$

**Air**
Rubidium nitride burns in air.
*Mellor* **8:** 8, 99, 101 (1946–1947).

## RUBIDIUM PHOSPHIDE $Rb_3P$

**Water**
Rubidium phosphide reacts instantaneously with water or moist air to yield spontaneously flammable phosphine.
*Van Wazer* (1958).

## RUBIDIUM SILICIDE $Rb_2Si_2$

**Water**
See CESIUM SILICIDE plus Water.

## RUTHENIUM Ru

**Oxygen Difluoride**
See IRIDIUM plus Oxygen Difluoride.

## RUTHENIUM TETROXIDE $RuO_4$

**Charcoal**
Ruthenium tetroxide (gas) in contact with activated charcoal reacted violently.
*Scott* (1963).

**Phosphorus Tribromide**
Ruthenium tetroxide and phosphorus tribromide undergo a vigorous exothermic reaction.
*Mellor* **8, Supp. 3:** 521 (1971).

## SAMARIUM Sm

**Air**
See RARE EARTH METALS plus Air.

**Halogens**
See RARE EARTH METALS plus Halogens.

**1,1,2-Trichlorotrifluoroethane**
A commercial mixer/mill was demolished and a technician was injured as a result of an explosion which occurred when an attempt was made to grind 20 grams of samarium in approximately 20 cc of 1,1,2-trichlorotrifluoroethane. Subsequent investigation revealed that the explosion was caused by the generation of fresh metal surface in the presence of the chlorinated halocarbon.
*Wischmeyer* (1970). *NSC Newsletter, R & D Sec.* (Aug. 1970).

## SELENIUM Se

**Barium Carbide**
A mixture of barium carbide and selenium heated to 150°C. becomes incandescent.
*Mellor* **5:** 862 (1946–1947).

**Bromine Pentafluoride**
See ARSENIC plus Bromine Pentafluoride.

**Calcium Carbide**
Calcium carbide and selenium vapor react with incandescence.
*Mellor* **5:** 862 (1946–1947).

**Chlorates**
A moist mixture of selenium and any chlorates but the alkali chlorates becomes incandescent.
*Mellor* **2, Supp. 1:** 583 (1956).

**Chlorine Trifluoride**
See ANTIMONY plus Chlorine Trifluoride.

**Chromium Trioxide**
Selenium reacts violently with chromium trioxide.
*Mellor* **11:** 233 (1946–1947).

**Fluorine**
Selenium unites directly with fluorine in the cold, giving off fumes, and finally the selenium ignites.
*Mellor* **10:** 747 (1946–1947).

**Lithium Carbide**
See SULFUR plus Lithium Carbide.

**Lithium Silicide**
See PHOSPHORUS plus Lithium Silicide.

**Nickel**
See NICKEL plus Selenium. See also SULFUR plus Nickel.



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**Nitric Acid**
Freshly reduced selenium (from selenium dioxide) reacts vigorously with nitric acid. Trace of organic matter probably influenced the reaction.
Austin, Newman, and Riley, *J. Chem. Soc.*, p. 391 (1938).

**Nitrogen Trichloride**
See NITROGEN TRICHLORIDE plus Ammonia.

**Oxygen**
Burning selenium in oxygen has resulted in explosion, probably due to the presence of organic matter.
Austin, Newman, and Riley, *J. Chem. Soc.*, p. 391 (1938).

**Potassium**
A mixture of potassium and selenium ignites; sodium does likewise and is attended by vivid incandescence.
*Mellor* **10:** 766–7 (1946–1947).

**Potassium Bromate**
The reaction is violently explosive.
*Mellor* **2, Supp. 1:** 763 (1956).

**Rubidium Carbide**
The carbide burns in selenium vapor.
*Mellor* **5:** 848 (1946–1947).

**Silver Bromate**
The reaction is violently explosive.
*Mellor* **2, Supp. 1:** 766 (1956).

**Sodium**
See SELENIUM plus Potassium.

**Strontium Carbide**
See SULFUR plus Strontium Carbide.

**Thorium Carbide**
Selenium vapor attacks heated thorium carbide with incandescence.
*Mellor* **5:** 886 (1946–1947).

**Uranium**
See URANIUM plus Selenium.

**Zinc**
See ZINC plus Selenium.

**SELENIUM CARBIDE** $SeC_2$

**Sulfur**
See SULFUR plus Thorium Carbide.

**SELENIUM IODOPHOSPHIDE** $Se_3P_4I_2$

**Nitric Acid**
These compounds react explosively.
*Mellor* **8, Supp. 3:** 247 (1971).

**SELENIUM MONOCHLORIDE** $Se_2Cl_2$

**Phosphorus**
See PHOSPHORUS plus Selenium Monochloride.

**Potassium**
See POTASSIUM plus Selenium Monochloride.

**Potassium Superoxide**
Selenium monochloride and potassium superoxide react very violently.
*Mellor* **10:** 897 (1946–1947).

**Sodium Peroxide**
Sodium peroxide reacts violently with the evolution of light when it is treated with selenium monochloride.
*Mellor* **10:** 897 (1946–1947.)

**SELENIUM OXYCHLORIDE** $SeOCl_2$

**Phosphorus**
See PHOSPHORUS plus Selenium Oxychloride.

**Potassium**
See POTASSIUM plus Selenium Oxychloride.

**SELENIUM OXYFLUORIDE** $SeOF_2$

**Phosphorus**
See PHOSPHORUS plus Selenium Oxyfluoride.

**SELENIUM SULFIDE** SeS

**Silver Oxide**
See SILVER OXIDE plus Antimony Trisulfide.

**SELENIUM TETRAFLUORIDE** $SeF_4$

**Phosphorus**
See PHOSPHORUS plus Selenium Tetrafluoride.

**SILANE** $SiH_4$
Silane and chlorosilanes can explode when mixed with various halocarbons and ignited.
*Plant Operations Progress,* Britton (1990).

**Air**
Silicon hydride will ignite in air by slightly raising the temperature or lowering the pressure.
*Mellor* **6:** 220 (1946–1947).

**Chlorine**
See CHLORINE plus Silicon Hydride.

**Nitrous Oxide**
Contaminated silane cylinder exploded as it was being vented.

**SILANES (SILANE, DISILANE, TRISILANE, etc.)**

**Air**
The first seven to eight members of the series $Si_nH_{2n+2}$ ignite spontaneously in air at room temperature or slightly higher.
*Latimer and Hildebrand,* p. 297 (1940). *Z. Anorg. Chemie* **117:** 209.
*Mellor* **1:** 376 (1946–1947).

**SILICA (SILICON DIOXIDE)** $SiO_2$

**Chlorine Trifluoride**
See CHLORINE TRIFLUORIDE plus Elements.

**Manganese Trifluoride**
See MANGANESE TRIFLUORIDE plus Glass.

**Oxygen Difluoride**
See OXYGEN DIFLUORIDE plus Silica.

**SILICATES**

**Lithium**
See LITHIUM plus Carbides.


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## SILICON Si

**Alkali Carbonates**
When a mixture of amorphous silicon and an alkali carbonate is heated, a vigorous reaction, attended by incandescence, occurs.
*Mellor* **6:** 164 (1946–1947).

**Aluminum and Lead Oxide**
A mixture of silicon, aluminum and lead oxide explodes when heated.
*Mellor* **7:** 657 (1946–1947).

**Calcium**
See CALCIUM plus Silicon.

**Cesium Carbide**
Cesium carbide reacts vigorously when heated with silicon or boron.
*Mellor* **5:** 848 (1946–1947).

**Chlorine**
Silicon burns spontaneously in gaseous chlorine.
*Mellor* **2:** 92, 95; **6:** 161; **9:** 626 (1946–1947).
See ANTIMONY plus Chlorine Trifluoride.

**Cobaltic Fluoride**
A mixture of silicon powder and cobaltic fluoride glows red on gently warming.
*Mellor* **2, Supp. 1:** 64 (1956).

**Fluorine**
See FLUORINE plus Selenium.

**Iodine Pentafluoride**
See ARSENIC plus Iodine Pentafluoride.

**Manganese Trifluoride**
See MANGANESE TRIFLUORIDE plus Glass.

**Nitrosyl Fluoride**
See BORON plus Nitrosyl Fluoride.

**Rubidium Carbide**
Rubidium carbide reacts vigorously when heated with silicon or boron.
*Mellor* **5:** 848 (1946–1947).

**Silver Fluoride**
Silicon (powdered) reacts violently with silver fluoride.
*Mellor* **3:** 389 (1946–1947).

**Sodium-Potassium Alloy**
The reaction of silicon and sodium-potassium alloy forms sodium silicide, which is spontaneously flammable in air.
*Mellor* **2, Supp. 2:** 564 (1961).
See also SODIUM SILICIDE plus Air.

## SILICON MONOXIDE SiO

**Air**
Silicon monoxide is spontaneously flammable in air.
*Ellern* (1961).

## SILICON NITRIDE $(Si_2N_2)_n$

**Air**
Silicocyn is spontaneously flammable in air.
*Ellern* (1961).

## SILICON TETRAAZIDE $Si(N_3)_4$

**(self-reactive)**
Spontaneous explosions have been observed with this compound.
*Mellor* **8, Supp. 2:** 50 (1967).
See BORON TRIAZIDE (self-reactive).

## SILICON TETRACHLORIDE $SiCl_4$

**Potassium**
See POTASSIUM plus Aluminum Bromide.

**Sodium**
See SODIUM plus Aluminum Bromide.

## SILICON TETRAFLUORIDE $SiF_4$

**Sodium**
Mixtures form shock-sensitive explosives.
Lelei, Cahiers (1975).

## SILOXANE $(OSiH_2)_3$

**Air**
Siloxane is spontaneously flammable in air.
*Ellern* (1961).

## SILVER Ag

**Acetylene**
An insoluble, explosive acetylide is formed with silver.
*Von Schwartz,* p. 142 (1918); J. K. Luchs, *Phot. Sci. Eng.* **10**(6): 334–7 (1966).

**Ammonia**
See GOLD plus Ammonia.

**Bromoazide**
See ANTIMONY plus Bromoazide.

**Chlorine Trifluoride**
See ALUMINUM plus Chlorine Trifluoride.

**Ethyl Alcohol and Nitric Acid**
When silver is treated with nitric acid in the presence of ethyl alcohol, silver fulminate may be formed, which can be detonated.
P. M. Hearbjes and J. P. Howtman, *Chem. Weekblad* **38;** J. K. Luchs, *Phot. Sci. Eng.* **10**(6): 334–7 (1966).

**Ethyleneimine**
Ethyleneimine forms explosive compounds with silver, hence silver solder should not be used to fabricate equipment for handling ethyleneimine.
*Ethyleneimine.*

**Hydrogen Peroxide**
See IRON plus Hydrogen Peroxide. Finely divided silver and a strong hydrogen peroxide solution may explode.
*Mellor* **1:** 936 (1946–1947).

**Oxalic Acid**
Silver is said to be incompatible with oxalic acid and tartaric acid.
NavAer. 09-01-505 (November 1, 1956).

**Permonosulfuric Acid**
See PERMONOSULFURIC ACID plus Manganese Dioxide. See PLATINUM plus Permonosulfuric Acid.

**Tartaric Acid**
See SILVER plus Oxalic Acid.



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**SILVER AZIDE** $AgN_3$

**(self-reactive)**

Silver azide decomposes at 250°C. It is explosively unstable.
*Mellor* **8, Supp. 2:** 43 (1967).
Silver azide is shock-sensitive when dry and has a detonation temperature of 250°C.
*Photo. Sci. & Eng.* **10** (6): 334–337 (1966).
See also AZIDES.

**Bromine**

See BROMINE plus Silver Azide.

**Iodine**

See IODINE plus Silver Azide.

**SILVER BROMATE** $AgBrO_3$

**Sulfur**

See SULFUR plus Silver Bromate.

**Tellurium**

See TELLURIUM plus Silver Bromate.

**SILVER BROMIDE** AgBr

**Potassium**

See SODIUM plus Silver Bromide.

**Sodium**

See SODIUM plus Silver Bromide.

**SILVER CHLORATE** $AgClO_3$

**Sulfur**

See SULFUR plus Silver Chlorate.

**SILVER CHLORIDE** AgCl

**Aluminum**

See ALUMINUM plus Silver Chloride.

**Ammonia**

When a solution of silver chloride in aqueous ammonia is exposed to air or to heat, a material, probably silver nitride, is formed that is detonated violently by shock.
*Mellor* **3:** 382 (1946–1947); J. K. Luchs, *Phot. Sci. Eng.* **10**(6): 334–7 (1966).
*Kite (1973).*

**Bromine Trifluoride**

See BROMINE TRIFLUORIDE plus Barium Chloride.

**Potassium**

See SODIUM plus Silver Bromide.
See POTASSIUM plus Ammonium Bromide.

**Sodium**

See SODIUM plus Silver Bromide.

**Sodium Peroxide and Charcoal**

See SODIUM PEROXIDE plus Silver Chloride and Charcoal.

**SILVER CYANIDE** AgCN

**Fluorine**

See FLUORINE plus Silver Cyanide.

**SILVER DIAMIDOTRIOXYPHOSPHORANE** $(AgO)_3P(NHAg)_2$

**Sulfuric Acid**

Pentasilver trihydroxydiamidophosphate explodes on heating, friction, or treatment with concentrated sulfuric acid.
*J. Am. Chem. Soc.* **17:** 275 (1895).
Tetrasilver trihydroxydiaminophosphate ignites when treated with concentrated sulfuric acid.
*Mellor* **8:** 705 (1946–1947).

**SILVER FLUORIDE** AgF

**Boron**

See BORON plus Silver Fluoride.

**Calcium Hydride**

When silver fluoride is ground with calcium hydride, the mass becomes incandescent.
*Mellor* **3:** 389 (1946–1947).

**Dimethyl Sulfoxide**

See DIMETHYL SULFOXIDE plus Silver Fluoride.

**Potassium**

See SODIUM plus Silver Bromide.
See POTASSIUM plus Aluminum Bromide.

**Silicon**

See SILICON plus Silver Fluoride.

**Sodium**

See SODIUM plus Silver Bromide.
See SODIUM plus Aluminum Bromide.

**SILVER FULMINATE** AgCNO

**(self-reactive)**

See SILVER CHLORIDE plus Ammonia. Silver fulminate is shock-sensitive when dry and has a detonation temperature of 175°C.
*Photo. Sci. & Eng.* **10** (6): 334–337 (1966).

**SILVER HALIDES**

**Sodium-Potassium Alloy**

See SODIUM-POTASSIUM ALLOY plus Silver Halides.

**SILVER IODATE** $AgIO_3$

**Potassium**

See POTASSIUM plus Boric Acid.

**SILVER IODIDE** AgI

**Potassium**

See SODIUM plus Silver Bromide.
See POTASSIUM plus Ammonium Bromide.

**Sodium**

See SODIUM plus Silver Bromide.

**SILVER NITRATE** $AgNO_3$

**Acetylene**

See MERCURY SALTS plus Acetylene.

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**Acetylene and Ammonium Hydroxide**

Silver acetylide is formed on precipitation of an ammoniacal solution of silver nitrate with acetylene. Silver acetylide is highly explosive in the dry state.
*Sprengstoffe, Waffen u. Munitions* (1905); J. K. Luchs, *Phot. Sci. Eng.* **10** (6): 334–7 (1966).

**Ammonium Hydroxide**

When a mixture of 28% ammonium hydroxid and silver nitrate solution was treated with a small amount of sodium hydroxide, black material precipitated. On being stirred the mixture exploded. The cause was formation of the sensitive silver nitride.
*MCA Case History* **1554** (1968).

**Arsenic**

See ARSENIC plus Silver Nitrate.

**Calcium Carbide**

A highly sensitive explosive is formed by the addition of calcium carbide to a silver nitrate solution.
*Mellor* **5:** 881 ff. (1946–1947); J. K. Luchs, *Phot. Sci. Eng.* **10**(6): 334–7 (1966).

**Charcoal**

A mixture of charcoal and silver nitrate ignites under impact.
*Mellor* **3:** 473 (1946–1947).

**Chlorine Trifluoride**

See CHLORINE TRIFLUORIDE plus Nitric Acid.

**Cuprous Acetylide**

See CUPROUS ACETYLIDE plus Silver Nitrate.

**Ethyl Alcohol**

Alcohols should not be mixed with silver nitrate, an explosive fulminate may be formed.
*Bahme,* p. 9 (1961): J. K. Luchs, *Phot. Sci. Eng.* **10** (6): 334–7 (1966).

**Magnesium**

See MAGNESIUM plus Silver Nitrate.

**Phosphine**

An explosion occurred when purified phosphine was passed rapidly into a concentrated solution of silver nitrate.
*Mellor* **3:** 471 (1946–1947).

**Phosphonium Iodide**

See PHOSPHONIUM IODIDE plus Silver Nitrate.

**Phosphorus**

See PHOSPHORUS plus Silver Nitrate.

**Phosphorus Isocyanate**

See PHOSPHORUS ISOCYANATE plus Acetaldehyde.

**Plastics**

In a study to assess potential shipping and storage containers the relative flammability of various plastics in contact with silver nitrate was examined. All plastics tested were shown to undergo propellant-type burning in the presence of silver nitrate under conditions that might be encountered under fire exposure conditions.
*Coffee* (1969).

**Sulfur**

See SULFUR plus Silver Nitrate.

## SILVER NITRIDE $Ag_3N$

**(self-reactive)**

Silver nitride can be detonated by shock even if wet. Detonation temperature is 100°C.
*Photo. Sci. & Eng.* **10** (6): 334–337 (1966).
Dried silver nitride explodes readily, even from a strong flash of light.
*Mellor* **8, Supp. 1:** 155 (1964).

## SILVER NITRIDOOSMATE $AgOsNO_3$

**(self-reactive)**

Silver osmiamate detonates violently at 80°C or by percussion.
*Mellor* **15:** 728 (1946–1947).

## SILVER OXALATE AgOCOCOOAg

**(self-reactive)**

Newly prepared silver oxalate, that had been oven dried for several days at 50°C maximum, was placed in a mechanical mortar-and-pestle type grinder. When the motor was turned on, an explosion occurred that seriously injured two people. Impact detonation was the probable cause of the detonation. Textbooks indicate that silver oxalate is explosive above 150°C and that the explosion hazard is moderate when exposed to heat.
*BCISC* **44** (175): 19 (1973).

**Chlorine**

See CHLORINE plus Mercuric Oxide.

## SILVER OXIDE $Ag_2O$

**Aluminum**

Silver oxide is subject to thermite reactions and will also readily combust solid aluminum once the reaction is initiated. The aluminum was sub-20 micron powder held under nitrogen until mixed with silver oxide in air. The reaction was observed to occur over a wide range of mixture compositions.
L. Britton, *Union Carbide Report* (1990).

**Ammonium Hydroxide**

An attempt to dissolve silver oxide (prepared 24 hours previously) in ammonium hydroxide in a stainless steel can caused a muffled explosion which distorted the can; numerous subsequent small explosions occurred in the spots of slurry scattered around the room by the initial explosion. Many similar incidents are also reported.
*ASESB Expl. Reports* **10** (1960); **172** (1964); **190** (1965). *Health & Safety Inf.* **198** (1964); J. K. Luchs, *Phot. Sci. Eng.* **10**(6): 334–7 (1966). *MCA Case History* **976** (1964).

**Antimony Trisulfide**

Ignition takes place when silver oxide is ground with various metal sulfides, e.g., those of antimony, mercury, selenium.
*Mellor* **3:** 377 (1946–1947).

**Aqueous Ammonia and Ethyl Alcohol**

A mixture of silver oxide plus ethyl alcohol and aqueous ammonia forms the very sensitive silver nitride.
*Mellor* **8:** 101 (1946–1947); J. K. Luchs, *Phot. Sci. Eng.* **10**(6): 334–7 (1966).



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**Carbon Monoxide**
Carbon monoxide reduces silver oxide energetically and considerable heat is generated.
*Mellor* **3:** 377 (1946–1947).

**Magnesium**
A mixture of silver oxide and magnesium heated in a sealed tube causes a reaction which proceeds with explosive violence.
*Mellor* **3:** 378 (1946–1947).

**Mercuric Sulfide**
See SILVER OXIDE plus Antimony Trisulfide.

**Phosphorus**
See PHOSPHORUS plus Silver Oxide.

**Selenium Sulfide**
See SILVER OXIDE plus Antimony Trisulfide.

**Sulfur**
See SULFUR plus Silver Oxide.

## SILVER PERCHLORATE $AgClO_4$

**(self-reactive)**
Silver perchlorate filter cake exploded while being pulverized in a mortar.
*ACS* **146:** 209.

**Acetic Acid**
Silver perchlorate-acetic acid solvated salt is liable to explode when struck. Shock-sensitive solvated salts are also formed with silver perchlorate and aniline, benzene, chlorobenzene, glycerol, nitrobenzene, pyridine, and toluene.
*Mellor* **2, Supp. 1:** 616 (1956).

**Aniline**
See SILVER PERCHLORATE plus Acetic Acid.

**Benzene**
An explosion of silver perchlorate crystallized from benzene has been reported. A similar explosion involving ethyl alcohol was cited.
S. R. Brinkley, *J. Am. Chem. Soc.* **62:** 3524 (1940). *ACS* **146:** 209.
See SILVER PERCHLORATE plus Acetic Acid.

**Carbon Tetrachloride and Hydrochloric Acid**
The reaction of silver perchlorate with carbon tetrachloride in the presence of a small amount of hydrochloric acid produces trichloromethyl perchlorate, which detonates at 40°C.
*Kirk and Othmer, Second Ed.* **5:** 72 (1963).
*Pascal* **16:** 316 (1931–1934).

**Chlorobenzene**
See SILVER PERCHLORATE plus Acetic Acid.

**Ethyl Alcohol**
See SILVER PERCHLORATE plus Benzene.

**Ethylenediamine**
A flask exploded while a chemist was adding ethylenediamine drop-wise to silver perchlorate.
*NSC Newsletter, R & D Sec.* (Jan. 1970).

**Glycerol**
See SILVER PERCHLORATE plus Acetic Acid.

**Nitrobenzene**
See SILVER PERCHLORATE plus Acetic Acid.

**Pyridine**
See SILVER PERCHLORATE plus Acetic Acid.

**Toluene**
See SILVER PERCHLORATE plus Acetic Acid.
Many "hydrocarbon-metal perchlorate" complexes are explosive, for example, the complexes of benzene, toluene, aniline, pyridine, and dioxane.
*Analyst* **80:** 13 (1955).

## SILVER PERMANGANATE $AgMnO_4$

**Ammonium Hydroxide**
Silver permanganate reacts with ammonium hydroxide to form a complex of the formula $[Ag(NH_3)_2]MnO_4$ which is shock sensitive.
*Pascal* **16:** 1062 (1931–1934).

**Sulfuric Acid (Vapor)**
Moist silver permanganate stored for drying in a desiccator over sulfuric acid under vacuum produced a strong explosion.
*Delhez* (1967).

## SILVER PEROXIDE $Ag_2O_2$

**Polyisobutylene**
An explosion occurred during filling of a container with 2 kilograms of silver peroxide containing 1% by weight of polyisobutylene.
*Arbeitsschutz* **6:** 248 (1972).

## SILVER SALTS

**Acetylene**
See MERCURY SALTS plus Acetylene.

**Nitromethane**
See COPPER SALTS plus Nitromethane.

## SILVER SULFIDE $Ag_2S$

**Iodine Monochloride**
See IODINE MONOCHLORIDE plus Cadmium Sulfide.

**Potassium Chlorate**
See POTASSIUM CHLORATE plus Silver Sulfide.

## SODIUM Na

**Air**
The ignition temperature of sodium in air depends on size of surface exposed: vapor ignites at room temperature; droplets at about 250°F; an agitated pool at 400°F.; a calm pool at 500°–800°F. In the absence of moisture and hydrogen, the reaction is insignificant below 1000°F.
*Gracie and Droher* (1960).
*Mellor* **2, Supp. 2:** 440 (1961).

**Aluminum Bromide**
A mixture of sodium and any of the following halide compounds produces a strong explosion on impact: aluminum bromide, aluminum chloride, aluminum fluoride, ammonium chlorocuprate, antimony tribromide, antimony trichloride, antimony triiodide, arsenic trichloride, arsenic triiodide, bismuth tribromide, bismuth trichloride, bismuth triiodide, boron tribromide, cupric chloride, ferrous chloride, iodine monobromide, manganous chloride, mercuric bromide, mercuric chloride, mercuric fluoride, mercuric iodide, mercurous chloride,

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silicon tetrachloride, silver fluoride, stannic chloride, stannic iodide (with sulfur), stannous chloride, sulfur dibromide, thallous bromide, vanadium pentachloride, and zinc bromide.
*Mellor* **2, Supp. 2:** 497 (1961).

**Aluminum Chloride**
See SODIUM plus Aluminum Bromide.

**Aluminum Fluoride**
See SODIUM plus Aluminum Bromide.

**Ammonium Chlorocuprate**
See SODIUM plus Aluminum Bromide.

**Ammonium Nitrate**
Sodium and ammonium nitrate react through a series of reductions to form a yellow explosive substance believed to be disodium nitrite.
*Mellor* **8: Supp. I, Part I,** p. 546 (1964).

**Antimony Tribromide**
See SODIUM plus Aluminum Bromide.

**Antimony Trichloride**
See SODIUM plus Aluminum Bromide.

**Antimony Triiodide**
See SODIUM plus Aluminum Bromide.

**Arsenic Trichloride**
See SODIUM plus Aluminum Bromide.

**Arsenic Triiodide**
See SODIUM plus Aluminum Bromide.

**Bismuth Tribromide**
See SODIUM plus Aluminum Bromide.

**Bismuth Trichloride**
See SODIUM plus Aluminum Bromide.

**Bismuth Triiodide**
See SODIUM plus Aluminum Bromide.

**Bismuth Trioxide**
Sodium reduces the heated trioxide to the metal and the reaction is accompanied by incandescence.
*Mellor* **9:** 649 (1946–1947).

**Boron Tribromide Bromine**
See SODIUM plus Aluminum Bromide.
Finely divided sodium reacts with bromine with luminescence. The system, solid sodium plus liquid bromine, requires a light mechanical shock to explode it.
*Mellor,* **Supp. II, Part I:** 714 (1956). H. Staudinger, *Z. Elektrochem.* **31:** 549–52 (1925).
See BROMINE plus Potassium.

**Bromoazide**
See ANTIMONY plus Bromoazide.

**Carbon Dioxide**
Molten sodium can be plunged into a carbon dioxide atmosphere without causing a vigorous reaction. But sodium manufacturers warn against using carbon dioxide on fires, because molten sodium burns with increasing vigor as the temperature is elevated. Small sodium fires can, however, be covered with solvent, like kerosine, and the resultant kerosine fire can be attacked with carbon dioxide.
H. N. Gilbert, *Chem. and Eng. News* **26:** 2604 (1948). *Metallic Sodium,* p. 19 (1952). *"Ethyl" Sodium,* p. 10 (1954). *Sodium, Plant Scale,* p. 38 (1956).
An explosive reaction occurs when dry ice and solid sodium are brought together by impact.
*Mellor* **2, Supp. 2:** 468 (1961).

**Carbon Monoxide and Ammonia**
The reaction of sodium and carbon monoxide in liquid ammonia forms sodium carbonyl, which explodes when heated in air.
*Mellor* **2, Supp. 2:** 467 (1961).
See also SODIUM CARBONYL plus Air.

**Carbon Tetrachloride**
Carbon tetrachloride reacts violently with hot sodium.
*Bahme,* p. 12 (1961). *Ellern,* p. 43 (1968).
See SODIUM plus Carbon Dioxide.
See SODIUM plus Cobaltous Bromide.

**Chlorinated Hydrocarbons**
Sodium forms explosive mixtures with chlorinated hydrocarbons.
H. N. Gilbert, *Chem. and Eng. News* **26:** 2604 (1948).

**Chlorine**
Cold sodium is spontaneously flammable in moist chlorine.
*Mellor* **2:** 95, 469 (1946–1947).
The vapors of sodium and chlorine react with a luminous flame.
*Mellor* **2, Supp. 1:** 380 (1956).

**Chlorine Trifluoride**
See CALCIUM plus Chlorine Trifluoride.

**Chloroform**
The system, sodium plus chloroform, is shock-sensitive, producing a fairly strong explosion.
H. Staudinger, *Z. Elektrochem.* **31:** 549–52 (1925).
See LITHIUM plus Chloroform.
See POTASSIUM plus Chloroform.

**Chromium Tetrachloride**
A mixture of sodium and chromium tetrachloride creates a very violent explosion on impact.
*Mellor* **2, Supp. 2:** 497 (1961).

**Chromium Trioxide**
Sodium or potassium reacts with chromium trioxide with incandescence.
*Mellor* **11:** 237 (1946–1947).

**Cobaltous Bromide**
A very violent explosion results when a mixture of sodium and any of the following is struck with a hammer: cobaltous bromide, carbon tetrachloride, cobaltous chloride, ferric bromide, ferric chloride, ferrous bromide, ferrous iodide, phosphorus pentachloride, phosphorus tribromide, sulfur dichloride.
*Mellor* **2, Supp. 2:** 497 (1961).

**Cobaltous Chloride**
See SODIUM plus Cobaltous Bromide.

**Cupric Chloride**
See SODIUM plus Aluminum Bromide.

**Cupric Oxide**
Cupric oxide is reduced when heated with sodium. The reaction proceeds with vivid incandescence.
*Mellor* **3:** 138 (1946–1947).



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**1,2-Dichloroethylene**

The addition of sodium, caustic or caustic solutions to 1,2-dichloroethylene or to trichloroethylene may form monochloroacetylene or dichloroacetylene, respectively. The addition of sodium or caustic to tetrachloroethane may form either of the chloroacetylenes, both of which are spontaneously flammable in air. Avoid the contact of the above chlorohydrocarbons with sodium or caustic except under carefully controlled experimental conditions.
*NAVWEPS OP* **3237,** p. 28 (1964). *Fire and Accident Prev.* **42** (1956).

**Dichvloromethane**

Sodium and other alkali metals form sensitive explosive mixtures with chloroform, dichloromethane, and methyl chloride.
H. Staudinger, *Z. Elektrochem.* **31:** 549 (1925).

**Ferric Bromide**

See SODIUM plus Cobaltous Bromide.

**Ferric Chloride**

See SODIUM plus Cobaltous Bromide.

**Ferrous Bromide**

See SODIUM plus Cobaltous Bromide.

**Ferrous Chloride**

See SODIUM plus Aluminum Bromide.

**Ferrous Iodide**

See SODIUM plus Cobaltous Bromide.

**Fluorine**

Sodium burns spontaneously in fluorine.
*Mellor* **2:** 469 (1946–1947).
*Mellor* **2, Supp. 2:** 450 (1961).

**Hydrazine Hydrate**

Hydrazine hydrate and sodium develop much heat with the liberation of hydrogen and ammonia. If hydrazine hydrate is added drop by drop to finely granulated sodium, suspended in ether, and the mixture is heated, a white substance is formed, which explodes in air.
*Mellor* **8:** 316 (1946–1947).

**Hydrochloric Acid**

Sodium explodes on contact with hydrochloric acid.
*Mellor* **2:** 469 (1946–1947).

**Hydrofluoric Acid**

An aqueous solution of hydrofluoric acid reacts with sodium with explosive violence.
*Mellor* **2:** 469 (1946–1947).

**Hydrogen Chloride**

Sodium reacts very vigorously with gaseous hydrogen chloride.
*Mellor* **2, Supp. 2:** 452 (1961).

**Hydrogen Peroxide**

See LEAD DIOXIDE plus Hydrogen Peroxide.

**Hydrogen Sulfide**

A very rapid reaction results when moist gaseous hydrogen sulfide contacts sodium.
*Mellor* **2, Supp. 2:** 456 (1961).

**Hydroxylamine**

Sodium and hydroxylamine (in an ether solution) form sodium hydroxylamine, which is spontaneously flammable in air.
*Mellor* **8:** 290 (1946–1947).

**Iodine**

See IODINE plus Lithium.

**Iodine Monobromide**

A mixture of sodium and iodine monobromide explodes when struck with a hammer.
*Mellor* **2, Supp. 2:** 452 (1961).
See also SODIUM plus Aluminum Bromide.

**Iodine Monochloride**

See POTASSIUM plus Iodine Monochloride. The reaction of sodium and iodine monochloride is vigorous when both materials are molten.
*Mellor* **2, Supp. 2:** 451 (1961).

**Iodine Pentafluoride**

A mixture of iodine pentafluoride and potassium or sodium (molten) will explode.
*Mellor* **2:** 114 (1946–1947).

**Lead Oxide**

Sodium, reduced to a fine state of subdivision, when mixed with lead oxide ignites spontaneously.
*Mellor* **7:** 658 (1946–1947).

**Maleic Anhydride**

See ALKALI METALS plus Maleic Anhydride.

**Manganous Chloride**

See SODIUM plus Aluminum Bromide.

**Mercuric Bromide**

See SODIUM plus Aluminum Bromide.

**Mercuric Chloride**

See SODIUM plus Aluminum Bromide.

**Mercuric Fluoride**

See SODIUM plus Aluminum Bromide.

**Mercuric Iodide**

See SODIUM plus Aluminum Bromide.

**Mercurous Chloride**

See SODIUM plus Aluminum Bromide.

**Mercurous Oxide**

Molten sodium or potassium decomposes mercurous oxide with a slight explosion.
J. B. Senderens, *Bull. Soc. Chim.* (3) **6:** 802 (1891).

**Methyl Chloride**

Sodium and other alkali metals react explosively with methyl chloride.
H. Staudinger, *Z. Elektrochem.* **31:**549–52 (1925).

**Molybdenum Trioxide**

Molybdenum trioxide is reduced by either potassium or sodium with incandescence.
*Z. Anorg. Chemie* **190:** 270 (1930).

**Monoammonium Phosphate**

An explosive reaction occurred when monoammonium phosphate was used to extinguish a sodium fire. No reactions were experienced when sodium bicarbonate or potassium bicarbonate was used in a sodium fire.
*Bohling* (1971).

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**Nitric Acid**
Sodium ignites spontaneously in contact with nitric acid of specific gravity exceeding 1.056.
*Mellor* **2:** 470 (1946–1947).
*Mellor* **2, Supp. 2:** 452 (1961).

**Nitrogen Peroxide**
Gaseous sodium reacts with the vapors of nitrogen peroxide and nitrous oxide with marked luminescence at 260°C.
*Mellor* **2, Supp. 2:** 463 (1961).

**Nitrosyl Fluoride**
The reaction between nitrosyl fluoride and sodium forms sodium fluoride with incandescence.
*Z. Anorg. Chemie* **47:** 190 (1905).

**Nitrous Oxide**
See SODIUM plus Nitrogen Peroxide.

**Phosgene**
Vapors of sodium and phosgene react with luminescence at about 260°C.
*Mellor* **2, Supp. 2:** 470 (1961).

**Phosphorus**
See PHOSPHORUS plus Cesium.

**Phosphorus Pentachloride**
Molten sodium may ignite or explode when in contact with phosphorus pentachloride.
*Baudrimant.*
See also SODIUM plus Cobaltous Bromide.

**Phosphorus Pentoxide**
See POTASSIUM plus Phosphorus Pentoxide.

**Phosphorus Tribromide**
Metallic sodium merely floats on liquid phosphorus tribromide, losing its metallic lustre; but, if a little water is sprinkled on the surface, there is a violent explosion.
*Z. Anorg. Chemie* **41:** 276 (1904).
See SODIUM plus Cobaltous Bromide.

**Phosphorus Trichloride**
Phosphorus trichloride explodes at the fusion temperature of sodium.
*Mellor* **2:** 470 (1946–1947).
See also SODIUM plus Phosphoryl Chloride.

**Phosphoryl Chloride**
Gaseous sodium reacts with the vapors of phosphoryl chloride and phosphorus trichloride with luminescence at 270°C.
*Mellor* **2, Supp. 2:** 463 (1961).

**Potassium Oxides**
See POTASSIUM plus Air.

**Potassium Ozonide**
Sodium in contact with either potassium ozonide or potassium superoxide produces an explosive reaction.
*Mellor* **2, Supp. 3:** 1577 (1963).

**Potassium Superoxide**
See SODIUM plus Potassium Ozonide.

**Selenium**
Potassium reacts with selenium and is attended by burning; sodium does likewise and is attended by vivid incandescence.
*Mellor* **10:** 766–7 (1946–1947).
The reaction of sodium and selenium is luminescent above 300°C at low pressure.
*Mellor* **2, Supp. 2:** 455 (1961).

**Silicon Tetrachloride**
See SODIUM plus Aluminum Bromide.

**Silver Bromide**
Silver bromide, silver chloride, silver fluoride, and silver iodide form impact-sensitive systems with sodium and other alkali metals.
H. Staudinger, *Z. Elektrochem.* **31:** 549–52 (1925).

**Silver Chloride**
See SODIUM plus Silver Bromide.

**Silver Fluoride**
See SODIUM plus Silver Bromide.
See SODIUM plus Aluminum Bromide.

**Silver Iodide**
See SODIUM plus Silver Bromide.

**Sodium Peroxide**
The reduction of sodium peroxide by molten sodium at 500°C is a very vigorous reaction.
*U.S. AEC Document UCRL-***1864:** 2–23 (1954).

**Stannic Chloride**
See SODIUM plus Aluminum Bromide.

**Stannic Iodide and Sulfur**
See SODIUM plus Aluminum Bromide.

**Stannic Oxide**
Stannic oxide is reduced by sodium or potassium with incandescence.
*Mellor* **7:** 401, 418 (1946–1947).

**Stannous Chloride**
See SODIUM plus Aluminum Bromide.

**Sulfur**
When sulfur is rubbed with sodium, the reaction proceeds with explosive violence.
*Mellor* **2:** 469 (1946–1947).
*Mellor* **2, Supp. 2:** 455 (1961).

**Sulfur Dibromide**
See SODIUM plus Aluminum Bromide.

**Sulfur Dichloride**
A mixture of sodium and sulfur dichloride explodes when struck with a hammer.
*Mellor* **2, Supp. 2:** 460 (1961).

**Sulfur Dioxide**
Sulfur dioxide reacts violently with sodium near the melting point.
H. N. Gilbert, *Chem. and Eng. News* **26:** 2604 (1948).
The reaction of sodium and sulfur dioxide is almost as vigorous as that between sodium and water.
*Mellor* **2, Supp. 2:** 458 (1961).

**Sulfuric Acid**
A dilute aqueous solution of sulfuric acid reacts with sodium with explosive violence.
*Mellor* **2:** 470 (1946–1947).
*Mellor* **2, Supp. 2:** 453 (1961).

**Tellurium**
A vigorous reaction results when liquid tellurium is poured over solid sodium.
*Mellor* **2, Supp. 2:** 455 (1961).



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**Tetrachloroethane**
Tetrachloroethane may explode with potassium or sodium. See also SODIUM plus 1,2-Dichloroethylene.
*Chem. Safety Data Sheet* **SD-34** (1949).

**Thallous Bromide**
See SODIUM plus Aluminum Bromide.

**Thiophosphoryl Fluoride**
When thiophosphoryl fluoride is passed over a metal such as heated sodium or potassium, the metal ignites. The residual mass, when treated with water, gives off spontaneously flammable phosphine.
*Mellor* **8:** 1072 (1946–1947).

**Trichloroethylene**
See SODIUM plus 1,2-Dichloroethylene.

**Vanadium Pentachloride**
See SODIUM plus Aluminum Bromide.

**Vanadyl Chloride**
Sodium and vanadyl chloride react violently when heated to 180°C.
*Mellor* **2, Supp. 2:** 496 (1961).

**Water**
At 40°C. the heat of reaction is adequate to ignite the hydrogen liberated.
*Mellor* **2:** 469 (1946–1947).
See SODIUM plus Carbon Dioxide.

**Zinc Bromide**
See SODIUM plus Aluminum Bromide.

## SODIUM ACETATE $CH_3COONa$

**Fluorine**
See FLUORINE plus Sodium Acetate.

**Potassium Nitrate**
See POTASSIUM NITRATE plus Sodium Acetate.

## SODIUM ACETOACETIC ESTER
$C_2H_5OCOCH{=}CO(Na)CH_3$

**2-Iodo-3, 5-Dinitrobiphenyl**
See 2-IODO-3, 5-DINITROBIPHENYL plus Ethyl Sodio-Acetoacetate.

## SODIUM ACETYLIDE $NaC{\equiv}CH$

**Bromine**
See BROMINE plus Sodium Acetylene Carbide.

**Chlorine**
See BROMINE plus Sodium Acetylene Carbide.

## SODIUM ACI-NITROMETHYLIDE $NaON(CH_2)O$

**Water**
Sodium or potassium salts of nitromethane exploded when the dry salt was moistened with a little water.
*Chem. and Eng. News* **28:** 1473 (1950).

## SODIUM AMIDE $NaNH_2$

**Chromic Anhydride**
When these solids are ground together, a vigorous reaction results.
*Mellor* **11:** 234 (1946–1947).

**1,1-Diethoxy-2-chloroethane**
The reaction in the presence of ammonia produces sodium ethoxyacetylide, which is extremely pyrophoric.
*Rutledge,* p. 35 (1968).

**Potassium Chlorate**
See POTASSIUM CHLORATE plus Sodium Amide.

**Water**
Sodium amide reacts violently with water and frequently bursts into flame.
F. W. Bergstrom and W. C. Fernelius, *Chem. Reviews* **12:** 61 (1933).

## SODIUM AZIDE $NaN_3$

**(self-reactive)**
Sodium azide decomposes at 275°C.
*Mellor* **8, Supp. 2:** 43 (1967).

**Benzoyl Chloride and Potassium Hydroxide**
The mixture of sodium azide and benzoyl chloride reacts spontaneously with evolution of heat in a potassium hydroxide solution.
*Mellor* **8, Supp. 2:** 55 (1967).

**Bromine**
See BROMINE plus Silver Azide.

**Carbon Disulfide**
See CARBON DISULFIDE plus Azides.

**Chromyl Chloride**
The reaction of sodium azide and chromyl chloride is an explosive one.
*Mellor* **8, Supp. 2:** 36 (1967).

**Copper**
A solution of sodium azide in copper pipe with lead joints formed copper azide and lead azide, both detonating compounds.
*Klotz* (1973).

**Dibromomalononitrile**
These materials react to produce a product that is extremely sensitive to light shock.
*MCA Case History* **820** (1962). *ASESB Expl. Report* **89** (1962).

**Dimethyl Sulfate**
During preparation of methyl azide from reaction of these two chemicals, a violent explosion occurred. Apparently the pH was allowed to fall below 5. At this acidity hydrazoic acid, a powerful explosive, readily forms.
*MCA Case History* **887** (1963).

**Lead**
See SODIUM AZIDE plus Copper.

**Methylene Chloride**
Explosive reaction can occur with methylene chloride and other halogenated solvents.
*Chem. and Eng. News* (Dec. 13, 1993).

**Nitric Acid**
The reaction of sodium azide and strong nitric acid is energetic.
*Mellor* **8, Supp. 2:** 315 (1967).

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**SODIUM BICARBONATE** $NaHCO_3$

**Monoammonium Phosphate**
A self-propagating reaction can occur when either sodium bicarbonate- or potassium bicarbonate-based dry chemical extinguishing agent is mixed with monoammonium phosphate dry chemical extinguishing agent. Moisture will accelerate the reaction. Products are water, ammonia, carbon dioxide and various solid substances. In a fire extinguisher the pressure developed will blow out the valve.
*Fire J.* **60** (1):49 (1966).

**Sodium-Potassium Alloy**
See SODIUM-POTASSIUM ALLOY plus Water.

**SODIUM BISULFIDE** NaHS

**m-Chloroaniline Diazonium Salt**
See SODIUM SULFIDE plus Diazonium and Diazonium Chloride Salts.

**4-Chloro-o-toluidine Diazonium Chloride**
See SODIUM SULFIDE plus Diazonium and Diazonium Chloride Salts.

**o-Nitroaniline Diazonium Salt**
See SODIUM SULFIDE plus Diazonium and Diazonium Chloride Salts.

**Diazonium Salts**
See DIAZONIUM SALTS plus Thiophenates.

**SODIUM BORINATE** $NaBH_2O$

**(self-reactive)**
Sodium hypoborate is a stronger, more violent reducing agent than sodium hypophosphite.
*Mellor* **5:** 37 (1946–1947).

**SODIUM BOROHYDRIDE** $NaBH_4$

**Hydrogen Peroxide**
Sodium borohydride is oxidized by hydrogen peroxide to give sodium metaborate and water. The reaction is very exothermic with the evolution of 1776 KJ/mole.

**SODIUM BROMATE** $NaBrO_3$

**Aluminum**
See ALUMINUM plus Bromates.

**Arsenic**
See ARSENIC plus Bromates.

**Carbon**
See CARBON plus Bromates.

**Copper**
See COPPER plus Bromates.

**Lubricant**
See BROMATES plus Organic Matter.

**Metal Sulfides**
See METAL SULFIDES plus Bromates.

**Organic Matter**
See BROMATES plus Organic Matter.

**Phosphorus**
See PHOSPHORUS plus Bromates.

**Sulfur**
See SULFUR plus Bromates.

**SODIUM BROMIDE** NaBr

**Bromine Trifluoride**
See BROMINE TRIFLUORIDE plus Potassium Bromide.

**SODIUM CARBIDE** $Na_2C_2$

**Aluminum**
See MERCURY plus Sodium Carbide.

**Bromine**
See BROMINE plus Sodium Carbide.

**Carbon Dioxide**
Sodium carbide reacts with incandescence when placed in carbon dioxide, chlorine, or sulfur dioxide.
*Von Schwartz,* p. 328 (1918).
Sodium carbide ignites on warming in carbon dioxide.
*Mellor* **5:** 848 (1946–1947).

**Chlorine**
See SODIUM CARBIDE plus Carbon Dioxide.
See CHLORINE plus Sodium Carbide.

**Iron**
See MERCURY plus Sodium Carbide.

**Lead**
See MERCURY plus Sodium Carbide.

**Mercury**
See MERCURY plus Sodium Carbide.

**Nitrogen Pentoxide**
Nitrogen pentoxide attacks sodium carbide with incandescence at 150°C.
*Mellor* **5:** 848–50 (1946–1947).

**Phosphorus**
See PHOSPHORUS plus Sodium Carbide.

**Sulfur Dioxide**
See SODIUM CARBIDE plus Carbon Dioxide.

**Water**
See BROMINE plus Sodium Carbide.
An explosion of sodium carbide can occur in water if a large excess of carbide is present.
*Mellor* **5:** 848 (1946–1947).

**SODIUM CARBONATE** $Na_2CO_3$

**Aluminum**
See ALUMINUM plus Sodium Carbonate.

**Fluorine**
See FLUORINE plus Carbonates.

**Phosphorus Pentoxide**
The anhydrous reaction of sodium carbonate and phosphorus pentoxide, initiated by local heating, can generate relatively high temperatures.
*Mellor* **8, Supp. 3:** 406 (1971).

**Sulfuric Acid**
Stratified concentrated sulfuric acid in a reaction tank was suddenly contacted by alkali wash. The violent ensuing reaction caused a geyser of material, propelled by carbon dioxide and steam, to shoot from the manhole of the tank.
*MCA Case History* **888** (1963).



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**SODIUM CARBONYL** NaCOCONa

**Air**
Sodium carbonyl or potassium carbonyl explodes on contact with air or water.
*Mellor* **5:** 951–54 (1946–1947).
See also SODIUM plus Carbon Monoxide and Ammonia.

**Water**
See SODIUM CARBONYL plus Air.

**SODIUM CHLORATE** $NaClO_3$

**(See also CHLORATES)**

**Aluminum**
See ALUMINUM plus Bromates.

**Ammonium Thiosulfate**
A bulk cargo of sodium chlorate became hot while being transported in a tank that had previously contained ammonium thiosulfate. Under controlled laboratory conditions, a small quantity of ammonium thiosulfate in sodium chlorate could be made to decompose explosively.
*MCA Case History* **2019** (April 1974).

**Antimony Sulfide**
See CHLORATES plus Antimony Sulfide.

**Arsenic**
See ARSENIC plus Bromates.

**Arsenic Trioxide**
The two chemicals form a spontaneously flammable mixture.
*Ellern,* p. 51 (1968).

**Carbon**
See CARBON plus Bromates.

**Charcoal**
See CHLORATES plus Organic Matter.

**Copper**
See COPPER plus Bromates.

**Manganese Dioxide**
See CHLORATES plus Manganese Dioxide.

**Metal Sulfides**
See METAL SULFIDES plus Bromates.

**Organic Acids (Dibasic)**
See CHLORATES plus Organic Acids (Dibasic).

**Organic Matter**
Mixtures containing more than 10 per cent sodium chlorate are sufficiently combustible to be hazardous at low relative humidity. Mixtures of sodium chlorate with organic material such as charcoal, sugar, flour or shellac may be ignited by friction or shock.
*Chem. Safety Data Sheet* **SD-42** (1951). W. H. Cook, *Can. J. Research* **8:** 509–44 (1933).
See CHLORATES plus Organic Matter.

**Phosphorus**
See PHOSPHORUS plus Bromates.

**Potassium Cyanide**
See CHLORATES plus Antimony Sulfide. See POTASSIUM CYANIDE plus Sodium Chlorate. See CHLORATES plus Potassium Cyanide.

**Sulfur**
See SULFUR plus Chlorates. See SULFUR plus Bromates.

**Sulfuric Acid**
Chlorates when brought in contact with sulfuric acid are likely to cause fire or explosions.
*Bahme,* p. 29 (1961).

**Thiocyanates**
See CHLORATES plus Antimony Sulfide.
See THIOCYANATES plus Chlorates.

**Zinc**
See ZINC plus Chlorates.

**SODIUM CHLORIDE** NaCl

**Bromine Trifluoride**
See BROMINE TRIFLUORIDE plus Potassium Bromide.

**Lithium**
See LITHIUM plus Sodium Chloride.

**SODIUM CHLORITE** $NaClO_2$

**(self-reactive)**
An 18-month-old bottle of recrystallized sodium chlorite stored at temperatures in excess of 90°F (32.2°C) ignited as the bottle cap was turned.
*Chem. and Eng. News,* p. 4 (March 22, 1993).
The trihydrate crystals of sodium chlorite explode on percussion.
*Mellor* **2, Supp. 1:** 573 (1956).

**Acids**
Sodium chlorite and acids react with rapid evolution of spontaneously explosive chlorine dioxide gas. If heated above 347°F, the reaction produces adequate heat to become self-sustaining.
*Diox Process* (1949).

**Organic Matter**
A mixture of organic matter and sodium chlorite can be extremely sensitive to heat, impact, or friction.
*Diox Process* (1949).

**Oxalic Acid**
A bleach mix was prepared by placing weighed quantities of the two chemicals in a stainless steel beaker. As water was being added, the mixture fizzed a moment, then exploded. Toxic chlorine dioxide gas was evolved.
*MCA Case History* **839** (1962).

**Phosphorus**
See PHOSPHORUS plus Sodium Chlorite.

**Sulfur**
See SULFUR plus Sodium Chlorite.

**SODIUM CYANIDE** NaCN

**Nitrates**
See NITRATES plus Cyanides.

**Nitrites**
See CYANIDES plus Chlorates.

**SODIUM DICHROMATE** $Na_2Cr_2O_7$

**Hydrazine**
See POTASSIUM DICHROMATE plus Hydrazine.

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**SODIUM HYDRAZIDE** $NaNHNH_2$

**Air**
Addition of air, or alcohol, or moisture to sodium hydrazide can produce an explosion.
*Mellor* **8:** 336 (1946–1947).

**Alcohol**
See SODIUM HYDRAZIDE plus Air.

**Moisture**
See SODIUM HYDRAZIDE plus Air.

**SODIUM HYDRIDE** NaH

**Acetylene**
If moisture is present, the reaction between sodium hydride and acetylene is vigorous even at minus 60°C.
*Mellor* **2:** 483 (1946–1947).

**Air**
Sodium hydride is spontaneously flammable in air if moistened with water.
*Von Schwartz,* p. 328 (1918).

**Chlorine**
See CHLORINE plus Sodium Hydride.

**Dimethyl Sulfoxide**
See DIMETHYL SULFOXIDE plus Sodium Hydride.

**Fluorine**
See CHLORINE plus Sodium Hydride.

**Iodine**
See IODINE plus Sodium Hydride.

**Oxygen**
See OXYGEN plus Sodium Hydride.

**Sulfur**
See SULFUR plus Sodium Hydride.

**Water**
Sodium hydride that was accidentally spilled from a polyethylene bag ignited spontaneously on contact with moisture.
*MCA Case History* **1587** (1969).

**SODIUM HYDROSULFITE** $Na_2S_2O_4$

**Aluminum Powder**
An explosion occurred when 8000 pounds of sodium hydrosulfite and 1000 pounds of aluminum powder were mixed to form a precipitating agent. Water was added accidentally to the mixing vat causing a decomposition reaction in the vat, which then began to smolder.
*Chemical Process Safety Report* **5:**8 (June 1995).

**Water**
Moist sodium hydrosulfite is likely to ignite upon drying.
*Bahme,* p. 95 (1961).

**SODIUM HYDROXIDE** NaOH

**Acetaldehyde**
See ACETALDEHYDE plus Sodium Hydroxide.

**Acetic Acid**
Mixing sodium hydroxide and glacial acetic acid in a closed container caused the temperature and pressure to increase.
*Flynn and Rossow* (1970). See Note under complete reference.

**Acetic Anhydride**
Mixing sodium hydroxide and acetic anhydride in a closed container caused the temperature and pressure to increase.
*Flynn and Rossow* (1970). See Note under complete reference.

**Acrolein**
An extremely violent polymerization reaction of acrolein results from contact with alkaline materials such as sodium hydroxide, potassium hydroxide, ammonia, and amines.
*Chem. Safety Data Sheet* **SD-85** (1961).
Mixing sodium hydroxide and acrolein in a closed container caused the temperature and pressure to increase.
*Flynn and Rossow* (1970). See Note under complete reference.

**Acrylonitrile**
Violent polymerization takes place in the presence of concentrated caustic (e.g., sodium hydroxide, potassium hydroxide).
*Haz. Chem. Data* (1966).

**Allyl Alcohol**
See ALLYL ALCOHOL plus Sodium Hydroxide.

**Allyl Chloride**
In contact with dry sodium hydroxide, hydrolysis may take place producing allyl alcohol.
*Ventrone* (1971).

**Aluminum**
See ALUMINUM plus Sodium Hydroxide.

**Chlorine Trifluoride**
See CHLORINE TRIFLUORIDE plus Nitric Acid.

**Chloroform and Methyl Alcohol**
When 1 gram of sodium hydroxide was added to a mixture of 1 ml methanol and 1 ml chloroform, an exothermic reaction occurred. Potassium hydroxide and other alkalies may replace sodium hydroxide as a reactant.
J. S. Snyder, *Fawcett and Wood,* p. 302 (1965).

**Chlorohydrin**
Mixing sodium hydroxide and chlorohydrin in a closed container caused the temperature and pressure to increase.
*Flynn and Rossow* (1970). See Note under complete reference.

**Chloronitrotoluenes**
Inadvertent contamination of mixed chloronitrotoluenes by sodium hydroxide in a feed line caused an exothermic reaction with runaway pressure build-up and eventual explosion of the processing apparatus.
*Queener* (1966). *ASESB Expl. Report* **130** (1963).

**Chlorosulfonic Acid**
Mixing sodium hydroxide and chlorosulfonic acid in a closed container caused the temperature and pressure to increase.
*Flynn and Rossow* (1970). See Note under complete reference.

**1,2-Dichloroethylene**
See SODIUM plus 1,2-Dichloroethylene.



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**Ethylene Cyanohydrin**
Mixing sodium hydroxide and ethylene cyanohydrin in a closed container caused the temperature and pressure to increase.
*Flynn and Rossow* (1970). See Note under complete reference.

**Glyoxal**
Mixing sodium hydroxide and glyoxal in a closed container caused the temperature and pressure to increase.
*Flynn and Rossow* (1970). See Note under complete reference.

**Hydrochloric Acid**
Mixing sodium hydroxide and 36% hydrochloric acid in a closed container caused the temperature and pressure to increase.
*Flynn and Rossow* (1970). See Note under complete reference.

**Hydrofluoric Acid**
Mixing sodium hydroxide and 48.7% hydrofluoric acid in a closed container caused the temperature and pressure to increase.
*Flynn and Rossow* (1970). See Note under complete reference.

**Hydroquinone**
Crude hydroquinone was pumped into a sodium hydroxide storage tank by mistake. The hydroquinone liquor at 85°C decomposed rapidly in the presence of the sodium hydroxide resulting in overflow of the tank and evolution of a considerable amount of heat.
*Wischmeyer* (1969).

**Maleic Anhydride**
The presence of a residue of weak sodium hydroxide solution in a pressure vessel caused maleic anhydride to decompose in a runaway explosive reaction.
*Chem. Haz. Info. Series* **C-71:** 5 (1960).
Alkali and other alkaline earth compounds such as potassium, lithium, calcium, barium and magnesium compounds, as well as amines and other nitrogen compounds will cause explosive decomposition of maleic anhydride.
*MCA Case History* **622** *and Suppl. to* **622** (1960).
Vogler, Cecil, and Koerner, *J. Chem. Eng. Data* **8** (4): 620–3 (1963).

**Nitric Acid**
Mixing sodium hydroxide and 70% nitric acid in a closed container caused the temperature and pressure to increase.
*Flynn and Rossow* (1970). See Note under complete reference.

**Nitroethane**
See CALCIUM HYDROXIDE plus Nitroethane.

**Nitromethane**
See CALCIUM HYDROXIDE plus Nitroethane.

**Nitroparaffins**
See CALCIUM HYDROXIDE plus Nitroethane.

**Nitropropane**
See CALCIUM HYDROXIDE plus Nitroethane.

**Oleum**
Mixing sodium hydroxide and oleum in a closed container caused the temperature and pressure to increase.
*Flynn and Rossow* (1970). See Note under complete reference.

**Pentol (3-Methyl-2- Penten-4-yn-1-ol)**
Pentol, being fractionated under high vacuum,was accidentally contacted by caustic cleaning solution and a violent explosion resulted.
*MCA Case History* **363.** *Chem. Process (Chicago)* ***27:*** 111 (1964).

**Phosphorus**
See PHOSPHORUS plus Alkaline Hydroxide.

**Phosphorus Pentoxide**
See CALCIUM OXIDE plus Phosphorus Pentoxide.

**Propiolactone (BETA-)**
Mixing sodium hydroxide and propiolactone (BETA-) in a closed container caused the temperature and pressure to increase.
*Flynn and Rossow* (1970). See Note under complete reference.

**Sulfuric Acid**
Mixing sodium hydroxide and 96% sulfuric acid in a closed container caused the temperature and pressure to increase.
*Flynn and Rossow* (1970). See Note under complete reference.

**Tetrachlorobenzene and Methyl Alcohol**
In the manufacturing of the sodium salt of trichlorophenol, sodium hydroxide, methyl alcohol and tetrachlorobenzene were heated. During the heating process, the pressure suddenly increased rapidly and an explosion occurred.
*MCA Guide for Safety,* Appendix 3 (1972).

**Tetrahydrofuran**
See TETRAHYDROFURAN plus Potassium Hydroxide.

**Trichloroethylene**
When heated, trichloroethylene and sodium hydroxide or potassium hydroxide form explosive mixtures of dichloroacetylene.
*Chem. Safety Data Sheet* **SD-14** (1956).
The presence of alkylamines as a stabilizer in commercial trichloroethylene furnishes a catalyst that accelerates this reaction.
*MCA Case History* **495.** *Fire and Accident Prev.* **42** (June 8, 1956).
A pail of trichloroethylene dumped into a tank of caustic caused a fireball and eruption of the contents.
*MCA Case History* **1065** (1965).
See SODIUM plus 1,2-Dichloroethylene.

**Water**
Sodium hydroxide in contact with water may generate enough heat to ignite adjacent combustible materials.
*Haz. Chem. Data* (1966).

## SODIUM HYDROXYLAMINE $NH_2ONa$

**Air**
Sodium hydroxylamine is spontaneously flammable in air.
*Mellor* **8:** 290 (1946–1947).

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**SODIUM HYPOBROMITE** NaOBr

**Acetone**
See ACETONE plus Sodium Hypobromite.

**Cupric Salts**
Solutions of sodium hypobromite are decomposed by powerful catalytic action of cupric ions, even as impurities.
*Mellor* **2, Supp. 1:** 751 (1956).

**SODIUM HYPOCHLORITE** NaOCl

**(See also HYPOCHLORITES)**

**(self-reactive)**
Anhydrous sodium hypochlorite is very explosive.
*Merck Index,* p. 960 (1968).

**Amines**
See CALCIUM HYPOCHLORITE plus Amines.

**Ammonium Acetate**
Decomposition of sodium hypochlorite takes place within a few seconds with the following salts: ammonium acetate, ammonium carbonate, ammonium nitrate, ammonium oxalate, and ammonium phosphate.
*Mellor* **2, Supp. 1:** 550 (1956).

**Ammonium Carbonate**
See SODIUM HYPOCHLORITE plus Ammonium Acetate.

**Ammonium Nitrate**
See SODIUM HYPOCHLORITE plus Ammonium Acetate.

**Ammonium Oxalate**
See SODIUM HYPOCHLORITE plus Ammonium Acetate.

**Ammonium Phosphate**
See SODIUM HYPOCHLORITE plus Ammonium Acetate.

**Cellulose**
See SODIUM HYPOCHLORITE plus Oxalic Acid.

**Ethyleneimine**
See ETHYLENEIMINE plus Sodium Hypochlorite.

**SODIUM HYPOPHOSPHITE** $NaPH_2O_2$

**(self-reactive)**
Explosions can occur when hot sodium hypophosphite solution is evaporated.
*Mellor* **8:** 881 (1946–1947).

**Air**
Sodium hypophosphite decomposes when heated, forming phosphine, a spontaneously flammable gas.
*Mellor* **8:** 881 (1946–1947).
*Mellor* **8, Supp. 3:** 623 (1971).

**Chlorates**
See CHLORATES plus Sodium Hypophosphite.

**Nitrates**
See CHLORATES plus Sodium Hypophosphite.

**Potassium Nitrate**
See POTASSIUM NITRATE plus Sodium Hypophosphite.

**Sodium Nitrate**
See SODIUM NITRATE plus Sodium Hypophosphite.

**SODIUM IODATE** $NaIO_3$

**Aluminum**
See ALUMINUM plus Bromates.

**Arsenic**
See ARSENIC plus Bromates.

**Carbon**
See CARBON plus Bromates.

**Copper**
See COPPER plus Bromates.

**Hydrogen Peroxide**
Iodates decompose hydrogen peroxide catalytically.
*Mellor* **1:** 940 (1946–1947).

**Metal Sulfides**
See METAL SULFIDES plus Bromates.

**Organic Matter**
See ORGANIC MATTER plus Bromates.

**Phosphorus**
See PHOSPHORUS plus Bromates.

**Potassium**
See POTASSIUM plus Boric Acid.

**Sulfur**
See SULFUR plus Bromates.

**SODIUM IODIDE** NaI

**Bromine Trifluoride**
See BROMINE TRIFLUORIDE plus Potassium Bromide.

**Cumene Hydroperoxide**
Cumene hydroperoxide catalytically decomposes with addition of small quantities of sodium iodide.
*Chem. and Eng. News* (February 5, 1990).

**Perchloric Acid**
Perchloric acid ignites in contact with sodium iodide.
*J. Am. Chem. Soc.* **23:** 444 (1901).

**SODIUM METHOXIDE** $NaOCH_3$

**Chloroform**
Too rapid addition of sodium methylate to a mixture of chloroform and methanol initiated an uncontrolled exothermic reaction between the chloroform and the methylate that terminated in a violent explosion.
*MCA Case History* **693** (1961).

**Methyl Azide and Dimethyl Malonate**
See METHYL AZIDE plus Dimethyl Malonate and Sodium Methylate.

**Perchloryl Fluoride**
See PERCHLORYL FLUORIDE plus Sodium Methylate.

**Water**
Sodium methylate ignites in moist air.
*Wischmeyer* (1966).



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**SODIUM MONOXIDE** $Na_2O$

**Nitric Oxide**
Sodium monoxide and nitric oxide react vigorously above 100°C.
*Mellor* **2, Supp. 2:** 629 (1961).

**SODIUM NITRATE** $NaNO_3$

**Antimony**
See ANTIMONY plus Potassium Nitrate.

**Barium Rhodanide**
See BARIUM RHODANIDE plus Sodium Nitrate.

**Boron Phosphide**
See BORON PHOSPHIDE plus Nitric Acid.

**Cyanides**
See NITRATES plus Cyanides.

**Sodium Hypophosphite**
A mixture of sodium nitrate and sodium hypophosphite constitutes a powerful explosive.
*Mellor* **8:** 831 (1946–1947).

**Sulfur and Charcoal**
See SULFUR plus Sodium Nitrate and Charcoal.

**SODIUM NITRIDE** $Na_3N$

**Air**
The reactivity of sodium nitride resembles that of sodium metal.
*Mellor* **8, Supp. 1:** 154 (1964).

**Performic Acid**
See PERFORMIC ACID plus Sodium Nitride.

**SODIUM NITRITE** $NaNO_2$

**Ammonium Salts**
A violent explosion occurs if an ammonium salt is melted with a nitrite salt.
*Von Schwartz,* p. 299 (1918).

**Cellulose**
Sodium nitrite at 460°F in contact with the fiber drums in which it is shipped undergoes a vigorous decomposition reaction producing a propellant-type burning until the carton is consumed.
*Wheeler* (1969).

**Cyanides**
See CYANIDES plus Chlorates.

**Lithium**
See LITHIUM plus Sodium Nitrite.

**Potassium and Ammonia**
See POTASSIUM plus Sodium Nitrite and Ammonia.

**Sodium Thiosulfate**
When a sodium nitrite and thiosulfate mixture was heated to evaporate to dryness, a violent explosion occurred.
*Mellor* **10:** 501 (1946–1947).

**SODIUM-o-NITROPHENYL SULFIDE** $NaSC_6H_4NO_2$

**(self-reactive)**
Methanol solutions of o-nitrothiophenol and sodium methoxide were mixed and evaporated under reduced pressure, dissolved in xylene and methanol and re-evaporated. As the flask was removed from the evaporator, it exploded.
*Chem. & Ind.* **6:** 257 (Feb. 5, 1966).

**SODIUM OXIDE** $Na_2O$

**Water**
See POTASSIUM OXIDE plus Water.

**SODIUM OZONIDE** $NaO_3$

**Acids**
Acids initiate a fast decomposition of sodium ozonate.
*Mellor* **2, Supp. 2:** 641 (1961).

**Water**
Water initiates a fast decomposition of sodium ozonate.
*Mellor* **2, Supp. 2:** 641 (1961).

**SODIUM PERCHLORATE** $NaClO_4$

**Ammonium Nitrate**
A mixture of these chemicals is used as an explosive.
*Mellor* **2, Supp. 1:** 608 (1956).

**Calcium Hydride**
See BROMATES plus Calcium Hydride.

**Charcoal**
See PERCHLORATES plus Charcoal.

**Magnesium**
See MAGNESIUM plus Potassium Perchlorate.

**Reducing Agents**
See PERCHLORATES plus Charcoal.

**Strontium Hydride**
See BROMATES plus Calcium Hydride.

**SODIUM PEROXIDE** $Na_2O_2$

**Acetic Acid**
Acetic acid or acetic anhydride can explode with sodium peroxide if not kept cold.
*Von Schwartz,* p. 321 (1918).

**Acetic Anhydride**
See SODIUM PEROXIDE plus Acetic Acid.

**Aluminum**
See ALUMINUM plus Sodium Peroxide.

**Aluminum and Carbon Dioxide**
See ALUMINUM plus Sodium Peroxide and Carbon Dioxide.

**Ammonium Persulfate**
See AMMONIUM PERSULFATE plus Sodium Peroxide.

**Aniline**
Sodium peroxide or potassium peroxide is spontaneously flammable with aniline, benzene, organic matter such as paper and wood, and diethyl ether. Mixtures with charcoal, glycerine, certain oils, and phosphorus burn or explode.
*Mellor* **2:** 490–93 (1946–1947). *Von Schwartz,* p. 328 (1918).

**Antimony**
See ANTIMONY plus Sodium Peroxide.

**Arsenic**
See ARSENIC plus Sodium Peroxide.


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**Benzene**
See SODIUM PEROXIDE plus Aniline.

**Boron Nitride**
See BORON NITRIDE plus Sodium Peroxide.

**Calcium Carbide**
When a mixture of sodium peroxide and calcium carbide (powdered) is exposed to damp air, spontaneous combustion occurs. The mixture explodes when heated.
*Mellor* **2:** 490 ff. (1946–1947).

**Charcoal**
See SODIUM PEROXIDE plus Aniline.

**Copper**
See COPPER plus Sodium Peroxide.

**Dextrose and Potassium Nitrate**
A micro Parr calorimeter exploded when the wrong proportions of these ingredients were used. The intended mixture was 4.0 g sodium peroxide, 0.2 g dextrose, and 0.2 g potassium nitrate; actual proportions were 0.35 g, 2.59 g, and 0.2 g respectively. There was insufficient sodium peroxide to dissolve decomposition gases, hence a rapid temperature and pressure build-up caused the Parr bomb to burst.
*Tennessee Eastman* (1967).

**Diethyl Ether**
See SODIUM PEROXIDE plus Aniline.

**Glycerine**
See SODIUM PEROXIDE plus Aniline.

**Hexamethylene-tetramine**
Sodium peroxide will ignite numerous organic compounds, e.g., hexamethylenetetramine, when the mixture is moistened.
*Ellern*, p. 46 (1968).
See also SODIUM PEROXIDE plus Aniline.
See also SODIUM PEROXIDE plus Organic Matter.

**Hydrogen Sulfide**
See HYDROGEN SULFIDE plus Sodium Peroxide.

**Magnesium**
See MAGNESIUM plus Sodium Peroxide.

**Magnesium and Carbon Dioxide**
See MAGNESIUM plus Sodium Peroxide and Carbon Dioxide.

**Manganese Dioxide**
The catalyzed decomposition of sodium peroxide with manganese dioxide may be violent.
*Mellor* **2, Supp. 2:** 635 (1961).

**Organic Matter**
When sodium peroxide is mixed with combustible materials, explosive mixtures may be formed. See also SODIUM PEROXIDE plus Aniline.
*Mellor* **2:** 490 (1946–1947). *Ellern*, p. 46 (1968).

**Phosphorus**
See PHOSPHORUS plus Sodium Peroxide.
See SODIUM PEROXIDE plus Aniline.

**Potassium**
See POTASSIUM plus Sodium Peroxide.

**Selenium Monochloride**
See SELENIUM MONOCHLORIDE plus Sodium Peroxide.

**Silver Chloride and Charcoal**
A mixture of sodium peroxide, silver chloride, and charcoal ignites spontaneously.
*Mellor* **3:** 401 (1946–1947).

**Sodium**
See SODIUM plus Sodium Peroxide.

**Sulfur Monochloride**
A violent reaction results on mixing sodium peroxide and sulfur monochloride.
*Mellor* **2, Supp. 2:** 634 (1961).

**Tin**
See TIN plus Sodium Peroxide.

**Zinc**
See ZINC plus Sodium Peroxide.

## SODIUM PHOSPHIDE $Na_3P$

**Water**
In contact with water or damp air, sodium phosphide evolves phosphine, which is spontaneously flammable in air.
*Lab. Govt. Chemist* (1965). *Van Wazer* (1958).

## SODIUM PHOSPHINAMIDE $NaNHPH_2$

**(self-reactive)**
Sodium amino phosphide is spontaneously flammable in air.
*Lehman and Wilson*, p. 50 (1949).

## SODIUM POLYSULFIDE $Na_2S_x$

**m-Chloroaniline Diazonium Salt**
See SODIUM SULFIDE plus Diazonium and Diazonium Chloride Salts.

**4-Chloro-o-toluidine Diazonium Chloride Salt**
See SODIUM SULFIDE plus Diazonium and Diazonium Chloride Salts.

**o-Nitroaniline Diazonium Salt**
See SODIUM SULFIDE plus Diazonium and Diazonium Chloride Salts.

## SODIUM-POTASSIUM ALLOY NaK

**(See also the reactions listed separately under SODIUM and POTASSIUM)**

**Ammonium Sulfate and Ammonium Nitrate**
See POTASSIUM plus Ammonium Sulfate and Ammonium Nitrate.

**Bromoform**
Mixtures of sodium-potassium alloy and bromoform, tetrachloroethane, or pentachloroethane can explode on standing at room temperature. They are especially sensitive to impact.
*Mellor* **2, Supp. 2:** 563 (1961).

**Carbon Dioxide**
Solid carbon dioxide with sodium-potassium alloy will explode under a slight impact.
H. Staudinger, *Z. Elektrochem.* **31:** 549–52 (1925).
*Mellor* **2, Supp. 2:** 563 (1961).



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**Carbon Tetrachloride**
If carbon tetrachloride is placed on sodium-potassium alloy, a light impact will cause a violent explosion. Chloroform, dichloromethane, or methyl chloride in contact with sodium-potassium alloy is similarly impact-sensitive.
H. Staudinger, *Z. Elektrochem.* **31:** 549–52 (1925). *Ellern,* p. 43 (1968).
Addition of a small amount of carbon tetrachloride to the alloy with a trace of kerosine and carbonaceous residue resulted in a violent explosion after a few moments.
*Bozich* (1966).
*Mellor* **2, Supp. 2:** 563 (1961).
See also SODIUM-POTASSIUM ALLOY plus Water.

**Chloroform**
See SODIUM-POTASSIUM ALLOY plus Carbon Tetrachloride. See LITHIUM plus Chloroform.

**Dichloromethane**
See SODIUM-POTASSIUM ALLOY plus Carbon Tetrachloride.

**Diiodomethane**
Sodium-potassium alloy reacts explosively with diiodomethane.
*Ellern,* p. 43 (1968).

**Mercuric Oxide**
Red mercuric oxide causes a violent explosion with sodium-potassium alloy when struck lightly; the yellow oxide does so at a much lighter blow.
H. Staudinger, *Z. Elektrochem.* **31:** 549–52 (1925).

**Methyl Chloride**
See SODIUM-POTASSIUM ALLOY plus Carbon Tetrachloride.

**Methyl Dichloride**
The mixture of sodium-potassium alloy and methyl dichloride detonates strongly if struck.
*Mellor* **2, Supp. 2:** 563 (1961).

**Oxalyl Bromide**
A mixture of sodium-potassium alloy and either oxalyl bromide or oxalyl chloride explodes violently.
*Mellor* **2, Supp. 2:** 564 (1961).

**Oxalyl Chloride**
See SODIUM-POTASSIUM ALLOY plus Oxalyl Bromide.

**Pentachloroethane**
See SODIUM-POTASSIUM ALLOY plus Bromoform.

**Potassium Oxides**
See POTASSIUM plus Air.

**Potassium Superoxide**
While 100 gallons of sodium-potassium was being transferred and filtered into a receiver tank, the waste oxide accumulating on the filter was periodically scraped into drums. Drops of hot liquid NaK fell into one drum receiving the oxide waste, and a serious explosion occurred. Potassium superoxide was considered the essential ingredient of the explosive mixture.
*Health and Safety Inf.* **251** (March 31, 1967).

**Silicon**
See SILICON plus Sodium-Potassium Alloy.

**Silver Halides**
Sodium-potassium alloys have exploded violently on contact with silver halides.
*Ellern,* p. 43 (1968).

**Sodium Bicarbonate**
See SODIUM-POTASSIUM ALLOY plus Water.

**Teflon®**
Sealing tape made of Teflon® (polytetrafluoroethylene or polyhexafluoroethylene) burned vigorously in contact with sodium-potassium alloy in a helium atmosphere.
*Scott* (1966).

**Tetrachloroethane**
See SODIUM-POTASSIUM ALLOY plus Bromoform.

**1,1,1-Trichloroethane**
A pipe- and solenoid-valve assembly used to transfer NaK had been purged with nitrogen, then flushed with water. Trichloroethane, used subsequently to remove traces of water, contacted a hidden residue of NaK in one valve and an explosion ensued.
*Inf. Exchange Bull.* **1:** 2 (1961).

**Trichlorotrifluoroethane**
When two drops of the trichlorotrifluoroethane were added to NaK, there was a violent explosion.
*Pancner* (1966).

**Water**
Sodium-potassium alloy undergoes a violent reaction with certain extinguishing agents: water, sodium bicarbonate, carbon tetrachloride.
*Mellor* **2, Supp. 2:** 564 (1961).

## SODIUM SILICATE $NaSiO_3$

**Fluorine**
See FLUORINE plus Sodium Silicate.

## SODIUM SILICIDE $Na_2Si_2$

**Air**
Sodium silicide in powder form is spontaneously flammable in air.
*Ellern* (1968).

**Water**
See CESIUM SILICIDE plus Water.

## SODIUM SULFATE $Na_2SO_4$

**Aluminum**
See ALUMINUM plus Sulfates.

## SODIUM SULFIDE $Na_2S$

**Carbon**
See CARBON plus Sodium Sulfide.

**m-Chloroaniline Diazonium Salt**
See SODIUM SULFIDE plus Diazonium and Diazonium Chloride Salts.

**4-Chloro-o-toluidine Diazonium Chloride Salts**
See SODIUM SULFIDE plus Diazonium and Diazonium Chloride Salts.

**Diazonium Salts and Diazonium Chloride Salts**
In the preparation of mercaptans, the slow addition of the diazonium chloride salt of 4-chloro-o-toluidine or o-nitroaniline or m-chloroaniline to sodium sulfide, so-


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dium bisulfide or sodium polysulfide solutions will result in explosions even at 5°C.
*Chem. and Eng. News* **23:** 1247 (1945).
Hodgson, *Chem. & Ind.*, p. 362 (1945).

**Diazonium Salts**
See DIAZONIUM SALTS plus Thiophenates.

**N, N-Dichloromethyl Amine**
See N, N-DICHLOROMETHYL AMINE plus Sodium Sulfide.

**o-Nitroaniline Diazonium Salt**
See SODIUM SULFIDE plus Diazonium and Diazonium Chloride Salts.

**Water**
Moist sodium sulfide is spontaneously flammable upon drying in air.
*Brauer* (1965).

## SODIUM SUPEROXIDE $NaO_2$

**(self-reactive)**
Sodium superoxide violently evolves oxygen above 250°C.
*Mellor* **2, Supp. 2:** 639 (1961).

**Water**
The reaction of sodium superoxide and water is fast and vigorous, liberating oxygen.
*Mellor* **2, Supp. 2:** 639 (1961).

## SODIUM TETRAHYDROALUMINATE $NaAlH_4$

**Tetrahydrofuran**
A violent explosion occurred during the preparation of sodium aluminum hydride from sodium and aluminum in a medium of tetrahydrofuran. Localized heating in the reaction vessel was the suspected trigger mechanism.
*Chem. and Eng. News* **39** (40): 57 (1961).

**Water**
On coming in contact with water sodium aluminum hydride ignites or explodes.
*NSC Nat. Safety News* **77** (2): 37–40 (1958).

## SODIUM TETRAHYDROBORATE $NaBH_4$

**Air**
Sodium borohydride burns quietly in air.
*Lab. Govt. Chemist* (1965).

## SODIUM TETRAPEROXYCHROMATE $Na_3Cr(OO)_4$

**(self-reactive)**
Sodium triperchromate decomposes explosively at 115°C.
*Mellor* **11:** 356 (1946–1947).

## SODIUM TETRAZOLYL-5-AZIDE $NaNN{=}NN{=}CNNN$

**(self-reactive)**
Sodium tetrazolyl-5-azide is a shock-sensitive compound.
*Chem. and Eng. News* **43** (52): 29, 30 (Dec. 27, 1965).

## SODIUM THIOSULFATE $Na_2S_2O_3$

**Sodium Nitrite**
See SODIUM NITRITE plus Sodium Thiosulfate.

## STAINLESS STEEL (302)

**Fluorine**
See FLUORINE plus Metals.

## STANNIC BROMIDE $SnBr_4$

**Nitryl Chloride**
See NITRYL CHLORIDE plus Stannic Bromide.

## STANNIC CHLORIDE $SnCl_4$

**Potassium**
See POTASSIUM plus Aluminum Bromide.

**Sodium**
See SODIUM plus Aluminum Bromide.

**Turpentine**
Stannic chloride reacts with turpentine, producing heat and sometimes flame.
*Mellor* **7:** 430–46 (1946–1947).

## STANNIC IODIDE $SnI_4$

**Nitryl Chloride**
See NITRYL CHLORIDE plus Stannic Bromide.

**Potassium and Sulfur**
See POTASSIUM plus Aluminum Bromide.

**Sodium and Sulfur**
See SODIUM plus Aluminum Bromide.

## STANNIC OXIDE $SnO_2$

**Chlorine Trifluoride**
See CHLORINE TRIFLUORIDE plus Arsenic Trioxide.

**Hydrogen Trisulfide**
See HYDROGEN TRISULFIDE plus Stannic Oxide.

**Magnesium**
See MAGNESIUM plus Stannic Oxide.

**Potassium**
See POTASSIUM plus Stannic Oxide.

**Sodium**
See POTASSIUM plus Stannic Oxide.

## STANNIC SULFIDE $SnS_2$

**Cadmium Chlorate**
Tin sulfides react with incandescence with chlorates of cadmium, magnesium, or zinc.
*Mellor* **Supp. II, Part I:** 584 (1956).

**Chloric Acid**
Tin sulfides and concentrated solutions of chloric acid react with incandescence.
*Mellor* **Supp. II, Part I:** 584 (1956).

**Chlorine Monoxide**
See CHLORINE MONOXIDE plus Calcium Phosphide.

**Magnesium Chlorate**
See STANNIC SULFIDE plus Cadmium Chlorate.

**Zinc Chlorate**
See STANNIC SULFIDE plus Cadmium Chlorate.

## STANNOUS CHLORIDE $SnCl_2$

**Bromine Trifluoride**
See BROMINE TRIFLUORIDE plus Stannous Chloride.



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**Calcium Carbide**
A mixture of stannous chloride and calcium carbide can be ignited with a match, and the reaction proceeds with incandescence.
*Mellor* **7:** 430 (1946–1947).

**Ethylene Oxide**
See ETHYLENE OXIDE plus Aluminum Oxide. See ETHYLENE OXIDE plus Acids and Bases.

**Hydrazine Hydrate**
Hydrazine hydrate reacts with stannous chloride to give a compound, stannous dihydrazinechloride. When this compound is heated, it decomposes explosively.
*Mellor* **7:** 430 (1946–1947).

**Nitrates**
See NITRATES plus Stannous Chloride.

**Potassium**
See POTASSIUM plus Aluminum Bromide.

**Sodium**
See SODIUM plus Aluminum Bromide.

## STANNOUS FLUORIDE $SnFl_2$

**Chlorine**
See CHLORINE plus Stannous Fluoride.

## STANNOUS NITRATE $Sn(NO_3)_2$

**Organic Matter (flour)**
In a flour-bleaching plant, dust found to contain tin nitrate was believed responsible for a violent decomposition explosion.
*J. Soc. Chem. Ind.* **41:** 423-24R (1922).

## STANNOUS OXIDE SnO

**Sulfur Dioxide**
When stannous oxide is heated in an atmosphere of sulfur dioxide, the reaction is attended by incandescence.
*Mellor* **7:** 388 (1946–1947). Hammick, J.
*Chem. Soc.* **III:** 379 (1917).

## STANNOUS SULFIDE SnS

**Cadmium Chlorate**
Tin sulfides react with incandescence with chlorates of cadmium, magnesium, or zinc.
*Mellor* **Supp. II, Part I:** 584 (1956).

**Chloric Acid**
Tin sulfides and concentrated solutions of chloric acid react with incandescence.
*Mellor* **Supp. II, Part I:** 584 (1956).

**Chlorine Monoxide**
See CHLORINE MONOXIDE plus Calcium Phosphide.

**Magnesium Chlorate**
See STANNOUS SULFIDE plus Cadmium Chlorate.

**Zinc Chlorate**
See STANNOUS SULFIDE plus Cadmium Chlorate.

## STEEL

**Perchloric Acid**
See PERCHLORIC ACID plus Steel.

**Sulfuric Acid**
See IRON plus Sulfuric Acid.

## STIBINE $SbH_3$

**Ammonia**
An explosion occurs if stibine is heated with ammonia or chlorine.
*Mellor* **9:** 397 (1946–1947).

**Chlorine**
See STIBINE plus Ammonia.

**Nitric Acid**
Stibine and concentrated nitric acid explode.
*Mellor* **9:** 397 (1946–1947).

**Ozone**
See OZONE plus Stibine.

## STRONTIUM ALLOYS

**Acids**
Alloys containing a substantial proportion of strontium react violently with acids.
*Lab. Govt. Chemist* (1965).

**Water**
Alloys containing a substantial proportion of strontium rapidly decompose water. The heat of reaction is sufficient that the evolved hydrogen may ignite.
*Lab. Govt. Chemist* (1965).

## STRONTIUM CARBIDE $SrC_2$

**Selenium**
See SULFUR plus Strontium Carbide.

**Sulfur**
See SULFUR plus Strontium Carbide.

## STRONTIUM CHLORATE $Sr(ClO_3)_2$

**Acids**
See CHLORATES plus Acids. See SODIUM CHLORATE plus Sulfuric Acid.

## STRONTIUM CHLORIDE $SrCl_2$

**2-Furan Percarboxylic Acid**
See 2-FURAN PERCARBOXYLIC ACID (self-reactive).

## STRONTIUM HYDRIDE $SrH_2$

**Bromates**
See BROMATES plus Strontium Hydride.

**Chlorates**
See BROMATES plus Strontium Hydride.

**Perchlorates**
See BROMATES plus Strontium Hydride.

## STRONTIUM IODIDE $SrI_2$

**Potassium**
See POTASSIUM plus Ammonium Bromide.

## STRONTIUM PHOSPHIDE $Sr_3P_2$

**Bromine**
See BROMINE plus Strontium Phosphide.

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**Chlorine**
See CHLORINE plus Strontium Phosphide.

**Fluorine**
See FLUORINE plus Strontium Phosphide.

## STYRENE MONOMER $CH_2=CHC_6H_5$

**Chlorosulfonic Acid**
Mixing styrene monomer and chlorosulfonic acid in a closed container caused the temperature and pressure to increase.
*Flynn and Rossow* (1970). See Note under complete reference.

**Oleum**
See OLEUM plus Styrene Monomer.

**Sulfuric Acid**
Mixing styrene monomer and 96% sulfuric acid in a closed container caused the temperature and pressure to increase.
*Flynn and Rossow* (1970). See Note under complete reference.

## SULFAMIC ACID $HSO_3NH_2$

**Chlorine**
See CHLORINE plus Sulfamic Acid.

**Nitric Acid**
Fuming nitric acid combined with sulfamic acid causes violent release of nitrous oxide.
*Mellor* **8, Supp. 2:** 316 (1967).

## SULFATES

**(See also specific sulfates as primary entries or under other reactants)**

**Aluminum**
See ALUMINUM plus Sulfates.

**Magnesium**
See MAGNESIUM plus Sulfates.

## SULFOLANE $O_2SCH_2CH_2CH_2CH_2$

**Chrosoulfonic Acid**
Mixing sulfolane and chlorosulfonic acid in a closed container caused the temperature and pressure to increase.
*Flynn and Rossow* (1970). See Note under complete reference.

**Oleum**
See OLEUM plus Sulfolane.

## SULFOXIDES

**Perchloric Acid**
The dialkyl sulfoxides form salts with perchloric acid. The lower members of the series are unstable, hydrolyze readily, and are explosive when dry.
*Chem. Abst.* **44:** p. 3935d (1950).

## SULFUR S

**Aluminum**
See ALUMINUM plus Nitrates.

**Aluminum and Niobium Oxide**
See ALUMINUM plus Niobium Oxide and Sulfur.

**Ammonia**
The reaction of ammonia with specially prepared sulfur may form explosive sulfur nitride.
*Mellor* **8, Supp. 1:** 330 (1964).

**Ammonium Nitrate**
Ammonium nitrate mixed with sulfur or with metal powders can be exploded by shock.
*Kirk and Othmer* **8:** 644. *Federoff* **1:** A-146.

**Ammonium Perchlorate**
Mixtures of ammonium perchlorate with sulfur, powdered metals, or carbonaceous materials are impact-sensitive.
*Haz. Chem. Data* (1966).

**Barium Bromate**
See SULFUR plus Bromates.

**Barium Carbide**
A mixture of barium carbide and sulfur heated to 150°C. becomes incandescent.
*Mellor* **5:** 862 (1946–1947).

**Barium Chlorate**
See SULFUR plus Bromates. See SULFUR plus Chlorates.
A mixture of sulfur and barium chlorate ignites at about 108°–111°C.
*Mellor* **2, Supp. 1:** 583 (1956).

**Barium Iodate**
See SULFUR plus Bromates.

**Boron**
See BORON plus Sulfur.

**Bromates**
A combination of finely divided sulfur and finely divided bromates (also chlorates or iodates) of barium, calcium, magnesium, potassium, sodium, or zinc will explode with heat, percussion, and sometimes, light friction.
*Mellor* **2:** 310 (1946–1947).
*Mellor* **2, Supp. 1:** 763 (1956).

**Bromine Pentafluoride**
See ARSENIC plus Bromine Pentafluoride.

**Bromine Trifluoride**
See ANTIMONY plus Bromine Trifluoride.

**Calcium**
See CALCIUM plus Sulfur.

**Calcium, Vanadium Oxide and Water**
See CALCIUM plus Vanadium Oxide, Sulfur, and Water.

**Calcium Bromate**
See SULFUR plus Bromates.

**Calcium Carbide**
Calcium carbide reacts incandescently with sulfur vapor at 500°C.
*Mellor* **5:** 862 (1946–1947).

**Calcium Chlorate**
See SULFUR plus Bromates. See SULFUR plus Chlorates.

**Calcium Hypochlorite**
A mixture of damp sulfur and calcium hypochlorite produced a brilliant crimson flash with scattering of molten sulfur. No heat is necessary. Equal parts of sulfur and



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bleach powder produced an explosion when heated in a closed vessel.
*Halane — Prelim. Info. Sheet. Mellor* **2:** 254–62 (1946–1947). *Chem. and Eng. News* **46**(28):9 (1968).

**Calcium Iodate**
See SULFUR plus Bromates.

**Calcium Phosphide**
Calcium phosphide reacts with sulfur or oxygen incandescently at about 300°C.
*Mellor* **8:** 841 (1946–1947).

**Carbon**
When the metal head of a hammer struck against the inner coating material of a brick tank consisting of a carbonaceous matrix loaded with 66% sulfur (absorbed from sulfuric acid), ignition occurred producing blue flames.

**Cesium Nitride**
See CESIUM NITRIDE plus Air.

**Charcoal**
Powdered sulfur is spontaneously flammable when mixed with lampblack or freshly calcined charcoal.
*Von Schwartz,* p. 328 (1918).

**Chlorates**
A mixture of sulfur and barium chlorate, calcium chlorate, magnesium chlorate, potassium chlorate, sodium chlorate, or zinc chlorate may liberate oxygen and heat explosively.
*Chem. and Eng. News* **30:** 3210 (1952). *Von Schwartz,* p. 323 (1918).
A mixture of chlorates and sulfur will explode.
*Von Schwartz,* p. 328 (1918). *Ellern,* p. 47 (1968).
See also SULFUR plus Bromates.

**Chlorates and Copper**
The sulfur-plus-chlorate explosion is remarkably spontaneous in the presence of copper ion or copper, e.g., in the form of bronze screen, even at room temperature.
*Ellern,* p. 304 (1968).

**Chlorine Dioxide**
A piece of sulfur or sugar takes fire spontaneously in chlorine dioxide and may produce an explosion.
*Mellor* **2:** 289 (1946–1947).

**Chlorine Monoxide**
See POTASSIUM plus Chlorine Monoxide.

**Chlorine Trifluoride**
See ANTIMONY plus Chlorine Trifluoride.

**Chromic Anhydride**
Sulfur and chromic anhydride ignite when heated and can explode.
*Mellor* **10:** 102, 132–34; **11:** 232 (1946–1947).

**Chromium Trioxide**
See SULFUR plus Chromic Anhydride.

**Chromyl Chloride**
Flowers-of-sulfur moistened with chromyl chloride ignites spontaneously.
*Mellor* **11:** 394–96 (1946–1947).

**Fluorine**
See FLUORINE plus Selenium.

**Hydrocarbons**
Even small percentages of hydrocarbons in contact with molten sulfur generate hydrogen sulfide and carbon disulfide, which may accumulate in explosive concentrations.
*NAS-USCG Advis. Com.* (1966).
*BM Report Invest.* **6185** (1963).

**Indium**
See INDIUM plus Sulfur.

**Iodates**
See SULFUR plus Bromates.

**Iodine Pentafluoride**
See ARSENIC plus Iodine Pentafluoride.

**Iodine Pentoxide**
See CARBON plus Iodine Pentoxide.

**Lead Chlorate**
A mixture of sulfur and lead chlorate ignites at about 63°–67°C.
*Mellor* **2, Supp. 1:** 583 (1956).
See also SULFUR plus Chlorates.

**Lead Chlorite**
A mixture of sulfur and lead chlorite will explode.
*Von Schwartz,* p. 328 (1918).

**Lead Dioxide**
A mixture of sulfur and lead dioxide will explode.
*Von Schwartz,* p. 328 (1918).

**Lithium**
See LITHIUM plus Sulfur.

**Lithium Carbide**
Lithium carbide burns in the vapor of sulfur or selenium.
*Mellor* **5:** 848 (1946–1947).

**Magnesium Bromate**
See SULFUR plus Bromates.

**Magnesium Chlorate**
See SULFUR plus Bromates.

**Magnesium Iodate**
See SULFUR plus Bromates.

**Mercuric Nitrate**
An explosion occurred in the use of mercuric nitrate for determining sulfur in Ball's reaction.
*Chem. and Eng. News* **26:** 3300 (1948).

**Mercuric Oxide**
When mercuric oxide is heated with sulfur in a retort, a violent explosion results.
*Mellor* **4:** 777 (1946–1947).

**Mercurous Oxide**
Mixture of the pulverized materials will ignite from light impact.
J. B. Senderens, *Bull. Soc. Chim.* (3) **6:** 802 (1891).

**Nickel**
Powdered nickel heated with sulfur or selenium reacts with incandescence.
*Mellor* **15:** 148,151 (1946–1947).

**Nitrogen Dioxide**
See MAGNESIUM plus Nitrogen Dioxide.

**Palladium**
See PALLADIUM plus Sulfur.

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**Perchlorates**
All inorganic perchlorates can form mixtures with sulfur that will explode on impact.
*ACS* **146:** 211–12. *BM Report Invest.* ***4169*** (1948).

**Phosphorus**
See PHOSPHORUS plus Sulfur.

**Phosphorus Trioxide**
The reaction is violent; small quantities should be used to avoid an explosion.
*Chem. and Eng. News* **27:** 2144 (1949).
*Mellor* **8, Supp. 3:** 436 (1971).

**Potassium**
See POTASSIUM plus Aluminum Bromide.
See POTASSIUM plus Sulfur.

**Potassium Bromate**
See SULFUR plus Bromates.

**Potassium Chlorate**
See SULFUR plus Bromates.
A mixture of sulfur and potassium chlorate ignites at about 160°–162°C.
*Mellor* **2, Supp. 1:** 583 (1956).
See also SULFUR plus Chlorates.

**Potassium Iodate**
See SULFUR plus Bromates.

**Potassium Nitrate and Arsenic Trisulfide**
A mixture of these ingredients is a known pyrotechnic formulation.
*Ellern,* p. 135 (1968).

**Potassium Nitride**
See PHOSPHORUS plus Potassium Nitride.

**Potassium Perchlorate**
This mixture, used in flashcrackers, can be exploded by a moderately strong impact.
*ACS* **146:** 211. *Davis. BM Report Invest.* **4169** (1948).

**Potassium Permanganate**
When powdered sulfur is heated with potassium permanganate, an explosion may occur.
*Mellor* **12:** 319 (1946–1947).

**Rubidium Acetylene Carbide**
See RUBIDIUM ACETYLENE CARBIDE plus Hydrochloric Acid.
See PHOSPHORUS plus Rubidium Acetylene Carbide.

**Selenium Carbide**
See SULFUR plus Thorium Carbide.

**Silver Bromate**
An explosive reaction occurs in the presence of water.
*Mellor* **2, Supp. 1:** 766 (1956).

**Silver Chlorate**
A mixture of sulfur and silver chlorate ignites at about 74°C.
*Mellor* **2, Supp. 1:** 583 (1956).
See also SULFUR plus Chlorates.

**Silver Nitrate**
A mixture of silver nitrate and sulfur explodes when struck with a hammer.
*Mellor* **3:** 469 (1946–1947).

**Silver Oxide**
When finely divided sulfur is ground with silver oxide, the mixture ignites.
*Mellor* **3:** 376 (1946–1947).

**Sodium**
See SODIUM plus Sulfur.

**Sodium Bromate**
See SULFUR plus Bromates.

**Sodium Chlorate**
See SULFUR plus Bromates.

**Sodium Chlorite**
Solid sulfur will ignite if mixed with solid sodium chlorite and moistened.
*Mellor* **2, Supp. 1:** 572 (1956).

**Sodium Hydride**
Sodium hydride reacts vigorously with sulfur vapor.
*Mellor* **2:** 483 (1946–1947).

**Sodium Iodate**
See SULFUR plus Bromates.

**Sodium Nitrate and Charcoal**
The familiar black powder explosion begins with the reaction, sulfur-plus-sodium-nitrate, which produces the energy to initiate the carbon-plus-sodium-nitrate explosion.
*Trans. Faraday Soc.* **55** (12):2221–8 (1959).

**Sodium and Stannic Iodide**
See SODIUM plus Aluminum Bromide.

**Strontium Carbide**
Strontium carbide mixed with selenium and heated to 500°C., or exposed to sulfur vapor at 500°C., becomes incandescent.
*Mellor* **5:** 852 (1946–1947).

**Sulfur Dichloride**
See SODIUM plus Cobaltous Bromide.

**Thallic Oxide**
See THALLIC OXIDE plus Antimony Sulfide.

**Thorium**
Thorium when heated with sulfur reacts vigorously with incandescence.
*Mellor* **7:** 208 (1946–1947).

**Thorium Carbide**
Sulfur vapor attacks heated thorium carbide or selenium carbide with incandescence.
*Mellor* **5:** 885–87 (1946–1947).

**Tin**
The reaction between tin and sulfur is vigorous and accompanied by incandescence.
*Mellor* **7:** 328 (1946–1947).

**Uranium**
See URANIUM plus Selenium.

**Zinc**
Powdered zinc and sulfur react explosively when warmed.
*Mellor* **4:** 476 (1946–1947).

**Zinc Bromate**
See SULFUR plus Bromates.



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**Zinc Chlorate**
See SULFUR plus Bromates.

**Zinc Iodate**
See SULFUR plus Bromates.

## SULFUR DIBROMIDE $SBr_9$

**Potassium**
See POTASSIUM plus Aluminum Bromide.

**Sodium**
See SODIUM plus Aluminum Bromide.

## SULFUR DICHLORIDE $SCl_2$

**Aluminum**
See ALUMINUM plus Carbon Disulfide.

**Ammonia**
The reaction product of sulfur dichloride and ammonia is a powerful detonating compound, sulfur nitride.
*Mellor* **8:** 624 (1946–1947).

**Potassium**
See POTASSIUM plus Boron Tribromide.

**Sodium**
See SODIUM plus Cobaltous Bromide.
See SODIUM plus Sulfur Dichloride.

## SULFUR DIOXIDE $SO_2$

**Acrolein**
See ACROLEIN plus Sulfur Dioxide.

**Aluminum**
See ALUMINUM plus Carbon Disulfide.

**Cesium Acetylene Carbide**
See CESIUM ACETYLENE CARBIDE plus Sulfur Dioxide.

**Cesium Monoxide**
See CESIUM MONOXIDE plus Sulfur Dioxide.

**Chlorates**
See CHLORATES plus Sulfur Dioxide.

**Chlorine Trifluoride**
See CHLORINE TRIFLUORIDE plus Ammonia.

**Chromium**
See CHROMIUM plus Sulfur Dioxide.

**Ferrous Oxide**
See FERROUS OXIDE plus Sulfur Dioxide.

**Fluorine**
See FLUORINE plus Sulfur Dioxide.

**Lithium Acetylene Carbide Diammino**
See LITHIUM ACETYLENE CARBIDE DIAMMINO plus Carbon Dioxide.

**Manganese**
See MANGANESE plus Sulfur Dioxide.

**Potassium Acetylene Carbide**
See POTASSIUM ACETYLENE CARBIDE plus Sulfur Dioxide.

**Potassium Chlorate**
See POTASSIUM CHLORATE plus Sulfur Dioxide.

**Rubidium Carbide**
See RUBIDIUM CARBIDE plus Sulfur Dioxide.

**Sodium**
See SODIUM plus Sulfur Dioxide.

**Sodium Carbide**
See SODIUM CARBIDE plus Carbon Dioxide.

**Stannous Oxide**
See STANNOUS OXIDE plus Sulfur Dioxide.

## SULFUR HEXAFLUORIDE $SF_6$

**Disilane**
See DISILANE plus Sulfur Hexafluoride.

## SULFURIC ACID $H_2SO_4$

**Acetic Anhydride**
See ACETIC ANHYDRIDE plus Sulfuric Acid.

**Acetone Cyanhydrin**
See ACETONE CYANHYDRIN plus Sulfuric Acid.

**Acetone and Nitric Acid**
See NITRIC ACID plus Acetone and Sulfuric Acid.

**Acetone and Potassium Dichromate**
See ACETONE plus Sulfuric Acid and Potassium Dichromate.

**Acetonitrile**
See ACETONITRILE plus Sulfuric Acid.

**Acrolein**
See ACROLEIN plus Sulfuric Acid.

**Acrylonitrile**
See ACRYLONITRILE plus Sulfuric Acid.

**Acrylonitrile and Water**
See ACRYLONITRILE plus Sulfuric Acid and Water.

**Alcohols and Hydrogen Peroxide**
See ALCOHOLS plus Hydrogen Peroxide and Sulfuric Acid.

**Allyl Alcohol**
See ALLYL ALCOHOL plus Sulfuric Acid.

**Allyl Chloride**
See ALLYL CHLORIDE plus Sulfuric Acid.
Allylchloride may polymerize violently under conditions involving an acid catalyst, such as sulfuric acid, ferric chloride, aluminum chloride, Lewis acids, and Ziegler type catalysts (initiators).
*Ventrone* (1971).

**2-Aminoethanol**
See 2-AMINOETHANOL plus Sulfuric Acid.

**Ammonium Hydroxide**
Mixing 96% sulfuric acid and 28% ammonia in a closed container caused the temperature and pressure to increase.
*Flynn and Rossow* (1970). See Note under complete reference.

**Ammonium Triperchromate**
See AMMONIUM TRIPERCHROMATE plus Sulfuric Acid.

**Aniline**
See ANILINE plus Sulfuric Acid.

**Bromates and Metals**
See CHLORATES plus Acids and Metals.


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**Bromine Pentafluoride**
See BROMINE PENTAFLUORIDE plus Nitric Acid.

**n-Butyraldehyde**
See n-BUTYRALDEHYDE plus Sulfuric Acid.

**Carbides**
Sulfuric acid (concentrated) is extremely hazardous in contact with carbides, chlorates, fulminates, picrates and powdered metals.
*Chem. Safety Data Sheet* **SD-20** (1963).
*Haz. Chem. Data* (1966).

**Cesium Acetylene Carbide**
See CESIUM ACETYLENE CARBIDE plus Sulfuric Acid.

**Chlorates**
See SULFURIC ACID plus Carbides.
See CHLORATES plus Acids.
See CHLORATES plus Sulfuric Acid.

**Chlorates and Metals**
See CHLORATES plus Acids and Metals.

**Chlorine Trifluoride**
See CHLORINE TRIFLUORIDE plus Nitric Acid.

**Chlorosulfonic Acid**
See CHLOROSULFURIC ACID plus Sulfuric Acid.

**Cuprous Nitride**
See CUPROUS NITRIDE plus Sulfuric Acid.

**Diisobutylene**
See DIISOBUTYLENE plus Sulfuric Acid.

**Dimethylbenzylcarbinol and Hydrogen Peroxide**
See ALCOHOLS plus Hydrogen Peroxide and Sulfuric Acid.

**Epichlorohydrin**
See ETHYLENE CYANOHYDRIN plus Sulfuric Acid.
See EPICHLOROHYDRIN plus Sulfuric Acid.

**Ethyl Alcohol and Hydrogen Peroxide**
See ALCOHOLS plus Hydrogen Peroxide and Sulfuric Acid.

**Ethylene Cyanohydrin**
See ETHYLENE CYANOHYDRIN plus Sulfuric Acid.

**Ethylene Diamine**
See ETHYLENE DIAMINE plus Sulfuric Acid.

**Ethylene Glycol**
See ETHYLENE GLYCOL plus Sulfuric Acid.

**Ethylenimine**
See ETHYLENIMINE plus Sulfuric Acid.

**Fulminates**
See SULFURIC ACID plus Carbides.

**Hydrochloric Acid**
See HYDROCHLORIC ACID plus Sulfuric Acid.

**Hydrochloric Acid and Nitric Acid**
An exothermic reaction occurred when 98% sulfuric acid was added to a mixture of hydrochloric acid and nitric acid. After the container was sealed, it was agitated causing the mixture to effervesce and increase pressure until the container ruptured.

**Hydrofluoric Acid**
See HYDROFLUORIC ACID plus Sulfuric Acid.

**Hydrogen Peroxide**
See HYDROGEN PEROXIDE plus Sulfuric Acid.

**Iodine Heptafluoride**
See IODINE HEPTAFLUORIDE plus Sulfuric Acid.

**Indane and Nitric Acid**
See INDANE plus Nitric Acid and Sulfuric Acid.

**Iron**
See IRON plus Sulfuric Acid.

**Isoprene**
See ISOPRENE plus Sulfuric Acid.

**Lithium Silicide**
See LITHIUM SILICIDE plus Sulfuric Acid.

**Mercuric Nitride**
See MERCURIC NITRIDE plus Sulfuric Acid.

**Mesityl Oxide**
See MESITYL OXIDE plus Sulfuric Acid.

**Metals (Powdered)**
See SULFURIC ACID plus Carbides.

**Nitric Acid and Glycerides**
See NITRIC ACID plus Sulfuric Acid and Glycerides.

**p-Nitrotoluene**
See p-NITROTOLUENE plus Sulfuric Acid.

**Pentasilver Trihydroxy- diaminophosphate**
See PENTASILVER TRIHYDROXYDIAMINOPHOSPHATE plus Sulfuric Acid.

**Perchlorates**
See PERCHLORATES plus Sulfuric Acid.

**Perchloric Acid**
See PERCHLORIC ACID plus Sulfuric Acid.

**Permanganates and Benzene**
See PERMANGANATES plus Sulfuric Acid and Benzene.

**1-Phenyl-2-methyl-propyl Alcohol and Hydrogen Peroxide**
See ALCOHOLS plus Hydrogen Peroxide and Sulfuric Acid.

**Phosphorus**
See PHOSPHORUS plus Sulfuric Acid.

**Phosphorus Isocyanate**
See PHOSPHORUS ISOCYANATE plus Acetaldehyde.

**Picrates**
See SULFURIC ACID plus Carbides.

**Potassium Tert.-Butoxide**
See ACETONE plus Potassium Tert.-Butoxide.

**Potassium Chlorate**
See POTASSIUM CHLORATE plus Sulfuric Acid.

**Potassium Permanganate**
See POTASSIUM PERMANGANATE plus Sulfuric Acid.

**Potassium Permanganate and Potassium Chloride**
See POTASSIUM PERMANGANATE plus Sulfuric Acid and Potassium Chloride.

**Potassium Permanganate and Water**
See POTASSIUM PERMANGANATE plus Sulfuric Acid and Water.

**Propiolactone (BETA-)**
See PROPIOLACTONE (BETA-) plus Sulfuric Acid.



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**Propylene Oxide**
See PROPYLENE OXIDE plus Sulfuric Acid.

**Pyridine**
See PYRIDINE plus Sulfuric Acid.

**Rubidium Acetylene Carbide**
See RUBIDIUM ACETYLENE CARBIDE plus Sulfuric Acid.

**Silver Permanganate**
See SILVER PERMANGANATE plus Sulfuric Acid.

**Sodium**
See SODIUM plus Sulfuric Acid.

**Sodium Carbonate**
See SODIUM CARBONATE plus Sulfuric Acid.

**Sodium Chlorate**
See SODIUM CHLORATE plus Sulfuric Acid.
See CHLORATES plus Acids.

**Sodium Hydroxide**
See SODIUM HYDROXIDE plus Sulfuric Acid.

**Steel**
See IRON plus Sulfuric Acid.

**Styrene Monomer**
See STYRENE MONOMER plus Sulfuric Acid.

**Toluene and Nitric Acid**
See NITRIC ACID plus Toluene and Sulfuric Acid.

**Vinyl Acetate**
See VINYL ACETATE plus Sulfuric Acid.

**Water**
During sulfonation of mononitrobenzene by *fuming* sulfuric acid, a leak from an internal cooling coil permitted water to enter the tank. A violent eruption occurred due to the heat of solution.
*MCA Case History* **944** (1963).

**Zinc Chlorate**
See ZINC CHLORATE plus Sulfuric Acid.
See CHLORATES plus Acids.

## SULFUR MONOCHLORIDE $S_2Cl_2$

**Chromyl Chloride**
See CHROMYL CHLORIDE plus Sulfur Monochloride.

**Organic Matter**
Sulfur chloride is strongly corrosive and can set fire to organic materials.
B. L. Huestis, *Safety Eng.* **54:** 95 (1927).

**Phosphorus Trioxide**
See PHOSPHORUS TRIOXIDE plus Sulfur Monochloride.

**Sodium Peroxide**
See SODIUM PEROXIDE plus Sulfur Monochloride.

**Water**
The mixing of sulfur chloride and water can be dangerous.
*Chem. Safety Data Sheet* **SD-77** (1960).

## SULFUR NITRIDE $S_4N_4$

**(self-reactive)**
Sulfur nitride detonates violently on impact.
*Mellor* **8:** 624 (1946–1947).

**Air**
Disulfur dinitride explodes when above 30°C in air.
*Brauer* (1965).

**Barium Chlorate**
Nitrogen sulfide and barium chlorate form very explosive crystals.
*Berichte* **38:** 2659.

## SULFUR TRIOXIDE $SO_3$

**Dioxygen Difluoride**
See DIOXYGEN DIFLUORIDE plus Sulfur Trioxide.

**Lead Oxide**
See LEAD OXIDE plus Sulfur Trioxide.

**Nitryl Chloride**
See NITRYL CHLORIDE plus Sulfur Trioxide.

**Perchloric Acid**
See PERCHLORIC ACID plus Sulfur Trioxide.

**Phosphorus**
See PHOSPHORUS plus Sulfur Trioxide.

**Tetrafluorethylene**
The reaction of sulfur trioxide in excess with tetrafluoroethylene causes explosive decomposition to carbonyl fluoride and sulfur dioxide.
*Chem. and Eng. News* **49** (22): 3 (1971).

## SULFURYL CHLORIDE $SO_2Cl_2$

**(See also THIONYL CHLORIDE)**

**Lead Dioxide**
Reaction between sulfuryl chloride and lead dioxide can take place with explosive violence.
*Mellor* **10:** 676 (1946–1947).

## TANTALUM Ta

**Air**
Tantalum, thorium, titanium, and zirconium (powdered and dry) ignited when a glass container of the powder was thrown at a wall with force sufficient to break the container.
*Chem. and Eng. News* **30:** 3210 (1952).

**Bromine Trifluoride**
See NIOBIUM plus Bromine Trifluoride.

**Fluorine**
See FLUORINE plus Tantalum.

## TANTALUM PENTACHLORIDE

Reaction between tantalum pentachloride with Lithium dimethyl amido ($LiN(Me)_2$) in pentane caused two separate explosions during the preparation of pentakis-dimethylamido tantalum.
*Chem. and Eng. News,* p. 2 (July 30, 1990).

## TANTALUM PENTOXIDE $Ta_2O_5$

**Bromine Trifluoride**
See BROMINE TRIFLUORIDE plus Bismuth Pentoxide.


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**Chlorine Trifluoride**
See CHLORINE TRIFLUORIDE plus Aluminum Oxide.

**Lithium**
See LITHIUM plus Tantalum Pentoxide.

**TARTARIC ACID** HOOC.CHOHCHOHCO.OH

**Silver**
See SILVER plus Oxalic Acid.

**TEFLON® (POLYTETRAFLUOROETHYLENE)** $(CF_2=CF_2)_x$

**Fluorine**
See FLUORINE plus Solid Nonmetals and Oxygen.

**Oxygen**
See OXYGEN plus Teflon®

**Sodium-Potassium Alloy**
See SODIUM-POTASSIUM ALLOY plus Teflon®

**TELLURIUM** Te

**Cadmium**
See ZINC plus Selenium.

**Chlorine**
See CHLORINE plus Tellurium.

**Chlorine Fluoride**
Tellurium is attacked by chlorine fluoride with incandescence.
*Mellor* **11:** 26 (1946–1947).

**Chlorine Trifluoride**
See ANTIMONY plus Chlorine Trifluoride.

**Fluorine**
See FLUORINE plus Tellurium.

**Lithium Silicide**
See PHOSPHORUS plus Lithium Silicide.

**Potassium**
When tellurium and potassium are warmed in an atmosphere of hydrogen, combination occurs with incandescence.
*Mellor* **11:** 40 (1946–1947).

**Silver Bromate**
A vigorous reaction occurs in the presence of moisture.
*Mellor* **2, Supp. 1:** 766 (1956).

**Sodium**
See SODIUM plus Tellurium.

**Zinc**
See ZINC plus Selenium.

**TELLURIUM TETRACHLORIDE HYDROCHLORIDE** $TeCl_4 \cdot HCl$

**Ammonia**
Tellurium hydropentachloride reacts with ammonia to produce a substance which detonates when heated, possibly nitrogen telluride.
*Mellor* **11:** 101 (1946–1947).

**TERBIUM** Tb

**Air**
See RARE EARTH METALS plus Air.

**Halogens**
See RARE EARTH METALS plus Halogens.

**TERPENES**

**Nitric Acid**
See NITRIC ACID plus Diborane.

**TETRABORANE (6)** $B_4H_6$

**Nitric Acid**
The mixture of tetraboron decahydride and nitric acid is explosive.
*Mellor* **5:** 36 (1946–1947).

**TETRABORANE (10)** $B_4H_{10}$

**Air**
See OXYGEN plus Boron Decahydride. This hydride ignites or explodes on exposure to air.
*Mellor* **5:** 36 (1946–1947).

**Nitric Acid**
A mixture of boron decahydride and concentrated nitric acid explodes.
*Mellor* **5:** 36 (1946–1947).

**Oxygen**
See OXYGEN plus Boron Decahydride.

**TETRABROMOETHANE**

**Lithium**
Mixtures of lithium shavings and several halocarbon derivatives (including carbon tetrabromide) are impact sensitive and will explode, sometimes violently.
*Bretherick* (1978).

**Hexacyclohexyldilead**
In the absence of solvent and presence of air, interaction with carbon tetrabromide is explosive.
*Bretherick* (1978).

**TETRACHLOROBENZENE** $Cl_4C_6H_2$

**Sodium Hydroxide and Methyl Alcohol**
See SODIUM HYDROXIDE plus Tetrachlorobenzene and Methyl Alcohol.

**TETRACHLORODIBORANE** $B_2Cl_4$

**Air**
Diboron tetrachloride is spontaneously flammable in air.
*Douda* (1966). *Chem. Abst.* **49:** 2240d (1955).

**TETRACHLOROETHANE (sym-)** $Cl_2CHCHCl_2$

**2, 4-Dinitrophenyl Disulfide**
See 2, 4-DINITROBENZENE SULFENYLCHLORIDE (self-reactive).

**Nitrogen Tetroxide**
See NITROGEN TETROXIDE plus 1,2-Dichloroethane.

**Potassium**
See SODIUM plus Tetrachloroethane.

**Potassium Hydroxide**
See POTASSIUM HYDROXIDE plus Tetrachloroethane.

**Sodium**
See SODIUM plus Tetrachloroethane.

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**Sodium-Potassium Alloy**
See SODIUM-POTASSIUM ALLOY plus Bromoform.

**TETRACHLOROETHYLENE** $CCl_2=CCl_2$

**Barium**
See BARIUM plus Trichlorotrifluoroethane.

**Beryllium**
See BERYLLIUM plus Carbon Tetrachloride.

**Lithium**
See LITHIUM plus Trichlorotrifluoroethane.

**TETRAFLUOROETHYLENE** $CF_2=CF_2$

**Iodine Pentafluoride and Limonene**
See IODINE PENTAFLUORIDE plus Tetrafluoroethylene and Limonene.

**Sulfur Trioxide**
See SULFUR TRIOXIDE plus Tetrafluoroethylene.

**TETRAFLUOROETHYLENE POLYMER**

**Fluorine**
See FLUORINE plus Solid Metals and Oxygen.

**TETRAFLUOROHYDRAZINE** $F_2NNF_2$

**Nitrogen Trifluoride**
See NITROGEN TRIFLUORIDE plus Tetrafluorohydrazine.

**Oxygen**
See OXYGEN plus Tetrafluorohydrazine.

**TETRAFLUOROMETHANE** $CF_4$

**Aluminum**
See ALUMINUM plus Dichlorodifluoromethane.

**1,2,3,4-TETRAHYDROCARBAZOLE** ($C_6H_4NHC_6H_8$)

**Acrylonitrile**
The reaction of 1,2,3,4-tetrahydrocarbazole with acrylonitrile, initiated by benzyl-tremethyl-ammonium hydroxide, is described in *J. Am. Chem. Soc.* **72:** 4313 (1960). For a run, eight times the literature scale of the initiator was added at 0°C, the ice bath removed, the reaction flask placed on the steam bath and the steam turned on. After 30–60 seconds an explosion shattered the apparatus.
*BCISC* **39** (156): 36 (1968). *Wischmeyer* (1970).
*NSC Newsletter, R & D Sec.* (Feb. 1970).

**TETRAHYDROFURAN** $OCH_2CH_2CH_2CH_2$

**Air**
Purified tetrahydrofuran should not be stored for more than a few months after its container has been opened if it contains no oxidation inhibitor. In this case, it is potentially explosive because of peroxide formation.
*NSC Newsletter, Chem. Sec.* (Nov. 1964).

**Lithium Aluminum Hydride**
Fire can occur when tetrahydrofuran is used as a solvent for lithium aluminum hydride. Peroxides of tetrahydrofuran or their reaction products probably caused a vigorous reaction with lithium aluminum hydride, and subsequent fire.
*MCA Guide for Safety,* Appendix 3 (1972).

**Potassium Hydroxide**
Using potassium hydroxide to dry impure tetrahydrofuran, which can contain peroxides, is hazardous. Serious explosions can occur. This reaction will also occur with sodium hydroxide.
*NSC Newsletter, Chem. Sec.* (March 1967).
*Wischmeyer* (1967).

**Sodium Aluminum Hydride**
See SODIUM ALUMINUM HYDRIDE plus Tetrahydrofuran.

**Sodium Hydroxide**
See TETRAHYDROFURAN plus Potassium Hydroxide.

**TETRAIODOETHYLENE** $I_2HC=CHI_2$

**Iodine Pentafluoride**
See IODINE PENTAFLUORIDE plus Tetraiodoethylene.

**TETRAMETHYLAMMONIUM CHLORITE**
$(CH_3)_4NH_4ClO_2$

**(self-reactive)**
Tetramethylammonium chlorite explodes on percussion.
*Mellor* **2, Supp. 1:** 573 (1956).

**TETRAMETHYLDIALUMINUM** $(CH_3)_2HAl_2H(CH_3)_2$

**Air**
Tetramethyl dialuminum is spontaneously flammable in air.
*Hurd,* p. 98 (1952).

**TETRAMETHYLDIARSINE** $(CH_3)_2As_2(CH_3)_2$

**Air**
Tetramethyl diarsine ignites spontaneously in dry air.
*Brauer* (1965). *Douda* (1966).

**Chlorine**
See CHLORINE plus Tetramethyl Diarsine.

**TETRAMETHYLDIBORANE** $H(CH_3)_2B_2(CH_3)_2H$

**Air**
Tetramethyl diborane is spontaneously flammable in air.
*Lehman and Wilson,* p. 50 (1949).

**TETRAMETHYLDIGALLINE** $(CH_3)_2Ga_2(CH_3)_2$

**Air**
Tetramethyl digalline is spontaneously flammable in air.
*Douda* (1966).

**TETRAMETHYLDISTIBINE** $(CH_3)_2Sb_2(CH_3)_2$

**Air**
Tetramethyl distibine is spontaneously flammable in air.
*Coates,* p. 156 (1956).

**TETRAMETHYLSILICANE** $Si(CH_3)_4$

**Air**
Tetramethyl silicane is spontaneously flammable in air.
*Douda* (1966).


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**TETRANITROMETHANE** $C(NO_2)_4$

**(self-reactive)**
This compound is a weak, but highly sensitive explosive.
*Van Dolah* (1967).

**Hydrocarbons**
Hydrocarbons exposed to tetranitromethane form exceedingly sensitive explosives.
*Van Dolah* (1967).

**TETRAPHENYLDIARSINE** $(C_6H_5)_2As_2(C_6H_5)_2$

**Air**
Tetraphenyl diarsine is spontaneously flammable in air.
*Ellern* (1961).

**TETRAPHOSPHORUS TRIIODIDE** $P_4I_3$

**Nitric Acid**
Concentrated nitric acid attacks phosphorus tetratriiodide vigorously, accompanied by flame.
*Comp. Rend.* **141:** 257.

**TETRAPHOSPHORUS TRISELENIDE** $P_4Se_3$

**Air**
Phosphorus tetratriselenide ignites when warmed in air.
*Z. Anorg. Chemie* **30:** 258.

**TETRASILANE** $Si_4H_{10}$

**Air**
See TRISILANE plus Air; also SILANES plus Air.

**Carbon Tetrachloride**
Carbon tetrachloride reacts more vigorously on trisilane and tetrasilane than on disilane.
*Mellor* **6:** 224 (1946–1947).

**Oxygen**
See OXYGEN plus Disilane.

**TETRYL** $(NO_2)_3C_6H_2N(CH_3)NO_2$

**Hydrazine**
See HYDRAZINE plus Tetryl.

**THALLIC NITRATE TRIHYDRATE** $Tl(NO_3)_3 \cdot 3H_2O$

**Formic Acid and Vanillin**
A violent reaction occurred when a small amount of vanillin was added to thallium trinitrate trihydrate (up to 50%) in 90% formic acid.
*Dean* (1973).

**THALLIC OXIDE** $Tl_2O_3$

**Antimony Sulfide**
A mixture of thallic oxide and antimony sulfide or sulfur explodes when ground in a mortar.
*Mellor* **5:** 421, 434 (1946–1947).

**Sulfur**
See THALLIC OXIDE plus Antimony Sulfide.

**THALLIUM** Tl

**Fluorine**
See FLUORINE plus Thallium.

**THALLOUS AMIDE** $TlNH_2$

**Acids**
Thallium amide explodes with dilute acids or water.
*Mellor* **8:** 2, 5, 70, 261 (1946–1947).

**Water**
See THALLIUM AMIDE plus Acids.

**THALLOUS AZIDE** $TlN_3$

**(self-reactive)**
Thallous azide decomposes at 334°C. It is almost as unstable as the copper salt.
*Mellor* **8, Supp. 2:** 43 (1967).

**THALLOUS BROMIDE** TlBr

**Potassium**
See POTASSIUM plus Aluminum Bromide.

**Sodium**
See SODIUM plus Aluminum Bromide.

**THALLOUS CHLORIDE** TlCl

**Fluorine**
See FLUORINE plus Thallous Chloride.

**Potassium**
See POTASSIUM plus Ammonium Bromide.

**THALLOUS NITRIDE** $Tl_3N$

**(self-reactive)**
See THALLIUM NITRIDE plus Water.

**Acids**
Thallium nitride explodes with dilute acids or water.
*Mellor* **8:** 2, 5, 70, 271 (1946–1947).

**Water**
Thallium nitride explodes with great violence when subjected to shock or heat, or when treated with water or dilute acids.
*Mellor* **8:** 262 (1946–1947).

**THALLOUS PHOSPHIDE** $Tl_3P$

**Air**
This salt ignites if heated in air.
*Mellor* **8, Supp. 3:** 312 (1971).

**THIANTHRENE PERCHLORATE** $(C_6H_4S_2C_6H_4) \cdot HClO_4$

**(self-reactive)**
A new batch of 1–2 grams of thianthrene perchlorate exploded violently while being transferred from a sintered glass filter to a Petri dish.
*BCISC* **40** (158): 17 (1969).

**THIOCYANATES** RSCN

**Chlorates**
Thiocyanates and chlorates or nitrates explode when fused. If intimately mixed, the mixture explodes at a temperature of 750°F., or when touched by flame or sparks.
*Von Schwartz,* pp. 299–300 (1918).
See also CHLORATES plus Antimony Sulfide.

**Nitrates**
See THIOCYANATES plus Chlorates.

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**Nitric Acid**
When thiocyanate solution was introduced into a pipeline containing nitric acid, an explosion ruptured the line.
*MCA Case History* **853** (1962).

**Organic Peroxides**
See THIOCYANATES plus Oxidizing Agents.

**Oxidizing Agents**
Caution should be exercised in treating a thiocyanate with an oxidizing agent such as a peroxide since such mixtures have been known to explode.
*Kharasch* Vol. 1, p. 312 (1961).

**Peroxides**
See THIOCYANATES plus Oxidizing Agents.

**Potassium Chlorate**
See THIOCYANATES plus Chlorates.

**Sodium Chlorate**
See THIOCYANATES plus Chlorates.

## THIODIGLYCOL $(HOCH_2CH_2)_2S$

**Hydrogen Peroxide and Acetone**
Thiodiglycol was being oxidized with an excess of hydrogen peroxide using acetone as a solvent. At the conclusion the acetone and excess hydrogen peroxide were removed under vacuum in a steam bath. After about 15 minutes of heating on a steam bath, a violent explosion occurred.
*MCA Case History* 223 (1962).

## THIONYL CHLORIDE $OSCl_2$

**Dimethylformamide**
Thionyl chloride with tetrahydrofuran and dimethylformamide demonstrate incompatibility resulting in explosions.
*Chem. and Eng. News* (July 4, 1988) (April 7, 1986).

**Dimethyl Sulfoxide**
See DIMETHYL SULFOXIDE plus Acyl Halides.

**Ethyl Acetate**
The mixture of thionyl chloride with ethyl acetate in the presence of zinc or iron metal results in an explosively hazardous mixture. Binary mixtures of these components seem stable, while ternary mixtures result in spontaneously violent reactions.
*Chem. and Eng. News* (June 1, 1992).

**2, 4-Hexadiyn-1, 6-Diol**
Thionyl chloride and 2, 4-hexadiyn-1, 6-diol reacting in dimethyl formamide forms 2, 4-hexadiyn-1, 6-bischlorosulfite which is shock sensitive and decomposes violently upon distillation.
P. E. Driedger and H. V. Isaacson, *Chem. and Eng. News* **50** (12): 51 (1972).

**o-Nitrobenzoylacetic Acid**
o-Nitrobenzoylacetic acid reacted with thionyl chloride to produce the corresponding nitrobenzoylacetyl chloride, which decomposed violently after removal of solvent by distillation. A similar reaction hazard exists for o-nitrophenylacetic acid plus thionyl chloride.
W. D. Bonner and C. O. Hurd, *J. Am. Chem. Soc.* **68:** 344 (1946).

**o-Nitrophenylacetic Acid**
See THIONYL CHLORIDE plus o-Nitrobenzoylacetic Acid.

**Tetrahydrofuran**
Thionyl chloride with tetrahydrofuran and dimethylformamide demonstrate incompatibility resulting in explosions.
*Chem. and Eng. News* (July 4, 1988) (April 7, 1986).

**Water**
A flexible stainless hose that was being used for thionyl chloride transfer ruptured when contaminated with water. Water reacts with thionyl chloride, liberating hydrogen chloride and sulfur dioxide gases.
*Wischmeyer* (1972).

## THIOPHENE $SCH{=}CHCH{=}CH$

**Nitric Acid**
A mixture of the two may cause an explosion.
*Pieters,* p. 30 (1957).

## THIOPHOSPHORYL FLUORIDE $SPF_3$

**Air**
Thiophosphoryl fluoride is spontaneously flammable in air; under proper conditions, it is spontaneously explosive.
*Mellor* **8:** 1072 (1946–1947).

**Potassium**
See SODIUM plus Thiophosphoryl Fluoride.

**Sodium**
See SODIUM plus Thiophosphoryl Fluoride.

## THIOUREA $S{=}C(NH_2)_2$

**Acrolein**
See ACROLEIN plus Sulfur Dioxide.

## THORIUM Th

**Air**
See TANTALUM plus Air.

**Chlorine**
Thorium, when heated with chlorine, reacts vigorously with incandescence.
*Mellor* **7:** 208 (1946–1947).

**Phosphorus**
See PHOSPHORUS plus Thorium.

**Sulfur**
See SULFUR plus Thorium.

## THORIUM CARBIDE $ThC_2$

**Air**
When heated in air, thorium carbide readily burns with incandescence.
*Mellor* **5:** 885–87 (1946–1947).

**Selenium**
See SELENIUM plus Thorium Carbide.

**Sulfur**
See SULFUR plus Thorium Carbide.


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**THORIUM HYDRIDE** $ThH_4$

**Air**
Thorium hydride explodes if heated in the presence of air.
*Mellor* **7:** 207–8 (1946–1947).

**THORIUM NITRIDE** $Th_3N_4$

**Air**
Thorium nitride burns in air with incandescence.
*Mellor* **8:** 121–22 (1946–1947).

**Water**
Thorium nitride hydrolyzes vigorously.
*Mellor* **8, Supp. 1:** 182 (1964).

**THORIUM OXYSULFIDE** ThOS

**Air**
Thorium oxysulfide ignites spontaneously in air.
*Mellor* **7:** 240 (1946–1947).

**THORIUM PHOSPHIDE** $Th_3P_4$

**Acids**
Thorium phosphide reacts with acids to release spontaneously flammable phosphine.
*Mellor* **8, Supp. 3:** 348 (1971).

**THULIUM** Tm

**Air**
See RARE EARTH METALS plus Air.

**Halogens**
See RARE EARTH METALS plus Halogens.

**TIN** Sn

**(For tin compounds see STANNIC and STANNOUS compounds)**

**Bromine**
The violent reaction between these chemicals is controlled in halocarbon solutions.
*Mellor* **2, Supp. 1:** 715 (1956).

**Bromine Trifluoride**
Tin and bromine trifluoride react violently.
*Mellor* **2, Supp. 1:** 164 (1956).

**Chlorine**
When heated in chlorine, tin reacts, producing light and much heat.
*Mellor* **7:** 436 (1946–1947).
*Mellor* **2, Supp. 1:** 380 (1956).

**Chlorine Trifluoride**
See ALUMINUM plus Chlorine Trifluoride.

**Cupric Nitrate**
In the presence of water, cupric nitrate and tin foil, on prolonged and intimate contact, will produce flaming and sparking.
*Ellern,* p. 46 (1968).

**Potassium Peroxide**
See POTASSIUM plus Potassium Peroxide.

**Sodium Peroxide**
Sodium peroxide oxidizes tin with incandescence.
*Mellor* **2:** 490–93 (1946–1947).

**Sulfur**
See SULFUR plus Tin.

**TITANIUM** Ti

**Air**
Most finely divided forms of titanium are flammable in air. See also TITANIUM DICHLORIDE plus Air and TANTALUM plus Air.
*NSC Data Sheet* **485.** *BM Report Invest.* **6516** (1964). *BM Report Invest.* **4835** (1951).

**Bromine Trifluoride**
See MOLYBDENUM plus Bromine Trifluoride.

**Carbon Dioxide**
Titanium burns in carbon dioxide above 550°C.
*NSC Data Sheet* **485.**

**Cupric Oxide**
Titanium reacts violently with cupric oxide or lead oxide when heated.
*Mellor* **7:** 20 (1946–1947).

**Fluorine**
See FLUORINE plus Titanium.

**Lead Oxide**
See TITANIUM plus Cupric Oxide.

**Nickel and Potassium Perchlorate**
See NICKEL plus Titanium and Potassium Perchlorate.

**Nitric Acid**
The residue from the reaction of titanium with red fuming nitric acid exploded violently when the flask was touched.
*Allison* (1969).

**Nitrogen**
Titanium burns vigorously in free nitrogen above 802°C.
*NSC Data Sheet* **485.**

**Oxidants, strong**
Metal flake plus strong oxidants, such as silver nitrate, can form extremely hazardous compositions. Mixtures can become shock sensitive upon drying.

**Oxygen**
*Liquid* oxygen gives a detonable mixture when combined with powdered titanium.
*Kirschenbaum* (1956).

**Potassium Chlorate**
When titanium is heated with potassium chlorate, potassium nitrate or potassium permanganate, an explosion occurs.
*Mellor* **7:** 20 (1946–1947).

**Potassium Nitrate**
See TITANIUM plus Potassium Chlorate.

**Potassium Permanganate**
See TITANIUM plus Potassium Chlorate.

**Steam**
Titanium at red heat, 704°C., decomposes steam. The hydrogen evolved burns or explodes.
*NSC Data Sheet* **485.**



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**Trichloroethylene**
It has been determined experimentally that a mixture of titanium powder with trichloroethylene or with trichlorotrifluoroethane will flash or spark on heavy impact.
*ASESB Pot. Incid.* **39** (1968).

**Trichlorotrifluoroethane**
See TITANIUM plus Trichloroethylene.

**TITANIUM ALLOY**

**Nitric Acid**
Extreme caution is urged in handling of all titanium alloys exposed to red fuming nitric acid since the reaction may cause an explosion.
*Chem. and Eng. News* **31:** 3320 (1953).

**Oxygen**
A titanium alloy tank containing liquid oxygen exploded during a laboratory experiment. Contamination might have triggered the reaction. An explosion hazard may exist in the use of titanium with either gaseous or liquid oxygen.
*MCA Case History* **988** (1964). *Jolicoeur* (1966).

**TITANIUM CARBIDE** TiC

**Air**
As micron-sized titanium carbide was being removed from a ball mill, a cloud of the dust ignited.
*MCA Case History* **618** (1960).

**TITANIUM DICHLORIDE** $TiCl_2$

**Air**
Titanium dichloride is highly flammable in air at room temperature. In inert gases, titanium dichloride converts to titanium tetrachloride plus very finely divided titanium metal, which can ignite on subsequent exposure to air.
*NSC Data Sheet* **485.**

**TITANIUM DIOXIDE** $TiO_2$

**Lithium**
See LITHIUM plus Titanium Dioxide.

**TITANIUM DISULFIDE** $TiS_2$

**Potassium Nitrate**
A mixture of titanium disulfide and potassium nitrate detonated when heated.
*Mellor* **7:** 91 (1946–1947).

**TITANIUM-MAGNESIUM ALLOY**

**Nitric Acid**
The residue from the reaction of titanium-magnesium alloy with red-fuming nitric acid may be detonated by friction, heat, or shock.
*Chem. and Eng. News* **31:** 3320 (1953).

**TITANIUM TETRACHLORIDE** $TiCl_4$

**Potassium**
See POTASSIUM plus Titanium Tetrachloride.

**TOLUENE** $C_6H_5CH_3$

**Nitric Acid and Sulfuric Acid**
See NITRIC ACID plus Toluene and Sulfuric Acid.

**Nitrogen Tetroxide**
See NITROGEN TETROXIDE plus Toluene.

**Silver Perchlorate**
See SILVER PERCHLORATE plus Acetic Acid.
See SILVER PERCHLORATE plus Toluene.

**TOLUENE DIISOCYANATE** $CH_3C_6H_3(NCO)_2$

**Acyl Chlorides and Bases**
The diisocyanate can undergo exothermic polymerization in contact with bases or more than traces of acyl chlorides, sometimes used as stabilizers.

**TOLUIDINE** $CH_3(C_6H_4)NH_2$

**Nitric Acid**
See NITRIC ACID plus Aniline.

**TOLYL CHLORIDE** $C_6H_5CH_2Cl$

**Dimethyl Sulfoxide**
See DIMETHYL SULFOXIDE plus Acyl Halides.

**TRIALLYL PHOSPHATE** $(CH_2{=}CHCH_2O)_3PO$

**(self-reactive)**
An explosion occurred on distilling triallyl phosphate prepared from phosphorus oxychloride, allyl alcohol and pyridine. The toluene solution of the product, washed with sodium carbonate and with pyrogallol added, exploded violently while being distilled under vacuum at 135°C.
W. T. Dye, G. E. Ham, *Chem. and Eng. News* **28:** 3452 (1950).

**TRIAZINE** N=CHN=CHN=CH

**Nitric Acid**
See NITRIC ACID plus Triazine.

**TRI-n-BROMOMELAMINE**
N=C(NHBr)NC=(NHBr)N=C(NHBr)

**Ally Alcohol**
See ALLYL ALCOHOL plus Tri-n-Bromomelamine.

**TRIBROMONEOPENANOL (Sym)** $(BrCH_2)_3COH$

**Ethyl Acetoacetate and Zinc**
See ETHYL ACETOACETATE plus Tribromoneopentyl Alcohol and Zinc.

**TRIBROMOTRIETHOXYDIALUMINUM** $Al_2Br_3(OC_2H_5)_3$

**Air**
See TRIBROMOTRIETHOXYDIALUMINUM plus Ethyl Alcohol.

**Ethyl Alcohol**
Aluminum sesquibromide ethylate explodes on contact with ethyl alcohol or water. It is also pyrophoric.
*Chem. Eng. Progs.* **62** (9): 128 (1968).

**Water**
See TRIBROMOTRIETHOXYDIALUMINUM plus Ethyl Alcohol.



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**TRIBROMOTRIMETHYLDIALUMINUM** $(CH_3)_3Al_2Br_3$

**Air**
Trimethyl tribromo dialuminum is spontaneously flammable in air.
*Douda* (1966).

**Water**
Trimethyl tribromo dialuminum reacts violently with water.
*Rose* (1961).

**TRIBUTYLALUMINUM** $(C_4H_9)_3Al$

**Air**
Tri-n-butyl aluminum is spontaneously flammable in air.
*Rose* (1961).

**TRIBUTYLBORANE** $(C_4H_9)_3B$

**Air**
Tri-n-butyl borane, if spread over a large area, ignites spontaneously in air.
W. H. Johnson et al., *J. Res. Nat. Bur. Stand.* **62** (1): 49 (1959).

**TRIBUTYLPHOSPHINE** $P(C_4H_9)_3$

**Air**
Tributyl phosphine is spontaneously flammable in air.
A. B. Steele and J. J. Duggan, *Chem. Eng.* **66:** 160 (April 1969).

**1,1,1-TRICHLOROETHANE** $CCl_3CH_3$

**Acetone**
See ACETONE plus Methyl Chloroform.

**Nitrogen Tetroxide**
See NITROGEN TETROXIDE plus 1,2-Dichloroethane.

**Oxygen**
See OXYGEN plus 1,1,1-Trichloroethane.

**Oxygen (Liquid)**
See OXYGEN (LIQUID) plus Chlorinated Hydrocarbons.

**Sodium**
See SODIUM plus 1,2-Dichloroethylene.

**Sodium Hydroxide**
See SODIUM plus 1,2-Dichloroethylene.

**Sodium-Potassium Alloy**
See SODIUM-POTASSIUM ALLOY plus 1,1,1-Trichloroethane.

**TRICHLOROETHYLENE** $Cl_2C{=}CHCl$

**Aluminum**
See ALUMINUM plus Trichloroethylene.

**Barium**
See BARIUM plus Trichlorotrifluoroethane.

**Nitrogen Tetroxide**
See NITROGEN TETROXIDE plus 1,2-Dichloroethane.

**Lithium**
See LITHIUM plus Trichlorotrifluorethane.

**Magnesium**
See MAGNESIUM plus Trichloroethylene.

**Oxygen (Liquid)**
See OXYGEN (LIQUID) plus Chlorinated Hydrocarbons.

**Oxygen**
See OXYGEN plus Trichloroethylene.

**Potassium Hydroxide**
See SODIUM HYDROXIDE plus Trichloroethylene.

**Potassium Nitrate**
A batch of 3257 grams of boron, 9362 grams of potassium nitrate, 989 grams of laminac, and 500 grams of trichloroethylene had been mixing for 5 minutes, when an explosion occurred.
*MCA Guide for Safety,* Appendix 3 (1972).

**Sodium**
See SODIUM plus 1,2-Dichloroethylene.

**Sodium Hydroxide**
See SODIUM HYDROXIDE plus Trichloroethylene.
See also SODIUM plus 1,2-Dichloroethylene.

**Titanium**
See TITANIUM plus Trichloroethylene.

**TRICHLOROETHYLSILANE** $C_2H_5SiCl_3$

**Water**
Ethyltrichlorosilane reacts violently with water.
*Title 46* (1970).

**1,1,1-TRICHLORO-2-FLUOROETHANE** $CCl_3CH_2F$

**Barium**
See BARIUM plus Trichlorotrifluoroethane.

**TRICHLOROFLUOROMETHANE** $CFCl_3$

**Aluminum**
See ALUMINUM plus Chlorofluorohydrocarbons.
See also ALUMINUM plus Dichlorodifluoromethane.

**Lithium**
See LITHIUM plus Trichlorotrifluoroethane.

**TRICHLOROMELAMINE** $C_3N_3(NHCl)_3$

**Acetone**
See HEXACHLOROMELAMINE plus Organic Contaminants.

**Ammonia**
See HEXACHLOROMELAMINE plus Organic Contaminants.

**Aniline**
See HEXACHLOROMELAMINE plus Organic Contaminants.

**Diphenylamine**
See HEXACHLOROMELAMINE plus Organic Contaminants.

**Turpentine**
See HEXACHLOROMELAMINE plus Organic Contaminants.



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**TRICHLOROMETHYLSILANE** $CH_3SiCl_3$

**Water**
Methyl trichlorosilane evolves white fumes with moist air. It reacts violently with water with the evolution of heat and white acid fumes.
*Title 46* (1970).

**TRICHLOROTRIETHYLDIALUMINUM** $(C_2H_5)_3Al_2Cl_3$

**Air**
Ethyl aluminum sesquichloride is spontaneously flammable in air.
*Douda* (1966).

**Benzene and Allyl Chloride**
See ALLYL CHLORIDE plus Benzene and Ethyl Aluminum Dichloride.

**Carbon Tetrachloride**
See ALUMINUM TRIETHYL plus Carbon Tetrachloride.

**Toluene and Allyl Chloride**
See ALLYL CHLORIDE plus Benzene and Ethyl Aluminum Dichloride.

**Water**
Ethyl aluminum sesquichloride reacts violently with water.
*Rose* (1961).

**1,1,2-TRICHLOROTRIFLUOROETHANE** $CCl_3CF_3$

**Aluminum**
See ALUMINUM plus Chlorofluorohydrocarbons.
See also ALUMINUM plus Dichlorodifluoromethane.

**Barium**
See BARIUM plus Trichlorotrifluoroethane.

**Lithium**
See LITHIUM plus Trichlorotrifluoroethane.

**Samarium**
See SAMARIUM plus 1,1,2-Trichlorotrifluoroethane.

**Sodium-Potassium Alloy**
See SODIUM-POTASSIUM ALLOY plus Trichlorotrifluoroethane.

**Titanium**
See TITANIUM plus Trichloroethylene.

**TRICHLOROTRIMETHYLDIALUMINUM** $(CH_3)_3Al_2Cl_3$

**Air**
Methyl aluminum sesquichloride ignites instantly in air.
*Rose* (1961).

**TRICHLOROVINYLSILANE** $Si(CH_2{=}CH)Cl_3$

**Water**
Vinyl trichloro silane reacts violently with water or moist air.
*Title 46* (1970).

**TRIDECANAL** $C_{12}H_{25}CHO$

**Air**
Tridecyl aldehyde is spontaneously flammable in air.
A. B. Steele and J. J. Duggan, *Chem. Eng.* **66:** 160 (April 1969).

**TRIETHYLALUMINUM** $Al(C_2H_5)_3$

**Air**
Triethyl aluminum is spontaneously flammable in air and explodes violently in water.
*Von Schwartz*, p. 321 (1918). *Kirk and Othmer, Second Ed.* **2:** 38 (1963). *MCA Case History* **819** (1962).

**Carbon Tetrachloride**
When mixtures of triethyl aluminum sesquichlorides in carbon tetrachloride that had been prepared with ice cooling were permitted to warm to room temperature, they first darkened, then exploded violently. The reaction is believed due to increased concentration of aluminum triethyl, which subsequently reacted with the carbon tetrachloride.
H. Reinheckel, *Angew. Chem. Inter. Ed. Engl.* **3:** 65 (1964).

**Dimethylformamide**
See DIMETHYLFORMAMIDE plus Triethyl Aluminum.

**Halogenated Hydrocarbons**
Violent reactions may occur when aluminum alkyls are exposed to halogenated hydrocarbons.
*Kirk and Othmer, Second Ed.* **2:** 38 (1963).

**Triethyl Borine and Air**
A mixture of 15% triethyl aluminum and 85% triethyl borine is pyrophoric.
*Rocketdyne Rept., Hypergol*, p. 3 (1961).

**Water**
See TRIETHYL ALUMINUM plus Air.

**TRIETHYLALUMINUM DIETHYL ETHERATE**
$4(C_2H_5)_3Al{\cdot}3(C_2H_5)_2O$

**Diethyl Ether and Air**
A mixture of triethyl aluminum diethyl etherate and diethyl ether is spontaneously flammable in air.
*Douda* (1966).

**TRIETHYLARSINE** $As(C_2H_5)_3$

**Air**
Triethyl arsine is spontaneously flammable in air.
*Von Schwartz*, p. 322 (1918).

**TRIETHYLBISMUTHINE** $(C_2H_5)_3Bi$

**Air**
Triethyl bismuthine is spontaneously flammable in air.
*Ellern*, pp. 24–25 (1968).

**TRIETHYLBORANE** $(C_2H_5)_3B$

**Air**
Triethyl borine is spontaneously flammable in air.
*Douda* (1966). *Ripley* (1966).

**Triethyl Aluminum and Air**
See TRIETHYL ALUMINUM plus Triethyl Borine and Air.

**TRIETHYLDIBORANE** $(C_2H_5)_3B_2H_3$

**Air**
Triethyl diborane is spontaneously flammable in air.
*Douda* (1966).

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**TRIETHYL ETHOXY DIPHOSPHINYL OXIDE** $(C_2H_5)_2POP(C_2H_5)(OC_2H_5)$

**Air**

Triethyl ethoxy diphosphinyl oxide is spontaneously flammable in air.
*Kaufman* (1961).

**TRIETHYLGALLIUM** $(C_2H_5)_3Ga$

**Air**

Triethyl gallium is spontaneously flammable in air.
*Ellern,* pp. 24–25 (1968).

**TRIETHYLINDIUM** $(C_2H_5)_3In$

**Air**

Triethyl indium is spontaneously flammable in air.
*Douda* (1966).

**TRIETHYLSTIBINE** $Sb(C_2H_5)_3$

**Air**

Triethyl antimony is spontaneously flammable in air.
*Von Schwartz,* p. 322 (1918).

**TRIETHYLSTIBINE SULFATE** $Sb(C_2H_5)_3SO_4$

**Air**

Triethyl antimony sulfate is spontaneously flammable in air.
*Bahme,* p. 25 (1961).

**(TRIFLUOROMETHYL) PHOSPHINE** $F_3CPH_2$

**Air**

Trifluoromethyl phosphine is spontaneously flammable in air.
*Douda* (1966).

**TRIFLUORONITROANILINE** $F_3C_6H(NO_2)N{=}NOH$

**(self-reactive)**

The recrystallized compound, which had been made from trifluoronitroaniline, hydrochloric acid and sodium nitrite, exploded violently on impact.
*MCA Guide for Safety,* Appendix 3 (1972).

**TRIISOBUTYLALUMINUM** $(CH_3CHCH_3CH_2)_3Al$

**Acids**

Tri-iso-butyl aluminum reacts violently with acids, alcohols, amines, halogens, and water.
*Rose* (1961).

**Air**

Tri-iso-butyl aluminum is spontaneously flammable in air.
*Rose* (1961).

**Alcohols**

See TRI-iso-BUTYL ALUMINUM plus Acids.

**Amines**

See TRI-iso-BUTYL ALUMINUM plus Acids.

**Halogens**

See TRI-iso-BUTYL ALUMINUM plus Acids.

**Water**

See TRI-iso-BUTYL ALUMINUM plus Acids.

**TRIMANGANESE TETROXIDE** $Mn_3O_4$

**Fluorine**

See FLUORINE plus Trimanganese Tetroxide.

**TRIMETHYLALUMINUM** $Al(CH_3)_3$

**Air**

Trimethyl aluminum is spontaneously flammable in air and explodes violently in water.
*Von Schwartz,* p. 321 (1918).

**Halogenated Hydrocarbons**

See TRIETHYL ALUMINUM plus Halogenated Hydrocarbons.

**Water**

See TRIMETHYL ALUMINUM plus Air.

**TRIMETHYLALUMINUM DIETHYL ETHERATE** $(CH_3)_3Al{\cdot}(C_2H_5)_2O$

**Diethyl Ether and Air**

A mixture of trimethyl aluminum diethyl etherate and diethyl ether is spontaneously flammable in air.
*Douda* (1966).

**TRIMETHYLALUMINUM DIMETHYL ETHERATE** $(CH_3)_3Al{\cdot}(CH_3)_2O$

**Air**

Trimethyl aluminum dimethyl etherate is spontaneously flammable in air.
*Douda* (1966).

**TRIMETHYLAMINE OXIDE PERCHLORATE** $(CH_3)_3NO{\cdot}HClO_4$

**(self-reactive)**

Trimethylamine oxide perchlorate explodes when heated or struck.
*ACS* **146:** 213. *Berichte* **43:** 2624–30 (1910).

**TRIMETHYLARSINE** $As(CH_3)_3$

**Air**

Trimethyl arsenic is spontaneously flammable in air.
*Von Schwartz,* p. 322 (1918).

**TRIMETHYLBISMUTHINE** $(CH_3)_3Bi$

**Air**

Trimethyl bismuthine is spontaneously flammable in air.
*Coates,* p. 161 (1956).

**TRIMETHYLBORANE** $B(CH_3)_3$

**Air**

Trimethyl borine is spontaneously flammable in air.
*Douda* (1966).

**TRIMETHYLDIALUMINUM HYDRIDE** $(CH_3)_2HAl_2H_2CH_3$

**Water**

Trimethyl dialuminum hydride reacts vigorously with water yielding methane and hydrogen, which ignite spontaneously.
*Hurd,* p. 98 (1952).



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**TRIMETHYLDIBORANE** $(CH_3)_3B_2H_3$

**Air**

Trimethyl diborane is spontaneously flammable in air.
*Lehman and Wilson,* p. 53 (1949).

**TRIMETHYLGALLIUM** $(CH_3)_3Ga$

**Air**

Trimethyl gallium is spontaneously flammable in air.
*Douda* (1966).

**TRIMETHYLPHOSPHINE** $(CH_3)_3P$

**Air**

Trimethyl phosphine ignites spontaneously and burns violently in air.
R. A. Zingaro and R. E. McGlothlin, *J. Chem. Eng. Data* **8** (2): 227 (1963).

**TRIMETHYL PHOSPHITE** $(CH_3O)_3P$

**Magnesium Perchlorate**

See MAGNESIUM PERCHLORATE plus Trimethyl Phosphite.

**TRIMETHYLSTIBINE** $Sb(CH_3)_3$

**Air**

Trimethyl antimony is spontaneously flammable in air.
*Von Schwartz,* p. 322 (1918).

**TRIMETHYLSTIBINE SULFATE** $(CH_3)_3SbSO_4$

**Air**

Trimethyl antimony sulfate is spontaneously flammable in air.
*Bahme,* p. 25 (1961).

**TRIMETHYLTHALLIUM** $(CH_3)_3Tl$

**Air**

Trimethyl thallium is spontaneously flammable in air.
*Douda* (1966).

**TRINITROETHANOL** $(NO_2)_3CCH_2OH$

**(self-reactive)**

Explosions were encountered during the distillation of trinitroethanol.
*J. Am. Chem. Soc.* **72:** 5329 (1950).

**TRINITROMETHANE** $(NO_2)_3CH$

**(self-reactive)**

Explosions were encountered during the distillation of trinitromethane.
*J. Am. Chem. Soc.* **72:** 5329 (1950).
See also NITRIC ACID plus Acetylene.

**TRIPHENYLALUMINUM** $(C_6H_5)_3Al$

**Water**

Triphenyl aluminum reacts explosively with water.
*Rose* (1961).

**TRIPROPYLALUMINUM** $Al(C_3H_7)_3$

**Air**

Tripropyl aluminum is spontaneously flammable in air and explodes violently in water.
*Von Schwartz,* p. 321 (1918).

**Halogenated Hydrocarbons**

See TRIETHYL ALUMINUM plus Halogenated Hydrocarbons.

**Water**

See TRIPROPYL ALUMINUM plus Air.

**TRIPROPYLBORANE** $(C_3H_7)_3B$

**Air**

Tripropylborane is spontaneously flammable in air.
*Douda* (1966).

**TRIPROPYLINDIUM** $(C_3H_7)_3In$

**Air**

Tripropyl indium is spontaneously flammable in air.
*Douda* (1966).

**TRIPROPYLSTIBINE** $(C_3H_7)_3Sb$

**Air**

Tripropyl antimony is spontaneously flammable in air.
*Ellern,* pp. 24–25 (1968).

**TRISILANE** $Si_3H_8$

**Air**

In air, trisilane and tetrasilane explode. See also SILANES plus Air.
*Mellor* **6:** 224 (1946–1947).

**Carbon Tetrachloride**

Carbon tetrachloride reacts more vigorously on trisilane and tetrasilane than on disilane.
*Mellor* **6:** 224 (1946–1947).

**Oxygen**

See OXYGEN plus Disilane.

**TRISILYLAMINE** $(SiH_3)_3N$

**Air**

Trisilylamine is spontaneously flammable in air.
*Mellor* **8:** 262 (1946–1947).

**TRISILYLARSINE** $(SiH_3)_3As$

**Air**

Trisilyl arsine is spontaneously flammable in air.
*Douda* (1966).

**TRISILYLPHOSPHINE** $(SiH_3)_3P$

**(self-reactive)**

This is a spontaneously flammable liquid.
*Mellor* **8, Supp. 3:** 283 (1971).

**Air**

The liquid ignites spontaneously in air.
*Ellern,* p. 22 (1968). *Douda* (1966).

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**TRIS(TRIFLUOROMETHYL)PHOSPHINE** $(CF_3)_3P$

**Air**
Tristrifluoromethyl phosphine is spontaneously flammable in air.
*Douda* (1966). *Handbook Chem. Phys.*, p. **C-428** (1970-1971).

**TRIS(TRIMETHYLSILYL)PHOSPHINE** $[(CH_3)_3Si]_3P$

**Air**
Tristrimethyl silyl phosphine is spontaneously flammable in air.
*Def. Res. and Eng.*, p. 247 (1963).

**TRITOLYLAMINE PERCHLORATE** $(CH_3C_4H_6)_3NHClO_4$

**(self-reactive)**
Tritolylamine perchlorate explodes above 123°C.
*ACS* **146:** 213. *Berichte* **43:** 2624–30 (1910).

**TRIVINYL ANTIMONY** $(CH_2{=}CH)_3Sb$

**Air**
Trivinyl antimony is spontaneously flammable in air.
*Zeiss*, p. 92 (1960).

**TRIVINYLBISMUTHINE** $(CH_2{=}CH)_3Bi$

**Air**
Trivinyl bismuthine is spontaneously flammable in air.
*Zeiss*, p. 129 (1960).

**TROPYLIUM PERCHLORATE** $(C_7H_7)ClO_4$

**(self-reactive)**
An 80-gram sample of tropylium perchlorate heaped in a transfer funnel exploded violently when it was touched by a glass rod.
*Angew. Chem. Intern. Ed. Engl.* **1** (7): **465** (1962).

**TUNGSTEN** W

**Bromine Trifluoride**
See MOLYBDENUM plus Bromine Trifluoride.

**Chlorine Trifluoride**
See ANTIMONY plus Chlorine Trifluoride.

**Fluorine**
See FLUORINE plus Tungsten.

**Iodine Pentafluoride**
See ARSENIC plus Iodine Pentafluoride.

**Lead Dioxide**
See MOLYBDENUM plus Lead Dioxide.

**TUNGSTEN CARBIDE** WC

**Chlorine Trifluoride**
See CHLORINE TRIFLUORIDE plus Mercuric Iodide.

**Fluorine**
See FLUORINE plus Tungsten Carbide.

**Nitrogen Dioxide**
Tungsten carbide burns with incandescence if heated to dull redness in either nitrous oxide or nitrogen dioxide.
*Mellor* **5:** 890 (1946–1947).

**Nitrous Oxide**
See TUNGSTEN CARBIDE plus Nitrogen Dioxide.

**TUNGSTEN DIOXIDE** $WO_2$

**Chlorine**
See CHLORINE plus Tungsten Dioxide.

**TUNGSTEN TRIOXIDE** $WO_3$

**Chlorine Trifluoride**
The reaction between tungsten trioxide and chlorine trifluoride is accompanied by incandescence.
*Mellor* **11:** 730 (1946–1947).
See also CHLORINE TRIFLUORIDE plus Aluminum Oxide.

**Lithium**
See LITHIUM plus Tungsten Trioxide.

**TURPENTINE**

**Calcium Hypochlorite**
See CALCIUM HYPOCHLORITE plus Turpentine.

**Chlorine**
See CHLORINE plus Hydrocarbons.

**Chromic Anhydride**
See CHROMIC ANHYDRIDE plus Naphthalene.

**Chromyl Chloride**
See CHROMYL CHLORIDE plus Acetone.

**Hexachloromelamine**
See HEXACHLOROMELAMINE plus Organic Contaminants.

**Stannic Chloride**
See STANNIC CHLORIDE plus Turpentine.

**Trichloromelamine**
See HEXACHLOROMELAMINE plus Organic Contaminants.

**TYGON®**

**Fluorine**
See FLUORINE plus Solid Nonmetals and Oxygen.

**URANIUM** U

**Air**
Clean uranium turnings or chips oxidize readily in air. If confined in a container without air movement, they can ignite spontaneously. Moisture increases this reactivity.
*Scott* (1970).

**Carbon Tetrachloride**
An explosion occurred when liquid carbon tetrachloride was used in an attempt to extinguish a small fire involving about a half pound of uranium.
*Allison* (1969).

**Chlorine**
See CHLORINE plus Uranium.

**Fluorine**
See FLUORINE plus Uranium.

**Nitric Acid**
Nitric acid can react with uranium with explosive violence.
*Katz and Rabinowitch* (1951).
Freshly cleaned uranium turnings in a stainless steel beaker were covered with hot water and nitric acid to bring the concentration to 4 to 6 normal. When cold rinse wa-



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ter was turned on, an explosion accompanied by a flash, ejected the turnings from the beaker.
*Serious Acc. Series* **250** (1965).

**Nitric Oxide**
Uranium ignites in warm nitric oxide.
*Mellor* **12:** 31–2 (1946–1947).

**Selenium**
Uranium reacts with incandescence with hot selenium or sulfur (boiling).
*Mellor* **12:** 31–2 (1946–1947).

**Sulfur**
See URANIUM plus Selenium.

**Water**
Uranium turnings and fines stored out of doors in a closed container under water or water-soluble oil will hydride and eventually ignite during hot weather.
*Scott* (1970).

**URANIUM DICARBIDE** $UC_2$

**Air**
Uranium dicarbide ignites if powdered in a mortar.
*Mellor* **5:** 890 (1946–1947).

**Bromine**
See BROMINE plus Uranium Dicarbide.

**Chlorine**
See BROMINE plus Uranium Dicarbide.

**Fluorine**
See BROMINE plus Uranium Dicarbide.

**Water**
Uranium dicarbide (at dull-red heat) reacts with steam with incandescence.
*Mellor* **5:** 890 (1946–1947).

**URANIUM DIOXIDE** $UO_2$

**Air**
Uranium oxide is spontaneously flammable in air.
*Brauer* (1965).

**URANIUM HYDRIDE** $UH_3$

**Air**
Uranium hydride is spontaneously flammable in air.
J. Zehr, *Staub* **22** (11): 494–508 (1962). *Brauer* (1965).

**URANIUM-NEODYMIUM ALLOY**

**Nitric Acid**
Explosive or violent reactions have occurred during or subsequent to pickling of the alloy with nitric acid.
*Allison* (1969).

**URANIUM-NEODYMIUM-ZIRCONIUM ALLOY**

**Nitric Acid**
Explosive or violent reactions have occurred during or subsequent to pickling of the alloy with nitric acid.
*Allison* (1969).

**URANIUM NITRIDE** UN

**Air**
Uranium nitride is spontaneously flammable in air.
J. Zehr, *Staub* **22** (11): 494–508 (1962).

**URANIUM OXIDES** $UO_2$; $UO_3$; $U_3O_8$

**Bromine Trifluoride**
See BROMINE TRIFLUORIDE plus Uranium Oxides.

**URANIUM PHOSPHIDE** $U_3P_4$

**Hydrochloric Acid**
Uranium phosphide reacts with hydrochloric acid to release spontaneously flammable phosphine.
*Mellor* **8, Supp. 3:** 349 (1971).

**URANIUM TETRAHYDROBORATE** $U(BH_4)_3$

**Air**
Uranium borohydride is spontaneously flammable in air.
H. I. Schlesinger et al, *J. Am. Chem. Soc.* **75:** 219–223 (1953).

**URANYL PERCHLORATE** $UO_2(ClO_4)_2$

**Ethyl Alcohol**
Attempts at recrystallization from ethyl alcohol resulted in an explosion.
*Mellor* **2, Supp. 1:** 617 (1956).

**p-URAZINE** NHNHCONHNHCO

**(self-reactive)**
While a chemist was manipulating the material in a glass container, an explosion occurred that shattered the container. The material that exploded was probably a nitrogen-containing byproduct.
*MCA Case History* **144** (1966).

**UREA** $(NH_2)_2CO$

**Gallium Perchlorate**
See GALLIUM PERCHLORATE plus Urea.

**Hypochlorites**
See HYPOCHLORITES plus Urea.

**VANADIUM** V

**Bromine Trifluoride**
See MOLYBDENUM plus Bromine Trifluoride.

**Chlorine**
See CHLORINE plus Vanadium.

**Lithium**
See LITHIUM plus Vanadium.

**VANADIUM OXYDICHLORIDE** $VOCl_2$

**Potassium**
See POTASSIUM plus Boric Acid.

**VANADIUM OXYTRICHLORIDE** $VOCl_3$

**Phosphorus**
See PHOSPHORUS plus Vanadium Oxytrichloride.

**VANADIUM PENTACHLORIDE** $VCl_5$

**Potassium**
See POTASSIUM plus Aluminum Bromide.

**Sodium**
See SODIUM plus Aluminum Bromide.

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**VANADIUM PENTOXIDE** $V_2O_5$

**Calcium, Sulfur and Water**
See CALCIUM plus Vanadium Oxide, Sulfur, and Water.

**Chlorine Trifluoride**
See CHLORINE TRIFLUORIDE plus Aluminum Oxide.

**Lithium**
See LITHIUM plus Vanadium Pentoxide.

**VANADIUM SESQUIOXIDE** $V_2O_3$

**Air**
Vanadium sesquioxide is spontaneously flammable in air.
*Ellern* (1961).

**VANILLIN** $CH_3O(HO)C_6H_3CHO$

**Thallium Trinitrate Trihydrate and Formic Acid**
See THALLIUM TRINITRATE TRIHYDRATE plus Formic Acid and Vanillin.

**VEGETABLE GLUES**

**Aluminum**
See ALUMINUM plus Nitrates.

**VINYL ACETATE** $CH_2=CHOCOCH_3$

**2-Aminoethanol Chlorosulfonic Acid**
See 2-AMINOETHANOL plus Vinyl Acetate.
Mixing vinyl acetate and chlorosulfonic acid in a closed container caused the temperature and pressure to increase.
*Flynn and Rossow* (1970). See Note under complete reference.

**Ethylene Diamine**
See ETHYLENE DIAMINE plus Vinyl Acetate.

**Ethyleneimine**
Mixing vinyl acetate and ethyleneimine in a closed container caused the temperature and pressure to increase.
*Flynn and Rossow* (1970). See Note under complete reference.

**Hydrochloric Acid**
Mixing vinyl acetate and 36% hydrochloric acid in a closed container caused the temperature and pressure to increase.
*Flynn and Rossow* (1970). See Note under complete reference.

**Hydrofluoric Acid**
Mixing vinyl acetate and 48.7% hydrofluoric acid in a closed container caused the temperature and pressure to increase.
*Flynn and Rossow* (1970). See Note under complete reference.

**Nitric Acid**
Mixing vinyl acetate and 70% nitric acid in a closed container caused the temperature and pressure to increase.
*Flynn and Rossow* (1970). See Note under complete reference.

**Oleum**
See OLEUM plus Vinyl Acetate.

**Peroxides**
Vinyl acetate in contact with peroxides may polymerize violently.
*Haz. Chem. Data* (1966).

**Sulfuric Acid**
Mixing vinyl acetate and 96% sulfuric acid in a closed container caused the temperature and pressure to increase.
*Flynn and Rossow* (1970). See Note under complete reference.

**VINYL ACETATE-CHLORIDE COPOLYMER**

**Fluorine**
See FLUORINE plus Solid Nonmetals and Oxygen.

**VINYL ACETYLENE** $C_4H_4$
Vinyl acetylene is included in a list of peroxidizable monomers where the presence of peroxide can initiate exothermic polymerization of the bulk of the material.
*Bretherick* (1978).

**VINYL AZIDE** $CH_2=CHN_3$

**(self-reactive)**
A sample of vinyl azide in a distilling flask with a ground glass joint exploded when the joint was rotated.
R. H. Wiley and J. Moffat, *J. Org. Chem.* **22:** 995 (1957).

**VINYL CHLORIDE** $CH_2=CHCl$

**Air**
An unstable polyperoxide is apparently formed in vinyl chloride through oxidation by atmospheric oxygen in the presence of any of a variety of contaminants. Storage under these conditions for a long period increases the concentration of unstable polyperoxide to hazardous levels.
*MCA Case History* **1551** (1969).

**VINYLIDENE CHLORIDE** $CH_2=CCl_2$

**(self-reactive)**
A coating of vinylidene chloride polymer on the inside of a 2-inch pipe exploded when the pipe touched a fitting on a tank car.
*MCA Case History* **1172** (1966).

**Chlorosulfonic Acid**
Mixing vinylidene chloride and chlorosulfonic acid in a closed container caused the temperature and pressure to increase.
*Flynn and Rossow* (1970). See Note under complete reference.

**Nitric Acid**
Mixing vinylidene chloride and 70% nitric acid in a closed container caused the temperature and pressure to increase.
*Flynn and Rossow* (1970). See Note under complete reference.

**Oleum**
See OLEUM plus Vinylidene Chloride.

**VITON A®**

**Fluorine**
See FLUORINE plus Solid Nonmetals and Oxygen.



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**WAX, DRAWING**

**Chlorine**
See CHLORINE plus Polypropylene.

**XANTHATES**

**Diazonium Salts**
See DIAZONIUM SALTS plus Thiophenates.

**XENON HEXAFLUORIDE** $XeF_6$

**Water**
Xenon hexafluoride reacted with water to form explosive xenon trioxide.
*Health & Safety Inf.* **181** (1964). *Chem. and Eng. News* **13:** 45–6 (1963). *J. Am. Chem. Soc.* **85:** 816 (1963).

**2(X, Y-XYLYL)ETHANOL** $(CH_3)_2C_6H_3CH_2CH_2OH$

**Hydrogen Peroxide and Sulfuric Acid**
See ALCOHOLS plus Hydrogen Peroxide and Sulfuric Acid.

**YTTERBIUM** Yb

**Air**
See RARE EARTH METALS plus Air.

**Halogens**
See RARE EARTH METALS plus Halogens.

**YTTRIUM** Yt

**Air**
See RARE EARTH METALS plus Air.

**Halogens**
See RARE EARTH METALS plus Halogens.

**ZIEGLER-TYPE CATALYSTS**

*Allyl Chloride*
See SULFURIC ACID plus Allyl Chloride.

**ZINC** Zn

**Acids**
Zinc powder or dust in contact with acids evolves hydrogen. The heat of reaction is sufficient that the hydrogen may ignite.
*Lab. Govt. Chemist* (1965).

**Ammonium Nitrate**
The two substances are mixed intimately and wetted with 3 or 4 drops of water. After a short time, a violent reaction occurs with evolution of steam and zinc oxide.
*Greaves* (1967).
*Mellor* **8, Supp. 1:** 546 (1964).
See also AMMONIUM NITRATE plus Metals (powdered).

**Barium Dioxide**
See MAGNESIUM plus Barium Nitrate, Barium Dioxide and Zinc.

**Barium Nitrate**
See MAGNESIUM plus Barium Nitrate, Barium Dioxide and Zinc.

**Cadmium**
See ZINC plus Selenium.

**Carbon Disulfide**
A mixture of zinc and carbon disulfide reacts with incandescence.
*Mellor* **4:** 476–90 (1946–1947).

**Chlorates**
A mixture of powdered zinc and an oxidizing agent such as potassium chlorate can be exploded by percussion.
*Mellor* **4:** 480 (1946–1947).

**Chlorine**
Zinc burns in moist chlorine.
*Mellor* **4:** 476 (1946–1947).

**Chlorine Trifluoride**
See ALUMINUM plus Chlorine Trifluoride.

**Chromic Anhydride**
A violent reaction or flaming is likely in the reaction of chromic anhydride and zinc dust.
*Mellor* **11:** 237 (1946–1947).

**Ethyl Acetoacetate and Tribromoneopentyl Alcohol**
See ETHYL ACETOACETATE plus Tribromoneopentyl and Zinc.

**Fluorine**
See FLUORINE plus Zinc.

**Hydrazine Mononitrate**
When hydrazine mononitrate is heated in contact with zinc, copper and most other metals as well as oxides, sulfides, nitrides and carbides, a flaming decomposition occurs at temperatures a little above its melting point.
*Mellor* **8:** 327 (1946–1947).

**Hydroxylamine**
Hydroxylamine is reduced when heated with zinc dust; sometimes the mixture merely ignites; other times, it explodes.
*Mellor* **8:** 290 (1946–1947).

**Lead Azide**
See COPPER plus Lead Azide.

**Magnesium, Barium Nitrate and Barium Dioxide**
See MAGNESIUM plus Barium Nitrate, Barium Dioxide and Zinc.

**Manganese Chloride**
Zinc powder reacts explosively when heated with manganese chloride.
*Mellor* **4:** 479 (1946–1947).

**Nitric Acid**
When concentrated nitric acid is poured on molten zinc, the reaction proceeds with incandescence.
*Mellor* **4:** 476–90 (1946–1947).

**Performic Acid**
Powdered zinc can decompose performic acid violently, causing an explosion.
*Berichte* **48:** 1139 (1915).

**Potassium Chlorate**
See ZINC plus Chlorates.

**Potassium Nitrate**
Powdered zinc and potassium nitrate explode if heated.
*Mellor* **7:** 116 (1946–1947).

**Potassium Peroxide**
See POTASSIUM plus Potassium Peroxide.



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**Selenium**
The reaction between zinc and selenium or tellurium is accompanied by incandescence (cadmium less so).
*Mellor* **4:** 480 (1946–1947).

**Sodium Chlorate**
See ZINC plus Chlorates.

**Sodium Peroxide**
Sodium peroxide oxidizes zinc with incandescence.
*Mellor* **2:** 490–93 (1946–1947).

**Sulfur**
See SULFUR plus Zinc.

**Tellurium**
See ZINC plus Selenium.

**Water**
Zinc powder or dust in contact with water or damp air evolves hydrogen. The heat of reaction is sufficient that the hydrogen may ignite.
*Haz. Chem. Data* p. 171 (1966).
*Lab. Govt. Chemist* (1965).

**Zinc Peroxide**
See ALUMINUM plus Zinc Peroxide.

## ZINC AMIDE $Zn(NH_2)_2$

**Hydrazine**
The action of an ethereal solution of hydrazine on zinc diamide or diethyl zinc, gives a product, zinc hydrazine, which explodes at 70°C.
*Mellor* **8:** 315 (1946–1947).

## ZINC BENZENEDIAZONIUM CHLORIDE
$C_6H_5$-N=NClZn$Cl_2$

**(self-reactive)**
Zinc benzenediazonium chloride had been washed in dry acetone and had been stored in a vacuum desiccator 15 hours when it exploded.
*Chem. & Ind.* p. 58–9 (1956).

## ZINC BROMATE $Zn(BrO_3)_2$

**Aluminum**
See ALUMINUM plus Bromates.

**Arsenic**
See ARSENIC plus Bromates.

**Carbon**
See CARBON plus Bromates.

**Copper**
See COPPER plus Bromates.

**Metal Sulfides**
See METAL SULFIDES plus Bromates.

**Organic Matter**
See BROMATES plus Organic Matter.

**Phosphorus**
See PHOSPHORUS plus Bromates.

**Sulfur**
See SULFUR plus Bromates.

## ZINC BROMIDE $ZnBr_2$

**Potassium**
See POTASSIUM plus Aluminum Bromide.

**Sodium**
See SODIUM plus Aluminum Bromide.

## ZINC CHLORATE $Zn(ClO_3)_2$

**Aluminum**
See ALUMINUM plus Bromates.

**Antimony Sulfide**
See CHLORATES plus Antimony Sulfide. See also METAL SULFIDES plus Bromates.

**Arsenic**
See ARSENIC plus Bromates.

**Arsenic Sulfide**
See CHLORATES plus Arsenic Sulfide. See also METAL SULFIDES plus Bromates.

**Carbon**
See CARBON plus Bromates.

**Charcoal**
Zinc chlorate and charcoal (or finely divided organic matter) form mixtures which may ignite or explode. Such ignition or explosion may be caused by friction, percussion, or shock.
*U.S. Army Ord. Safety Man.* (1951).
See also CHLORATES plus Organic Matter.

**Copper**
See COPPER plus Bromates.

**Copper Sulfide**
See COPPER SULFIDE plus Cadmium Chlorate.

**Manganese Dioxide**
See CHLORATES plus Manganese Dioxide.

**Metal Sulfides**
See METAL SULFIDES plus Bromates.

**Organic Acids (Dibasic)**
See CHLORATES plus Organic Acids.

**Organic Matter**
See ZINC CHLORATE plus Charcoal. See ALUMINUM plus Bromates.
See CHLORATES plus Organic Matter.

**Phosphorus**
See PHOSPHORUS plus Bromates.

**Stannic Sulfide**
See STANNIC SULFIDE plus Cadmium Chlorate.
See METAL SULFIDES plus Bromates.

**Stannous Sulfide**
See STANNOUS SULFIDE plus Cadmium Chlorate.
See METAL SULFIDES plus Bromates.

**Sulfur**
See SULFUR plus Bromates. See CHLORATES plus Organic Matter.

**Sulfuric Acid**
Zinc chlorate in contact with concentrated sulfuric acid is likely to cause fires and explosions.
*Bahme,* p. 29 (1961).
See CHLORATES plus Acids.



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**ZINC CHLORIDE** $ZnCl_2$

**Potassium**
See POTASSIUM plus Aluminum Bromide.

**ZINC CYANIDE** $Zn(CN)_2$

**Magnesium**
See MAGNESIUM plus Cadmium Cyanide.

**ZINC DIALKYLS**

**Air**
These compounds are spontaneously flammable in air.
*Von Schwartz,* p. 329 (1918).

**ZINC FLUORIDE** $ZnF_2$

**Potassium**
See POTASSIUM plus Ammonium Bromide.

**ZINC-HYDRAZINE CHLORATE**

**(self-reactive)**
This compound detonates when struck but is less sensitive than tetramminiozinc chlorate.
*Mellor* **2, Supp. 1:** 592 (1956).

**ZINC IODATE** $Zn(IO_3)_2$

**Aluminum**
See ALUMINUM plus Bromates.

**Arsenic**
See ARSENIC plus Bromates.

**Carbon**
See CARBON plus Bromates.

**ZINC IODIDE** $ZI_2$

**Potassium**
See POTASSIUM plus Alumium Bromide.

**ZINC NITRATE** $Zn(NO_3)_2$

**Carbon**
See CARBON plus Zinc Nitrate.

**Copper**
See COPPER plus Bromates.

**Metal Sulfides**
See METAL SULFIDES plus Bromates.

**Organic Matter**
See BROMATES plus Organic Matter.

**Phosphorus**
See PHOSPHORUS plus Bromates.

**Sulfur**
See SULFUR plus Bromates.

**ZINC OXIDE** ZnO

**Chlorinated Rubber**
Reaction between zinc oxide and chlorinated rubber in a large batch resulted in a violent explosion that wrecked a manufacturing building.
*Chem. and Eng. News* **40** (36): 79 (1962).

**Magnesium**
See MAGNESIUM plus Beryllium Oxide.

**ZINC PEROXIDE** $ZnO_2$

**Aluminum**
See ALUMINUM plus Zinc Peroxide.

**Zinc**
See ALUMINUM plus Zinc Peroxide.

**ZINC PHOSPHIDE** $Zn_3P_2$

**Water**
Moisture reacts with zinc phosphide with production of phosphine, a spontaneously flammable gas.
*Oldbury Chemicals.*

**ZINC SULFIDE** ZnS

**Iodine Monochloride**
See IODINE MONOCHLORIDE plus Cadmium Sulfide.

**ZINC-TETRAMMINE CHLORATE** $Zn(NH_3)_4(ClO_3)_2$

**(self-reactive)**
This compound detonates when struck.
*Mellor* **2, Supp. 1:** 592 (1956).

**ZINC-TETRAMMINE PERCHLORATE** $Zn(NH_3)_4(ClO_4)_2$

**(self-reactive)**
This compound detonates when struck but is less sensitive than tetramminiozine chlorate.
*Mellor* **2, Supp. 1:** 592 (1956).

**ZIRCONIUM** Zr

**Air**
See TANTALUM plus Air.

**Alkali Hydroxides**
When a mixture of alkali hydroxide and zirconium is heated, the liberated oxygen reacts explosively with the zirconium.
*Mellor* **7:** 116 (1946–1947).

**Alkali Metal Chromates**
See ZIRCONIUM plus Alkali Metal Salts.

**Alkali Metal Dichromates**
See ZIRCONIUM plus Alkali Metal Salts.

**Alkali Metal Molybdates**
See ZIRCONIUM plus Alkali Metal Salts.

**Alkali Metal Salts**
Chromates, dichromates, sulfates, molybdates and tungstates of lithium, sodium, potassium, rubidium and cesium will react violently, even explosively, with an excess of zirconium powder and yield the impure metal.
*Ellern,* p. 249 (1968). *Mellor* **2: Supp. II and III.**

**Alkali Metal Sulfates**
See ZIRCONIUM plus Alkali Metal Salts

**Alkali Metal Tungstates**
See ZIRCONIUM plus Alkali Metal Salts.

**Borax**
A mixture of hydrated borax and zirconium explodes when heated.
*Mellor* **7:** 116 (1946–1947).

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**Carbon Tetrachloride**

An explosion occurred when zirconium sponge was placed in a beaker of carbon tetrachloride.
*Allison* (1969).

**Cupric Oxide**

Zirconium explodes violently with cupric oxide or lead oxide.
*Mellor* **7:** 116 (1946–1947).

**Lead**

See LEAD plus Zirconium.

**Lead Oxide**

See ZIRCONIUM plus Cupric Oxide.

**Phosphorus**

See PHOSPHORUS plus Zirconium.

**Potassium Chlorate**

When heated, potassium chlorate reacts with zirconium with slight explosions.
*Mellor* **7:** 116 (1946–1947).

**Potassium Nitrate**

A mixture of powdered zirconium and potassium nitrate explodes when heated above the melting temperature.
*Mellor* **7:** 116 (1946–1947).

## ZIRCONIUM CARBIDE ZrC

**Air**

Zirconium carbide in the form of a fine powder is spontaneously flammable in air.
*Rose* (1961).

## ZIRCONIUM DIBROMIDE $ZrBr_2$

**Air**

Zirconium dibromide is spontaneously flammable in air.
*Douda* (1966).

## ZIRCONIUM DICARBIDE $ZrC_2$

**Bromine**

See BROMINE plus Zirconium Dicarbide.

**Chlorine**

See BROMINE plus Zirconium Dicarbide.

**Fluorine**

See BROMINE plus Zirconium Dicarbide.

**Iodine**

See BROMINE plus Zirconium Dicarbide.

## ZIRCONIUM DIHYDRIDE $ZrH_2$

**Air**

When heated in air, zirconium dihydride burns with incandescence.
*Mellor* **7:** 116 (1946–1947).

## ZIRCONIUM TETRACHLORIDE $ZrCl_4$

**Lithium**

See LITHIUM plus Chromium Trichloride.

## ZIRCONIUM TETRAHYDROBORATE $Zr(BH_4)_4$

**Air**

Zirconium borohydride is spontaneously flammable in air.
*Gaylord,* p. 58 (1956).

## ZIRCONIUM-URANIUM ALLOY

**Nitric Acid**

Contact of etched or cleaned zirconium-uranium alloy with nitric acid results in a mild explosion.
*Allison* (1969).

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## Cross-Reference of Chemical Names and Synonyms

| Synonym | Chemical Name |
|---|---|

### -A-

| | |
|---|---|
| **Acetone cyanohydrin** | a-Hydroxyisobutyronitrile (p. 99) |
| **Acetyl peroxide** | Diacetyl peroxide (p. 69) |
| **Acyl hypofluorites (self-reactive)** | Perfluoropropionyl fluoride plus Fluorine (p. 142) |
| **Air** | *see* other reactants |
| **Aldehydes** | *see* specific aldehyde plus other reactants |
| **Alkyd Azides** | Azides, organic (p. 26) |
| **Aluminum borohydride** | Aluminum tetrahydroborate (p. 17) |
| **Aluminum sesquibromide dialuminum** | Tribromotriethoxy-dialuminum (p. 198) |
| **Aluminum triethyl** | Triethyl aluminum (p. 200) |
| **Aluminum trimethyl** | Trimethyl aluminum (p. 201) |
| **Aluminum triphenyl** | Triphenyl aluminum (p. 202) |
| **Aluminum tripropyl** | Tripropyl aluminum (p. 202) |
| **Ammonium periodate (self-reactive)** | Periodates (self-reactive) (p. 142) |
| **Antimony triethyl** | Triethyl antimony (p. 201) |
| **Antimony trimethyl** | Trimethyl antimony (p. 202) |
| **Antimony tripropyl** | Tripropyl antimony (p. 202) |
| **Antimony trivinyl** | Trivinyl antimony (p. 203) |
| **Arsenic triethyl** | Triethyl arsine (p. 200) |
| **Arsenic trimethyl** | Trimethyl arsenic (p. 201) |
| **Arsenic trisilyl** | Trisilylarsine (p. 202) |
| **Aryl halides** | Dimethyl sulfoxide plus Acyl halides (p. 76) |
| **Azidoalkanes (self-reactive)** | Alkyl azides (self-reactive) (p. 12) |
| **Azidofluorine (self-reactive)** | Fluorine azide (self-reactive) (p. 89) |
| **Azine fluoride** | Fluorine azide (p. 89) |

### -B-

| | |
|---|---|
| **Beryllium diisopropyl** | Diisopropyl beryllium (p. 74) |
| **Biscyclopentadienyl manganese** | Manganocene (p. 116) |
| **Bismuth triethyl** | Triethyl bismuthine (p. 200) |
| **Bismuth trimethyl** | Trimethyl bismuthine (p. 201) |
| **Bismuth trivinyl** | Trivinyl bismuthine (p. 203) |
| **Borane-phosphorus trifluoride compound (self-reactive)** | Phosphorus trifluoride plus Diborane (p. 151) |
| **Boron decahydride** | Tetraborane (p. 193) |
| **Boron hexahydride** | Hexaborane (10) (p. 93) |
| **Boron tri-n-butyl** | Tributylborane (p. 199) |
| **Boron trimethyl** | Trimethylborane (p. 201) |
| **Boron tripropyl** | Tripropylborane (p. 202) |
| **Bromides** | *see* specific bromides as primary entries or under other reactants |
| **1,3-Butadiene** | Butadiene (p. 38) |
| **Butyl boron dichloride** | Butyl dichloroborane (p. 38) |
| **Butyl mercaptan** | 1-Butanethiol (p. 38) |
| **t-Butyl peracetate** | t-Butyl peroxyacetate (p. 38) |
| **t-Butyl perbenzoate** | t-Butyl peroxybenzoate (p. 38) |

### -C-

| | |
|---|---|
| **Cadmium diethyl** | Diethyl cadmium (p. 72) |
| **Caro's acid** | Permonosulfuric acid plus second reactant (p. 143) |
| **Caustic potash** | Potassium hydroxide plus second reactant (p. 160) |
| **Caustic soda** | Sodium hydroxide plus second reactant (p. 179) |
| **Cerium aluminohydride** | Cerium tetrahydroaluminate (p. 47) |
| **Cesium hexahydroaluminate (self-reactive)** | Potassium hexahydroaluminate (self-reactive) (p. 159) |
| **Chlorides** | *see* specific chlorides as primary entries or under other reactants |
| **4-Chloro-3,6-Dinitrophenyldiazonium-2-oxide (self-reactive)** | 4-Chloro-2-nitroaniline plus Nitric acid (p. 59) |
| **Chloropentammine cobalt perchlorate** | Cobaltous-pentammine chloro-perchlorate (p. 64) |
| **Chlorosilicone hydrides** | Chlorosilanes (p. 59) |
| **Chlorosulfonic acid** | Chlorosulfuric acid (p. 59) |
| **Chromic acid** | Chromic anhydride (p. 61) |
| **Chromic oxide** | Chromium oxide (p. 62) |
| **Chromium III oxide** | Chromium oxide (p. 62) |
| **Chromium VI oxide** | Chromic anhydride (p. 61) |
| **Chromium sesquioxide** | Chromium oxide (p. 62) |
| **Chromium trioxide** | Chromic anhydride (p. 61) |
| **Cobalt alloys** | Lithium plus Cobalt alloys (p. 108) |
| **Cobalt triphosphine** | Cobaltic dihydrophosphide (p. 64) |
| **Cobaltic-tetrammine azide (self-reactive)** | Cobaltic-pentammine azide (self-reactive) (p. 64) |
| **Cobaltic-triammine azide (self-reactive)** | Cobaltic-pentammine azide (self-reactive) (p. 64) |
| **Copper acetylide** | Cuprous carbide (p. 67) |
| **Copper aluminohydride** | Cuprous tetrahydroaluminate (p. 68) |
| **Copper cyanide** | Cuprous cyanide (p. 68) |
| **Copper methyl** | Methyl copper (p. 120) |
| **Copper oxide** | Cupric oxide (p. 67) |

### -D-

| | |
|---|---|
| **Diacetylene** | Butadiyne (p. 38) |
| **Diboron tetrachloride** | Tetrachlorodiborane (p. 193) |
| **Dibromo-3,5-dimethoxyaniline (self-reactive)** | 2-Bromo-3, 5-dimethoxyaniline (self-reactive) (p. 37) |
| **Dicyclopentadienyliron** | Ferrocene (p. 84) |
| **Diethoxy-siloxene** | 2, 2-Diethoxycyclodisiloxane (p. 72) |
| **Diethyl aluminum bromide** | Bromodiethylaluminum (p. 37) |
| **Diethyl aluminum chloride** | Chlorodiethylaluminum (p. 57) |
| **Diethyl bismuth chloride** | Chlorodiethylbismuthine (p. 58) |
| **Diethyl boron chloride** | Chlorodiethylborane (p. 58) |
| **Diethylene glycol dimethyl ether** | Bis(2-methoxyethyl) ether (p. 120) |
| **Diethylene glycol monomethyl ether** | 2 (2-methoxyethoxy) ethanol (p. 120) |
| **Diethyl-4-ethoxybutylamine** | (4-Ethoxybutyl) diethylaluminum (p. 79) |
| **1,1-Diethyoxy-2-chloroethane** | 2-Chloro-1, 1-diethoxyethane (p. 58) |
| **Dihydrazinocupric chlorate** | Cupric-dihydrazine chlorate (p. 66) |
| **Dihydrohexaborane** | Hexaborane (12) (p. 93) |
| **Diisobutyl aluminum chloride** | Chlorodiisobutyl aluminum (p. 58) |
| **Dimethylallylarsine** | Allydimethyl arsine (p. 13) |
| **Dimethylamino chlorodiborane** | Chloro (dimethylamino) diborane (p. 58) |
| **Dimethylbenzylcarbinol** | 2(X, y-xylyl)ethanol (p. 206) |
| **Dimethyldichlorosilane** | Dichlorodimethylsilane (p. 71) |
| **Dioxygen difluoride** | Difluorine peroxide (p. 74) |
| **Dipotassium nitroacetate** | Potassium aci-nitroacetate (p. 157) |



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| Synonym | Chemical Name |
|---|---|
| **Dipropylchloroborine** | Chlorodipropylborane (p. 58) |
| **Disilyamino dichloroborine** | Dichloro(disilylamino)borane (p. 71) |
| **Disodium nitrite (self-reactive)** | Potassium plus Sodium nitrite and Ammonia (p. 156) |
| **Disulfur dinitride** | Sulfur nitride (p. 192) |
| **Divinyl acetylene** | 1, 5-Hexadien-3-yne (p. 93) |

**-E-**

| | |
|---|---|
| **Ethanolamine** | 2-Amino ethanol (p. 17) |
| **Ethyl aluminum dichloride** | Dichloroethylaluminum (p. 71) |
| **Ethyl aluminum sesquichloride** | Trichlorotriethyldialuminum (p. 200) |
| **Ethyl azides (self-reactive)** | Methyl azides (self-reactive) (p. 120) |
| **Ethyl boron dichloride** | Dichloroethylborane (p. 72) |
| **Ethyl isonitrile** | Isocyanoethane (p. 104) |
| **Ethylene chlorohydrin** | 2-Chloroethanol (p. 58) |
| **Ethylene cyanohydrin** | 2-Cyanoethanol (p. 68) |
| **Ethylene dichloride** | 1, 2-Dichloroethane (p. 72) |
| **Ethylene glycol monomethyl ether** | 2-Methoxyethanol (p. 120) |
| **Ethyltrichlorosilane** | Trichloroethylsilane (p. 199) |

**-F-**

| | |
|---|---|
| **Fluorazide** | Fluorine azide (p. 89) |

**-G-**

| | |
|---|---|
| **Gallium triethyl** | Triethyl gallium (p. 201) |
| **Gallium trimethyl** | Trimethyl gallium (p. 202) |
| **Guanidine nitrate (self-reactive)** | Ammonium thiocyanate plus Lead nitrate (p. 22) |

**-H-**

| | |
|---|---|
| **Hafnium borohydride** | Hafnium tetrahydroborate (p. 92) |
| **Halogenated hydrocarbons** | *see* specific halogenated hydrocarbon or under other reactants |
| **Hexammine chromium nitrate** | Chromic-hexammine nitrate (p. 62) |
| **Hexammine cobalt iodate** | Cobaltic-hexammine iodate (p. 64) |
| **Hexammine cobalt perchlorate** | Cobaltic-hexammine perchlorate (p. 64) |
| **Hexammino calcium** | Calcium hexammoniate (p. 41) |
| **Hexamminocadmium chlorate** | Cadmium-haxammine chlorate (p. 39) |
| **Hexamminocadmium perchlorate** | Cadmium-hexammine perchlorate (p. 39) |
| **Hexamminocobalt chlorate** | Cobalt-hexammine chlorate (p. 63) |
| **Hexamminocobalt perchlorate** | Cobalt-hexammine perchlorate (p. 63) |
| **Hexamminocobaltic chlorite** | Cobaltic-hexammine chlorite (p. 63) |
| **Hexamminonickel chlorate** | Nickel-hexammine chlorate (p. 123) |
| **Hexamminonickel perchlorate** | Nickel-hexammine perchlorate (p. 123) |
| **Hydrides** | *see* specific hydrides as primary entries or under other reactants |
| **Hydrogen phosphide** | Diphosphine (p. 77) |

**-I-**

| | |
|---|---|
| **Indium triethyl** | Triethyl indium (p. 201) |
| **Indium tripropyl** | Tripropyl indium (p. 202) |
| **Iodides** | *see* specific iodides as primary entries or under other reactants |
| **Iron alloys** | Lithium plus Cobalt alloys (p. 108) |
| **Isopropyl ether** | Diisopropyl ether (p. 75) |

**-L-**

| | |
|---|---|
| **Lead trinitroresorcinate** | Lead styphnate (p. 107) |
| **Lithium borohydride** | Lithium tetrahydroborate (p. 111) |
| **Lithium butyl** | Butyl lithium (p. 38) |
| **Lithium carbonyl (self-reactive)** | Lithium plus Carbon monoxide and Water (p. 108) |
| **Lithium ethyl** | Ethyl lithium (p. 83) |
| **Lithium methyl** | Methyl lithium (p. 121) |
| **Lithium phenyl** | Phenyl lithium (p. 144) |
| **Lithium phenylazoxide (self-reactive)** | Phenyl-lithium plus Nitrous oxide (p. 144) |
| **Lithium propyl** | Propyl lithium (p. 165) |
| **Lithium sodium hydronitrite** | Lithium plus Sodium nitrite (p. 109) |
| **Lithium tetraazidoborate (self-reactive)** | Boron triazide (self-reactive) (p. 32) |

**-M-**

| | |
|---|---|
| **Magnesium dibutyl** | Dibutyl magnesium (p. 71) |
| **Magnesium diethyl** | Diethyl magnesium (p. 73) |
| **Magnesium dimethyl** | Dimethyl magnesium (p. 76) |
| **Manganese aluminohydride** | Manganous tetrahydroaluminate (p. 116) |
| **Manganese dimethyl** | Dimethyl manganese (p. 76) |
| **Mercurous fluoracetylide (self-reactive)** | Fluoracetylene (self-reactive) (p. 90) |
| **Methyl acetylene** | Propyne (p. 165) |
| **Methyl alcohol** | Methanol (p. 119) |
| **Methyl aluminum sesquichloride** | Trichlorotrimethyldialuminum (p. 200) |
| **Methyl chloroform** | Trichloroethane or other reactants plus trichloroethane (p. 199) |
| **Methyl ethyl ether** | Ethyl methyl ether (p. 83) |
| **Methyl ethyliodoarsine** | Ethyliodomethylarsine (p. 83) |
| **Methyl isonitrile** | Isocyanomethane (p. 104) |
| **n-Methyl n,n-bis diethylborinimide** | Methyl-bis (diethylboryl) amine (p. 120) |
| **Methyl trichlorosilane** | Trichloromethylsilane (p. 200) |
| **Methylene dilithium** | Lithium methylide (p. 111) |
| **Methylene magnesium** | Magnesium methylide (p. 114) |
| **Methylolacrylamide** | n-Hydroxymethylacrylamide (p. 100) |
| **Monofluorotrichloromethane** | Trichlorofluoromethane (p. 199) |

**-N-**

| | |
|---|---|
| **NaK** | Sodium-potassium alloy (p. 183) |
| **Nitrides** | *see* specific nitrides or under other reactants |
| **o-Nitrobenzoyl chloride (self-reactive)** | o-Nitrophenylacetyl chloride (p. 131) |
| **Nitrogen sulfide** | Sulfur nitride (p. 192) |
| **Nitropentammine cobalt nitrate** | Cobaltous-pentammine nitrito-n nitrate (p. 64) |

**-O-**

| | |
|---|---|
| **Oxides** | *see* specific oxides, dioxides, trioxides as primary entries or under other reactants |

**-P-**

| | |
|---|---|
| **Pentamminoazidocobaltic azide** | Cobaltic-pentammine azide (p. 64) |


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| Synonym | Chemical Name |
|---|---|
| **Pentamminochlorocobaltic chlorite** | Cobaltic-pentammine chlorite (p. 64) |
| **Pentasilver trihydroxy diamidophosphate** | Silver diamidotrioxyphosphorane (p. 170) |
| **Peracetic acid** | Peroxyacetic acid (p. 143) |
| **Percamphoric acid** | Peroxycamphoric acid (p. 143) |
| **Perchloryl fluoroxide** | Fluorine perchlorate (p. 89) |
| **Performic acid** | Peroxyformic acid (p. 144) |
| **Persulfates** | *see* specific persulfates as primary entries or under other reactants |
| **Pertrichloroacetic acid** | Peroxytrichloroacetic acid (p. 143) |
| **Phenyl chloride** | Chlorobenzene (p. 57) |
| **Phenyl cyclotetramethylene borine** | b-Phenylboracyclopentane (p. 144) |
| **Phenyl diazosulfide** | Diphenyl diazosulfide (p. 77) |
| **Phenyl dicyclopentadienyl vanadium** | Phenylvanadocene (p. 145) |
| **Phenylchlorodiazirine** | Benzenediazonium chloride (p. 29) |
| **1-Phenyl-2-methyl-propyl alcohol** | 2-Methyl-3-phenyl-1-propanol (p. 121) |
| **Phosphides** | *see* specific phosphides as primary entries or under other reactants |
| **Phosphoric anhydride** | Phosphorus pentoxide (p. 150) |
| **Phosphorus oxide** | Phosphorus trioxide (p. 151) |
| **Phosphorus tetratriiodide** | Tetraphosphorus triiodide (p. 195) |
| **Phosphorus tetratriselenide** | Tetraphosphorus triselenide (p. 195) |
| **Phosphorus triflouride-borane compound (self-reactive)** | Phosphorus trifluoride plus Diborane (p. 151) |
| **Picrates** | Specific picrates or under other reactants (p. 152) |
| **Piranha solution** | Permonosulfuric acid (p. 143) |
| **Polychloroprene** | Neoprene (p. 122) |
| **Polymethylmethacrylate** | Methyl methacrylate polymer (p. 121) |
| **Polytetrafluoroethylene** | Tetrafluorethylene polymer (p. 194) |
| **Polyvinylchloride acetate** | Vinyl acetate-chloride copolymer (p. 205) |
| **Potassium borohydride** | Potassium tetrahydroborate (p. 163) |
| **Potassium dihydrophosphide (self-reactive)** | Potassium plus Phosphine and Ammonia (p. 156) |
| **Potassium mercuricyanide** | Potassium tricyanomercurate (p. 163) |
| **Potassium tetraoxide** | Potassium superoxide $KO_2$ (p. 163) |
| **Propargyl alcohol** | 2-Propyn-1-ol (p. 165) |
| **Propargyl bromide** | 3-Bromo-1-propyne (p. 37) |
| **Propargyl chloride** | 3-Chloro-1-propyne (p. 59) |
| **Propyl perchlorate (self-reactive)** | Methyl perchlorate (self-reactive) (p. 121) |
| **Propylene dichloride** | 1, 2-Dichloropropane (p. 72) |
| **Prosiloxane** | Oxosilane (p. 136) |

## -Q-

| | |
|---|---|
| **Quicklime** | Calcium oxide (p. 43) |

## -S-

| | |
|---|---|
| **Silicides** | *see* specific silicides as primary entries or under other reactants |
| **Silicocyn** | Silicon nitride (p. 169) |
| **Silicon hydride** | Silane (p. 168) |
| **Silver fluoroacetylide (self-reactive)** | Fluoroacetylene (self-reactive) (p. 90) |
| **Silver perchlorate-acetic acid solvated salt (self-reactive)** | Silver perchlorate plus Acetic acid (p. 172) |
| **Silver phenyl** | Phenyl silver (p. 145) |
| **Sodium aluminum hydride** | Sodium tetrahydroaluminate (p. 185) |
| **Sodium benzyl** | Benzyl sodium (p. 29) |
| **Sodium dioxide** | Sodium peroxide (p. 182) |
| **Sodium ethoxyacetylide (self-reactive)** | Sodium amide plus 1, 1-Diethoxy-2-chloroethane (p. 176) |
| **Sodium ethyl** | Ethyl sodium (p. 84) |
| **Sodium methyl** | Methyl sodium (p. 121) |
| **Sodium methylate** | Sodium methoxide (p. 181) |
| **Sodium nitromethane** | Sodium aci-nitromethylide (p. 176) |
| **Sodium-o-nitrothiophenate** | Sodium-o-nitrophenyl sulfide (p. 182) |
| **Sulfides** | *see* specific sulfides as primary entries or under other reactants |

## -T-

| | |
|---|---|
| **Tellurium diethyl** | Diethyl telluride (p. 73) |
| **Tellurium hydropentachloride** | Tellurium tetrachloride hydrochloride (p. 193) |
| **Tetraacetenyl nickel tetrapotassium** | Potassium tetraethynylnickelate (p. 163) |
| **Tetramethylsilane** | Tetramethyl silicane (p. 194) |
| **Tetramminocupric chlorate** | Cupric-tetrammine chlorate (p. 67) |
| **Tetramminocupric perchlorate** | Cupric-tetrammine perchlorate (p. 67) |
| **Tetramminozinc chlorate** | Zinc-tetrammine chlorate (p. 208) |
| **Tetramminozinc perchlorate** | Zinc-tetrammine perchlorate (p. 208) |
| **Tetrasilver trihydroxydiaminophosphate** | Silver diamidotrioxyphosphorane (p. 170) |
| **Thallium trimethyl** | Trimethyl thallium (p. 202) |
| **Thermite** | Aluminum plus Iron oxide (p. 14) |
| **Thiophenates** | Phenyl sulfide salts (p. 145) |
| **2,6,-n-Trichlorobenzoquinonimine (self-reactive)** | 2, 6-Dibromo-n-chlorobenzoquinonimine (self-reactive) (p. 70) |
| **Trichloromethyl perchlorate (self-reactive)** | Silver perchlorate plus Carbon tetrachoride and Hydrochloric acid (p. 172) |
| **Triethyl aluminum sesquichloride** | Trichlorotriethyldialuminum (p. 200) |
| **Triethyl antimony** | Triethylstibine (p. 201) |
| **Trifluoropropyl methyl polysiloxane** | Methyl (trifluoropropyl) polysiloxane (p. 121) |
| **Trihydrazinocadmium chlorate** | Cadmium-trihydrazine chlorate (p. 40) |
| **Trihydrazinocadmium perchlorate** | Cadmium-trihydrazine perchlorate (p. 40) |
| **Trihydrazinocobaltous chlorate** | Cobaltous-trihydrazine chlorate (p. 64) |
| **Trihydrazinonickel chlorate** | Nickel-trihydrazine chlorate (p. 123) |
| **Trihydrazinonickel nitrate** | Nickel-trihydrazine nitrate (p. 123) |
| **Trimethyl aluminum bromide** | Dibromotrimethylaluminum (p. 71) |
| **Trimethyl antimony** | Trimethylstibine (p. 202) |
| **Trimethyl antimony sulfate** | Trimethylstibine sulfate (p. 202) |
| **Trimethyl arsenic** | Trimethylarsine (p. 201) |
| **Trimethyl chlorosilane** | Chlorotrimethylsilane (p. 61) |
| **Triphenyl tungsten-tris(phenyl lithium)-tri-(diethyl) ether** | Lithium hexaphenyltungstate etherate (p. 111) |

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| Synonym | Chemical Name |
|---|---|
| **Tripropyl antimony** | Tripropylstibine (p. 202) |
| **1,3,5-Tris(nitromethyl)benzene (self-reactive)** | Nitric acid plus Mesitylene (p. 126) |

**-U-**

| Synonym | Chemical Name |
|---|---|
| **Unsymmetrical dimethylhydrazine** | uns-Dimethylhydrazine (p. 76) |
| **Uranium borohydride** | Uranium tetrahydroborate (p. 204) |
| **Uranium carbide** | Uranium dicarbide (p. 204) |

**-V-**

| Synonym | Chemical Name |
|---|---|
| **Vinyl trichloro silane** | Trichlorvinylsilane (p. 200) |

**-Z-**

| Synonym | Chemical Name |
|---|---|
| **Zinc diethyl** | Diethyl zinc (p. 73) |
| **Zinc dipropyl** | Dipropyl zinc (p. 78) |
| **Zinc divinyl** | Divinyl zinc (p. 78) |
| **Zirconium borohydride** | Zirconium tetrahydroborate (p. 209) |

## Cross-Reference of Chemical Names and CAS Numbers

| CAS No. | Chemical Name |
|---|---|
| **50-00-0** | Formaldehyde |
| **50-21-5** | Lactic acid |
| **50-99-7** | Dextrose |
| **55-63-0** | Nitroglycerin |
| **56-23-5** | Carbon tetrachloride |
| **56-38-2** | Parathion |
| **57-13-6** | Urea |
| **57-14-7** | uns-Dimethylhydrazine (UDMH) |
| **57-57-8** | Propiolactone |
| **60-29-7** | Diethyl ether |
| **60-34-4** | Methylhydrazine |
| **62-53-3** | Aniline |
| **62-56-6** | Thiourea |
| **64-17-5** | Ethyl alcohol |
| **64-18-6** | Formic acid |
| **64-19-7** | Acetic acid |
| **64-67-5** | Diethyl sulfate |
| **67-56-1** | Methanol |
| **67-63-0** | Isopropyl alcohol |
| **67-64-1** | Acetone |
| **67-66-3** | Chloroform |
| **67-68-5** | Dimethyl sulfoxide |
| **71-23-8** | Propyl alcohol |
| **71-41-0** | Amyl alcohol |
| **71-43-2** | Benzene |
| **71-55-6** | Methyl chloroform |
| **72-20-8** | Endrin |
| **74-82-8** | Methane |
| **74-83-9** | Methyl bromide |
| **74-84-0** | Ethane |
| **74-85-1** | Ethylene |
| **74-86-2** | Acetylene |
| **74-87-3** | Methyl chloride |
| **74-90-8** | Hydrogen cyanide |
| **74-98-6** | Propane |
| **74-99-7** | Propyne |
| **75-01-4** | Vinyl chloride |
| **75-05-8** | Acetonitrile |
| **75-07-0** | Acetaldehyde |
| **75-09-2** | Dichloromethane |
| **75-11-6** | Methylene iodide |
| **75-15-0** | Carbon disulfide |
| **75-20-7** | Calcium carbide |
| **75-21-8** | Ethylene oxide |
| **75-24-1** | Trimethylaluminum |
| **75-25-2** | Bromoform |
| **75-35-4** | Vinylidene chloride |
| **75-36-5** | Acetyl chloride |
| **75-44-5** | Phosgene |
| **75-47-8** | Iodoform |
| **75-56-9** | Propylene oxide |
| **75-65-0** | t-Butyl alcohol |
| **75-69-4** | Trichlorofluoromethane |

| CAS No. | Chemical Name |
|---|---|
| **75-71-8** | Dichlorodifluoromethane |
| **75-72-9** | Chlorotrifluoromethane |
| **75-73-0** | Tetrafluoromethane |
| **75-76-3** | Tetramethylsilicane |
| **75-78-5** | Dimethyldichlorosilane |
| **75-79-6** | Trichloromethylsilane |
| **75-86-5** | Acetone cyanohydrin |
| **75-94-5** | Trichlorovinylsilane |
| **76-01-7** | Pentachlorethane |
| **76-06-2** | Chloropicrin |
| **76-13-1** | 1, 2-Trichlorotrifluoroethane |
| **76-22-2** | Camphor |
| **77-76-9** | 2-Dimethoxypropane |
| **77-78-1** | Dimethyl sulfate |
| **78-67-1** | a, a'-Azodiisobutyronitrile |
| **78-79-5** | Isoprene |
| **78-87-5** | 1, 2-Dichloropropane |
| **78-93-3** | Ethyl methyl ketone |
| **78-95-5** | Chloroacetone |
| **79-00-5** | 1-Trichloroethane |
| **79-01-6** | Trichloroethylene |
| **79-06-1** | Acrylamide |
| **79-10-7** | Acrylic acid |
| **79-21-0** | Peroxyacetic acid |
| **79-24-3** | Nitroethane |
| **79-34-5** | Tetrachloroethane |
| **79-37-8** | Oxalyl chloride |
| **79-46-9** | 2-Nitropropane |
| **80-15-9** | Cumene hydroperoxide |
| **80-62-6** | Methyl methacrylate |
| **84-74-2** | Dibutyl phthalate |
| **85-44-9** | Phthalic anhydride |
| **87-69-4** | Tartaric acid |
| **88-89-1** | Picric acid |
| **88-99-3** | Phthalic acid |
| **89-63-4** | 4-Chloro-2-nitroaniline |
| **91-20-3** | Naphthalene |
| **91-22-5** | Quinoline |
| **91-23-6** | Nitroanisole |
| **94-36-0** | Benzoyl peroxide |
| **95-50-1** | Dichlorobenzene |
| **95-94-3** | Tetrachlorobenzene |
| **96-10-6** | Chlorodiethylaluminum |
| **96-50-4** | 2-Aminothiazole |
| **97-00-7** | 1-Chloro-2, 4-Dinitrobenzene |
| **97-93-8** | Triethylaluminum |
| **97-94-9** | Triethylborane |
| **98-00-0** | Furfyryl alcohol |
| **98-09-9** | Benzenesulfonyl chloride |
| **98-82-8** | Cumene |
| **98-88-4** | Benzoyl chloride |
| **98-95-3** | Nitrobenzene |
| **99-99-0** | p-Nitrotoluene |



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| CAS No. | Chemical Name |
|---|---|
| 100-07-2 | Anisoyl chloride |
| 100-42-5 | Styrene monomer |
| 100-44-7 | Tolyl chloride |
| 100-51-6 | Benzyl alcohol |
| 100-52-7 | Benzaldeyhyde |
| 100-63-0 | Phenylhydrazine |
| 100-99-2 | Triisobutylaluminum |
| 102-67-0 | Tripropylaluminum |
| 103-71-9 | Phenyl isocyanate |
| 104-01-8 | p-Methoxybenzyl formate |
| 104-03-0 | o-Nitrophenylacetic acid |
| 104-90-5 | 5-Ethyl-2-methylpyridine |
| 104-91-6 | Nitrosophenol |
| 105-64-6 | Diisopropyl peroxydicarbonate |
| 106-89-8 | Epichlorohydrin |
| 106-96-7 | 3-Bromo-1-propyne |
| 106-97-8 | n-Butane |
| 106-99-0 | 1, 3-Butadiene, Butadiene |
| 107-02-8 | Acrolein |
| 107-03-9 | 1-Propanethiol |
| 107-05-1 | Allyl chloride |
| 107-06-2 | Ethylene dichloride |
| 107-07-3 | 2-Chloroethanol |
| 107-13-1 | Acrylonitrile |
| 107-15-3 | Ethylenediamine |
| 107-18-6 | Allyl alcohol |
| 107-19-7 | 2-Propyn-1-ol |
| 107-21-1 | Ethylene glycol |
| 107-22-2 | Glyoxal |
| 107-71-1 | t-Butyl peroxyacetate |
| 107-92-6 | Butyric acid |
| 108-03-2 | Nitropropane |
| 108-05-4 | Vinyl acetate |
| 108-20-3 | Diisopropyl ether |
| 108-23-6 | Isopropyl chloroformate |
| 108-24-7 | Acetic anhydride |
| 108-31-6 | Maleic anhydride |
| 108-44-1 | Toluidine |
| 108-67-8 | Mesitylene |
| 108-77-0 | Cyanuric chloride |
| 108-88-3 | Toluene |
| 108-90-7 | Chlorobenzene |
| 108-93-0 | Cyclohexanol |
| 108-94-1 | Cyclohexanone |
| 108-95-2 | Phenol |
| 109-63-7 | Boron trifluoride etherate |
| 109-72-8 | Butyllithium |
| 109-78-4 | 2-Cyanoethanol, 3-Hydroxypropionitrile |
| 109-79-5 | 1-Butanethiol |
| 109-86-4 | 2-Methoxyethanol |
| 109-89-7 | Diethylamine |
| 109-93-3 | Divinyl ether |
| 109-95-5 | Ethyl nitrite |
| 109-99-9 | Tetrahydrofuran |
| 110-02-1 | Thiophene |
| 110-22-5 | Acetyl peroxide |
| 110-46-3 | Isoamyl nitrite |
| 110-74-7 | Propyl formate |
| 110-82-7 | Cyclohexane |
| 110-86-1 | Pyridine |
| 110-89-4 | Piperidine |
| 111-48-8 | Thiodiglycol |
| 111-77-3 | 2(2-Methoxyethoxy) ethanol, Methyl carbitol |
| 111-96-6 | Bis(2-Methoxyethyl) ether |
| 115-07-1 | Propylene |
| 115-10-6 | Dimethyl ether |
| 115-21-9 | Trichloroethysilane |
| 116-14-3 | Tetrafluoroethylene |
| 118-74-1 | Hexachlorobenzene |
| 120-12-7 | Anthracene |

| CAS No. | Chemical Name |
|---|---|
| 121-33-5 | Vanillin |
| 121-45-9 | Trimethyl phosphite |
| 122-04-3 | 4 Nitrobenzoyl chloride |
| 122-39-4 | Diphenylamine |
| 123-31-9 | Hydroquinone |
| 123-39-7 | Methyl formamide |
| 123-72-8 | n-Butyraldehyde |
| 123-86-4 | Butyl acetate |
| 123-91-1 | Dioxane |
| 124-41-4 | Sodium methoxide |
| 126-33-0 | Sulfolane |
| 127-09-3 | Sodium acetate |
| 127-18-4 | Tetrachloroethylene |
| 131-74-8 | Ammonium picrate |
| 138-86-3 | Limonene |
| 140-88-5 | Ethyl acrylate |
| 141-43-5 | 2-Aminoethanol |
| 141-78-6 | Ethyl acetate |
| 141-79-7 | Mesityl oxide |
| 141-97-9 | Ethyl acetoacetate |
| 142-82-5 | Heptane |
| 142-96-1 | Dibutyl ether |
| 143-33-9 | Sodium cyanide |
| 144-55-8 | Sodium bicarbonate |
| 144-62-7 | Oxalic acid |
| 148-53-8 | Vanillin |
| 149-91-7 | Gallic acid |
| 151-50-8 | Potassium cyanide |
| 151-56-4 | Ethyleneimine |
| 298-00-0 | Methyl parathion |
| 298-14-6 | Potassium bicarbonate |
| 301-04-2 | Lead acetate |
| 302-01-2 | Hydrazine |
| 334-88-3 | Diazomethane |
| 372-09-8 | Cyanoacetic acid |
| 460-19-5 | Cyanogen |
| 463-49-0 | Allene |
| 471-34-1 | Calcium carbonate |
| 479-45-8 | Tetryl |
| 497-19-8 | Sodium carbonate |
| 506-64-9 | Silver cyanide |
| 506-65-0 | Gold cyanide |
| 506-78-5 | Cyanogen iodide |
| 506-93-4 | Guanidine nitrate (self-reactive) |
| 506-96-7 | Acetyl bromide |
| 507-25-5 | Carbon tetraiodide |
| 509-14-8 | Tetranitromethane |
| 513-92-8 | Tetraiodoethylene |
| 517-25-9 | Nitroform, Trinitromethane |
| 540-59-0 | 1, 2-Dichloroethylene |
| 540-67-0 | Ethyl methyl ether |
| 544-92-3 | Cuprous cyanide |
| 554-13-2 | Lithium carbonate |
| 557-18-6 | Diethylmagnesium |
| 557-19-7 | Nickel cyanide |
| 557-20-0 | Diethylzinc |
| 557-21-1 | Zinc cyanide |
| 558-13-4 | Carbon tetrabromide |
| 584-08-7 | Potassium carbonate |
| 589-92-4 | 4-Methylcyclohexanone |
| 591-51-5 | Phenyl lithium |
| 592-04-1 | Mercuric cyanide |
| 592-05-2 | Lead cyanide |
| 593-88-4 | Trimethylarsine |
| 594-09-2 | Trimethylphosphine |
| 594-10-5 | Trimethylstibine |
| 598-63-0 | Lead carbonate |



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| CAS No. | Chemical Name |
|---|---|
| 614-45-9 | t-Butyl peroxybenzoate |
| 617-75-4 | Triethlyarsine |
| 627-54-3 | Tellurium diethyl |
| 630-08-0 | Carbon monoxide |
| 631-61-8 | Ammonium acetate |
| 674-82-8 | Diketene |
| 684-93-5 | n-Methyl-n-nitroso urea |
| 692-42-2 | Diethylarsine |
| 782-44-7 | Oxygen (liquid) |
| 822-06-0 | Hexamethylene diisocyanate |
| 865-47-4 | Potassium tert.-butoxide |
| 917-54-4 | Methyl lithium |
| 998-40-3 | Tributylphosphine |
| 1271-19-8 | Titanium dichloride |
| 1299-86-1 | Aluminum carbide |
| 1302-30-3 | Lithium aluminum hydride |
| 1303-28-2 | Arsenic oxide |
| 1303-32-8 | Arsenic disulfide |
| 1303-33-9 | Arsenic sulfide, Arsenic trisulfide |
| 1304-28-5 | Barium oxide |
| 1304-29-6 | Barium peroxide |
| 1304-56-9 | Beryllium oxide |
| 1304-76-3 | Bismuth trioxide |
| 1305-62-0 | Calcium hydroxide |
| 1305-78-8 | Calcium oxide |
| 1305-79-9 | Calcium peroxide |
| 1305-99-3 | Calcium phosphide |
| 1306-19-0 | Cadmium oxide |
| 1306-23-6 | Cadmium sulfide |
| 1309-42-8 | Magnesium hydroxide |
| 1309-48-4 | Magnesium oxide |
| 1309-60-0 | Lead dioxide |
| 1310-58-3 | Potassium hydroxide |
| 1310-73-2 | Sodium hydroxide |
| 1312-81-8 | Lanthanum oxide |
| 1313-13-9 | Manganese dioxide |
| 1313-59-3 | Sodium monoxide, Sodium oxide |
| 1313-60-6 | Sodium peroxide, Sodium superoxide |
| 1313-99-1 | Nickel monoxide |
| 1314-13-2 | Zinc oxide |
| 1314-22-3 | Zinc peroxide |
| 1314-32-5 | Thallic oxide |
| 1314-34-7 | Vanadium sesquioxide |
| 1314-35-8 | Tungsten trioxide |
| 1314-56-3 | Phosphorus pentoxide |
| 1314-62-1 | Vanadium pentoxide |
| 1314-80-3 | Phosphorus pentasulfide |
| 1314-84-7 | Zinc phosphide |
| 1314-87-0 | Lead sulfide |
| 1314-98-3 | Zinc sulfide |
| 1315-04-4 | Antimony sulfide |
| 1317-33-5 | Molybdenum trioxide |
| 1317-35-7 | Trimanganese tetroxide |
| 1317-36-8 | Lead oxide |
| 1317-37-9 | Ferrous sulfide |
| 1317-38-0 | Cupric oxide |
| 1317-40-4 | Cupric sulfide |
| 1317-65-3 | Limestone (crushed) |
| 1319-77-3 | Cresol |
| 1327-53-3 | Arsenic trioxide |
| 1332-37-2 | Iron oxide |
| 1333-74-0 | Hydrogen |
| 1333-82-0 | Chromic anhydride |
| 1335-31-5 | Mercuric cyanide oxide |
| 1336-21-6 | Ammonium hydroxide |
| 1344-08-7 | Sodium polysulfide |
| 1344-09-8 | Sodium silicate |
| 1344-28-1 | Aluminum oxide |
| 1344-43-0 | Manganous oxide |
| 1344-48-5 | Mercuric sulfide |
| 1344-57-6 | Uranium dioxide |
| 1345-04-6 | Antimony trisulfide |
| 1445-79-0 | Trimethylgallium |
| 1590-87-0 | Disilane (silicoethane) |
| 1762-95-4 | Ammonium thiocyanate |
| 2551-62-4 | Sulfur hexafluoride |
| 2681-52-9 | Sodium hypochlorite |
| 2696-92-6 | Nitrosyl chloride |
| 2999-74-8 | Dimethylmagnesium |
| 3251-23-8 | Cupric nitrate |
| 3811-04-9 | Potassium chlorate |
| 4109-96-0 | Dichlorosilane |
| 4170-30-3 | Crotonaldehyde |
| 5329-14-6 | Sulfamic acid |
| 6100-20-5 | Potassium tetroxide |
| 6484-52-2 | Ammonium nitrate |
| 7439-88-5 | Iridium |
| 7439-89-6 | Iron |
| 7439-91-0 | Lanthanum |
| 7439-92-1 | Lead |
| 7439-93-2 | Lithium |
| 7439-94-3 | Lutetium |
| 7439-95-4 | Magnesium |
| 7439-96-5 | Manganese |
| 7439-97-6 | Mercury |
| 7439-98-7 | Molybdenum |
| 7440-00-8 | Neodymium |
| 7440-02-0 | Nickel |
| 7440-03-0 | Niobium (columbium) |
| 7440-04-2 | Osmium |
| 7440-05-3 | Palladium |
| 7440-06-4 | Platinum |
| 7440-09-7 | Potassium |
| 7440-10-0 | Praseodymium |
| 7440-15-5 | Rhenium |
| 7440-16-6 | Rhodium |
| 7440-17-7 | Rubidium |
| 7440-18-8 | Ruthenium |
| 7440-19-9 | Samarium |
| 7440-21-3 | Silicon |
| 7440-22-4 | Silver |
| 7440-25-7 | Tantalum pentoxide |
| 7440-27-9 | Terbium |
| 7440-28-0 | Thallium |
| 7440-29-1 | Thorium |
| 7440-30-4 | Thulium |
| 7440-31-5 | Tin |
| 7440-32-6 | Titanium |
| 7440-33-7 | Tungsten |
| 7440-36-0 | Antimony |
| 7440-38-2 | Arsenic |
| 7440-41-7 | Beryllium |
| 7440-42-8 | Boron |
| 7440-43-9 | Cadmium |
| 7440-44-0 | Carbon |
| 7440-45-1 | Cerium |
| 7440-46-2 | Cesium |
| 7440-47-3 | Chromium |
| 7440-48-4 | Cobalt |
| 7440-50-8 | Copper |
| 7440-52-0 | Erbium |
| 7440-53-1 | Europium |
| 7440-54-2 | Gadolinium |
| 7440-56-4 | Germanium |
| 7440-57-5 | Gold |
| 7440-60-0 | Holmium |
| 7440-62-2 | Vanadium |
| 7440-66-6 | Zinc |
| 7440-70-2 | Calcium |
| 7440-74-6 | Indium |



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| CAS No. | Chemical Name |
|---|---|
| 7446-09-5 | Sulfur dioxide |
| 7446-11-9 | Sulfur trioxide |
| 7446-14-2 | Lead sulfate |
| 7446-70-0 | Aluminum chloride |
| 7447-39-4 | Cupric chloride |
| 7447-40-7 | Potassium chloride |
| 7447-41-8 | Lithium chloride |
| 7487-94-7 | Mercuric chloride |
| 7546-30-7 | Mercurous chloride |
| 7550-45-0 | Titanium tetrachloride |
| 7553-56-2 | Iodine |
| 7572-29-4 | Dichloracetylene |
| 7580-67-8 | Lithium hydride |
| 7601-89-0 | Sodium perchlorate |
| 7601-90-3 | Perchloric acid |
| 7616-94-6 | Perchloryl fluoride |
| 7631-86-9 | Silica (silica dioxide) |
| 7631-99-4 | Sodium nitrate |
| 7632-00-0 | Sodium nitrite |
| 7637-07-2 | Boron trifluoride |
| 7646-69-7 | Sodium hydride |
| 7646-78-8 | Stannic chloride |
| 7646-85-7 | Zinc chloride |
| 7647-01-0 | Hydrochloric acid, Hydrogen chloride |
| 7647-14-5 | Sodium chloride |
| 7647-15-6 | Sodium bromide |
| 7647-17-8 | Cesium chloride |
| 7647-18-9 | Antimonyl chloride |
| 7664-39-3 | Hydrofluoric acid, Hydrogen fluoride |
| 7664-41-7 | Ammonia (anhydrous) |
| 7664-93-9 | Sulfuric acid |
| 7673-09-8 | Trichloromelamine |
| 7681-11-0 | Potassium iodide |
| 7681-53-0 | Sodium hypophosphite |
| 7681-55-2 | Sodium iodate |
| 7681-82-5 | Sodium iodide |
| 7693-27-8 | Magnesium hydride |
| 7697-37-2 | Nitric acid |
| 7704-34-9 | Sulfur |
| 7704-99-6 | Zirconium dihydride |
| 7718-54-9 | Nickel chloride |
| 7719-09-7 | Thionyl chloride |
| 7719-12-2 | Phosphorus trichloride |
| 7722-64-7 | Potassium permanganate |
| 7722-76-1 | Ammonium phosphate, Monoammonium phosphate |
| 7722-84-1 | Hydrogen peroxide |
| 7722-86-3 | Permonosulfuric acid (Caro's acid) |
| 7723-14-0 | Phosphorus |
| 7726-95-6 | Bromine |
| 7727-21-1 | Potassium persulfate |
| 7727-37-9 | Nitrogen |
| 7727-43-7 | Barium sulfate |
| 7727-54-0 | Ammonium persulfate |
| 7757-79-1 | Potassium nitrate |
| 7757-82-6 | Sodium sulfate |
| 7758-01-2 | Potassium bromate |
| 7758-02-3 | Potassium bromide |
| 7758-05-6 | Potassium iodate |
| 7758-09-0 | Potassium nitrite |
| 7758-19-2 | Sodium chlorite |
| 7758-89-6 | Cuprous chloride |
| 7758-94-3 | Ferrous chloride |
| 7758-97-6 | Lead chromate |
| 7758-98-7 | Cupric sulfate |
| 7761-88-8 | Silver nitrate |
| 7772-98-7 | Sodium thiosulfate |
| 7772-99-8 | Stannous chloride |
| 7773-01-5 | Manganous chloride |
| 7774-29-0 | Mercuric iodide |
| 7775-09-9 | Sodium chlorate |
| 7775-14-6 | Sodium hydrosulfite |
| 7778-50-9 | Potassium dichromate |
| 7778-54-3 | Calcium hypochlorite |
| 7778-74-7 | Potassium perchlorate |
| 7778-80-5 | Potassium sulfate |
| 7779-88-6 | Zinc nitrate |
| 7782-41-4 | Fluorine |
| 7782-42-5 | Graphite |
| 7782-44-7 | Oxygen |
| 7782-49-2 | Selenium |
| 7782-50-5 | Chlorine |
| 7782-65-2 | Germane (Germanium hydride) |
| 7782-78-7 | Nitrosylsulfuric acid |
| 7782-89-0 | Lithium amide |
| 7782-92-5 | Sodium amide |
| 7783-06-4 | Hydrogen sulfide |
| 7783-07-5 | Hydrogen selenide |
| 7783-18-8 | Ammonium thiosulfate |
| 7783-20-2 | Ammonium sulfate |
| 7783-46-2 | Lead fluoride |
| 7783-49-5 | Zinc fluoride |
| 7783-54-2 | Nitrogen trifluoride |
| 7783-55-3 | Phosphorus trifluoride |
| 7783-66-6 | Iodine pentafluoride |
| 7783-70-2 | Antimony pentafluoride |
| 7783-90-6 | Silver chloride |
| 7783-93-9 | Silver perchlorate |
| 7783-95-1 | Silver fluoride |
| 7783-96-2 | Silver iodide |
| 7784-18-1 | Aluminum fluoride |
| 7784-21-6 | Aluminum hydride |
| 7784-34-1 | Arsenic trichloride |
| 7784-42-1 | Arsine |
| 7784-45-4 | Arsenic triiodide |
| 7786-30-3 | Magnesium chloride |
| 7787-60-2 | Bismuth trichloride |
| 7787-70-4 | Cuprous bromide |
| 7787-71-5 | Bromine trifluoride |
| 7789-09-5 | Ammonium dichromate |
| 7789-23-3 | Potassium fluoride |
| 7789-30-2 | Bromine pentafluoride |
| 7789-33-5 | Iodine monobromide |
| 7789-38-0 | Sodium bromate |
| 7789-40-4 | Thallous bromide |
| 7789-42-6 | Cadmium bromide |
| 7789-45-9 | Cupric bromide |
| 7789-47-1 | Mercuric bromide |
| 7789-60-8 | Phosphorus tribromide |
| 7789-61-9 | Antimony tribromide |
| 7789-67-5 | Stannic bromide |
| 7789-78-8 | Calcium hydride |
| 7789-79-9 | Calcium hypophosphite |
| 7790-33-2 | Manganous iodide |
| 7790-44-5 | Antimony triiodide |
| 7790-47-8 | Stannic iodide |
| 7790-79-6 | Cadmium fluoride |
| 7790-80-9 | Cadmium iodide |
| 7790-89-8 | Chlorine monofluoride |
| 7790-91-2 | Chlorine trifluoride |
| 7790-93-4 | Chloric acid |
| 7790-94-5 | Chlorosulfuric acid |
| 7790-98-9 | Ammonium perchlorate |
| 7791-10-8 | Strontium chlorate |
| 7791-11-9 | Rubidium chloride |
| 7791-12-0 | Thallous chloride |
| 7791-21-1 | Chlorine monoxide |
| 7791-23-3 | Selenium oxychloride |
| 7791-25-5 | Sulfuryl chloride |
| 7803-49-8 | Hydroxylamine |
| 7803-51-2 | Phosphine |



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| CAS No. | Chemical Name |
|---|---|
| 7803-52-3 | Stibine |
| 7803-62-5 | Silane |
| 8001-26-1 | Linseed oil |
| 8052-42-4 | Asphalt |
| 9002-84-0 | Polytetrafluoroethylene, Teflon® (polytetrafluoroethylene) |
| 9002-88-4 | Polyethylene |
| 9003-07-0 | Polypropylene |
| 9003-27-4 | Polyisobutylene |
| 9003-35-4 | Phenol-formaldehyde resin |
| 9004-34-6 | Cellulose |
| 9006-04-6 | Rubber |
| 9010-98-4 | Neoprene |
| 9011-14-7 | Lucite®, Methyl methacrylate polymer |
| 9011-17-0 | Viton A® |
| 10022-31-8 | Barium nitrate |
| 10024-97-2 | Nitrous oxide |
| 10025-67-9 | Sulfur monochloride |
| 10025-85-1 | Nitrogen trichloride |
| 10025-87-3 | Phosphoryl chloride |
| 10025-91-9 | Antimony trichloride |
| 10026-04-7 | Silicon tetrachloride |
| 10026-11-6 | Zirconium tetrachloride |
| 10026-13-8 | Phosphorus pentachloride |
| 10028-15-6 | Ozone |
| 10028-18-9 | Nickel fluoride |
| 10034-81-8 | Magnesium perchlorate |
| 10034-85-2 | Hydriodic acid, Hydrogen iodide |
| 10035-10-6 | Hydrogen bromide |
| 10038-98-9 | Germanium tetrachloride |
| 10043-11-5 | Boron nitride |
| 10043-35-3 | Boric acid |
| 10043-52-4 | Calcium chloride |
| 10045-94-0 | Mercuric nitrate |
| 10049-04-4 | Chlorine dioxide |
| 10097-28-6 | Silicon monoxide |
| 10099-74-8 | Lead nitrate |
| 10102-43-9 | Nitric oxide |
| 10102-44-0 | Nitrogen dioxide |
| 10108-64-2 | Cadmium chloride |
| 10137-74-3 | Calcium chlorate |
| 10139-47-6 | Zinc iodide |
| 10217-52-4 | Hydrazine hydrate |
| 10294-33-4 | Boron tribromide |
| 10294-34-5 | Boron trichloride |
| 10308-82-4 | Aminoguanidine nitrate |
| 10326-21-3 | Magnesium chlorate |
| 10361-29-2 | Ammonimum carbonate |
| 10361-37-2 | Barium chloride |
| 10361-95-2 | Zinc chlorate |
| 10377-60-3 | Magnesium nitrate |
| 10415-75-5 | Mercurous nitrate |
| 10450-60-9 | Periodic acid |
| 10476-85-4 | Strontium chloride |
| 10476-86-5 | Strontium iodide |
| 10486-19-8 | Tridecanal |
| 10544-72-6 | Nitrogen peroxide, Nitrogen tetroxide |
| 10544-73-7 | Nitrogen trioxide |
| 10545-99-0 | Sulfur dichloride |
| 10588-01-9 | Sodium dichromate |
| 11104-28-2 | Polychlorinated biphenyl |
| 11113-50-1 | Boric acid |
| 11135-81-2 | Sodium-potassium alloy |
| 12013-56-8 | Calcium silicide |
| 12013-82-0 | Calcium nitride |
| 12027-06-4 | Ammonium iodide |
| 12029-98-0 | Iodine pentoxide |
| 12030-88-5 | Potassium superoxide |
| 12033-89-5 | Silicon nitride |
| 12039-13-3 | Titanium disulfide |

| CAS No. | Chemical Name |
|---|---|
| 12057-74-8 | Magnesium phosphide |
| 12058-85-4 | Sodium phosphide |
| 12070-08-5 | Titanium carbide |
| 12070-12-1 | Tungsten carbide |
| 12070-14-3 | Zirconium carbide |
| 12071-33-9 | Uranium dicarbide |
| 12075-68-2 | Trichlorotriethyldialuminum |
| 12124-97-9 | Ammonium bromide |
| 12125-02-9 | Ammonium chloride |
| 12136-45-7 | Potassium oxide |
| 12164-94-2 | Ammonium azide |
| 12504-16-4 | Strontium phosphide |
| 12674-11-2 | Polychlorinated biphenyl |
| 13424-46-9 | Lead azide |
| 13444-85-4 | Nitrogen iodide, Nitrogen triiodide |
| 13446-10-1 | Ammonium permanganate |
| 13462-88-9 | Nickel bromide |
| 13463-39-3 | Nickel carbonyl |
| 13463-40-6 | Iron pentacarbonyl |
| 13463-67-7 | Titanium dixoide |
| 13465-95-7 | Barium perchlorate |
| 13477-00-4 | Barium chlorate |
| 13477-09-3 | Barium hydride |
| 13494-80-9 | Tellurium |
| 13637-76-8 | Lead perchlorate |
| 13746-66-2 | Potassium ferricyanide |
| 13762-51-1 | Potassium tetrahydroborate |
| 13779-96-2 | Sodium tetrahydroaluminate |
| 13818-89-8 | Digermane |
| 13943-58-3 | Potassium ferrocyanide |
| 13973-87-0 | Bromine azide |
| 13981-16-3 | Plutonium |
| 14038-43-8 | Ferric ferrocyanide |
| 14258-49-2 | Ammonium oxalate |
| 14519-17-6 | Magnesium bromate |
| 14674-72-7 | Calcium chlorite |
| 14977-61-8 | Chromyl chloride |
| 15117-48-3 | Plutonium |
| 15219-34-8 | Oxalyl bromide |
| 15245-44-0 | Lead styphnate |
| 15829-53-5 | Mercurous oxide |
| 16721-80-5 | Sodium bisulfide |
| 16853-85-3 | Lithium aluminum hydride |
| 16872-11-0 | Fluoboric acid |
| 16940-66-2 | Sodium tetrahydroborate |
| 16949-15-8 | Lithium tetrahydroborate |
| 17014-71-0 | Potassium peroxide |
| 17242-52-3 | Potassium amide |
| 17702-41-9 | Decaborane |
| 18282-10-5 | Stannic oxide |
| 19287-45-7 | Diborane |
| 19597-69-4 | Lithium azide |
| 19624-22-7 | Pentaborane |
| 20548-54-3 | Calcium sulfide |
| 20667-12-3 | Silver oxide |
| 20762-60-1 | Potassium azide |
| 20859-73-8 | Aluminum phosphide |
| 21109-95-5 | Barium sulfide |
| 21645-51-2 | Aluminum hydroxide |
| 21651-19-4 | Stannous oxide |
| 21908-53-2 | Mercuric oxide |
| 25154-55-6 | o-Nitrophenol |
| 25167-70-8 | Diisobutylene |
| 26628-22-8 | Sodium azide |
| 30525-89-4 | Paraformaldehyde |
| 32480-00-5 | Nitromethane |
| 37211-05-5 | Nickel chloride |
| 38232-63-2 | Mercurous azide |
| 63148-62-9 | Polydimethylsiloxane |
| 65996-77-2 | Coke |


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# REPORT OF HAZARDOUS REACTION

**MAIL TO: Amy B. Spencer, Chemical Engineer**
**National Fire Protection Association**
**1 Batterymarch Park, P.O. Box 9101**
**Quincy, MA 02269-9101**

**REACTANTS:** _____

_____

_____

**DESCRIPTION OF REACTION:** _____

_____

_____

_____

_____

_____

_____

**SOURCE OF INFORMATION (If possible, please include a copy of the documentation):** _____

_____

_____

_____

_____

**SUBMITTED BY:**

**NAME** _____

**ADDRESS** _____

_____

_____

**phone/fax/e-mail** _____

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# The NFPA Codes and Standards Development Process

Since 1896, one of the primary purposes of the NFPA has been to develop and update the standards covering all areas of fire safety.

**Calls for Proposals**
The code adoption process takes place twice each year and begins with a call for proposals from the public to amend existing codes and standards or to develop the content of new fire safety documents.

**Report on Proposals**
Upon receipt of public proposals, the technical committee members meet to review, consider, and act on the proposals. The public proposals – together with the committee action on each proposal and committee-generated proposals – are published in the NFPA's Report on Proposals (ROP). The ROP is then subject to public review and comment.

**Report on Comments**
These public comments are considered and acted upon by the appropriate technical committees. All public comments – together with the committee action on each comment – are published as the Committee's supplementary report in the NFPA's Report on Comments (ROC).

The committee's report and supplementary report are then presented for adoption and open debate at either of NFPA's semi-annual meetings held throughout the United States and Canada.

**Association Action**
The Association meeting may, subject to review and issuance by the NFPA Standards Council, (a) adopt a report as published, (b) adopt a report as amended, contingent upon subsequent approval by the committee, (c) return a report to committee for further study, and (d) return a portion of a report to committee.

**Standards Council Action**
The Standards Council will make a judgement on whether or not to issue an NFPA document based upon the entire record before the Council, including the vote taken at the Association meeting on the technical committee's report.

**Voting Procedures**
Voting at an NFPA Annual or Fall Meeting is restricted to members of record for 180 days prior to the opening of the first general session of the meeting, except that individuals who join the Association at an Annual or Fall Meeting are entitled to vote at the next Fall or Annual Meeting.

"Members" are defined by Article 3.2 of the Bylaws as individuals, firms, corporations, trade or professional associations, institutes, fire departments, fire brigades, and other public or private agencies desiring to advance the purposes of the Association. Each member shall have one vote in the affairs of the Association. Under Article 4.5 of the Bylaws, the vote of such a member shall be cast by that member individually or by an employee designated in writing by the member of record who has registered for the meeting. Such a designated person shall not be eligible to represent more than one voting privilege on each issue, nor cast more than one vote on each issue.

Any member who wishes to designate an employee to cast that member's vote at an Association meeting in place of that member must provide that employee with written authorization to represent the member at the meeting. The authorization must be on company letterhead signed by the member of record, with the membership number indicated, and the authorization must be recorded with the President of NFPA or his designee before the start of the opening general session of the Meeting. That employee, irrespective of his or her own personal membership status, shall be privileged to cast only one vote on each issue before the Association.

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## *Sequence of Events Leading to Publication of an NFPA Committee Document*

Call goes out for proposals to amend existing document or for recommendations on new document.

▼

Committee meets to act on proposals, to develop its own proposals, and to prepare its report.

▼

Committee votes on proposals by letter ballot. If two-thirds approve, report goes forward. Lacking two-thirds approval, report returns to committee.

▼

Report — *Report on Proposals* (ROP) — is published for public review and comment.

▼

Committee meets to act on each public comment received.

▼

Committee votes on comments by letter ballot. If two-thirds approve, supplementary report goes forward. Lacking two-thirds approval, supplementary report returns to committee.

▼

Supplementary report — *Report on Comments* (ROC) — is published for public review.

▼

NFPA membership meets (Annual or Fall Meeting) and acts on committee report (ROP or ROC).

▼

Committee votes on any amendments to report approved at NFPA Annual or Fall Meeting.

▼

Appeals to Standards Council on Association action must be filed within 20 days of the NFPA Annual or Fall Meeting.

▼

Standards Council decides, based on all evidence, whether or not to issue standard or to take other action, including upholding any appeals.

## *Committee Membership Classifications*

The following classifications apply to Technical Committee members and represent their principal interest in the activity of a committee.

M *Manufacturer:* A representative of a maker or marketer of a product, assembly, or system, or portion thereof, that is affected by the standard.

U *User:* A representative of an entity that is subject to the provisions of the standard or that voluntarily uses the standard.

I/M *Installer/Maintainer:* A representative of an entity that is in the business of installing or maintaining a product, assembly, or system affected by the standard.

L *Labor:* A labor representative or employee concerned with safety in the workplace.

R/T *Applied Research/Testing Laboratory:* A representative of an independent testing laboratory or independent applied research organization that promulgates and/or enforces standards.

E *Enforcing Authority:* A representative of an agency or an organization that promulgates and/or enforces standards.

I *Insurance:* A representative of an insurance company, broker, agent, bureau, or inspection agency.

C *Consumer:* A person who is, or represents, the ultimate purchaser of a product, system, or service affected by the standard, but who is not included in the *User* classification.

SE *Special Expert:* A person not representing any of the previous classifications, but who has special expertise in the scope of the standard or portion thereof.

NOTE 1: "Standard" connotes code, standard, recommended practice, or guide.

NOTE 2: A representative includes an employee.

NOTE 3: While these classifications will be used by the Standards Council to achieve a balance for Technical Committees, the Standards Council may determine that new classifications of members or unique interests need representation in order to foster the best possible committee deliberations on any project. In this connection, the Standards Council may make such appointments as it deems appropriate in the public interest, such as the classification of "Utilities" in the National Electrical Code Committee.

NOTE 4: Representatives of subsidiaries of any group are generally considered to have the same classification as the parent organization.

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# FORM FOR PROPOSALS ON NFPA TECHNICAL COMMITTEE DOCUMENTS

**Mail to: Secretary, Standards Council**
**National Fire Protection Association, 1 Batterymarch Park, Quincy, Massachusetts 02269-9101**
**Fax No. 617-770-3500**

Note: All proposals must be received by 5:00 p.m. EST/EDST on the published proposal-closing date.

**If you need further information on the standards-making process, please contact the Standards Administration Department at 617-984-7249. For technical assistance, please call NFPA at 617-770-3000**

Please indicate in which format you wish to receive your ROP/ROC: ☐ electronic or ☐ paper

**Date** 9/18/93 **Name** John B. Smith **Tel. No.** 617-555-1212

**Company** _____

**Street Address** 9 Seattle St., Seattle, WA 02255

**Please Indicate Organization Represented (if any)** Fire Marshals Assn. of North America

**1. a) NFPA Document Title** National Fire Alarm Code **NFPA No. & Year** NFPA 72, 1993 ed.

**b) Section/Paragraph** 1-5.8.1 (Exception No.1)

**FOR OFFICE USE ONLY**
**Log #** _____
**Date Rec'd** _____

**2. Proposal recommends: (Check one)**
- ☐ **new text**
- ☐ **revised text**
- ☒ **deleted text**

**3. Proposal (include proposed new or revised wording, or identification of wording to be deleted):** (Note: Proposed text should be in legislative format: i.e., use underscore to denote wording to be inserted (inserted wording) and strike-through to denote wording to be deleted (~~deleted wording~~).

Delete exception.

SAMPLE

**4. Statement of Problem and Substantiation for Proposal:** (Note: State the problem that will be resolved by your recommendation; give the specific reason for your proposal including copies of tests, research papers, fire experience, etc. If more than 200 words, it may be abstracted for publication.)

A properly installed and maintained system should be free of ground faults. The occurrence of one or more ground faults should be required to cause a "trouble" signal because it indicates a condition that could contribute to future malfunction of the system. Ground fault protection has been widely available on these systems for years and its cost is negligible. Requiring it on all systems will promote better installations, maintenance and reliability.

**5. ☒ This Proposal is original material.** (Note: Original material is considered to be the submitter's own idea based on or as a result of his/her own experience, thought, or research and, to the best of his/her knowledge, is not copied from another source.)

**☐ This Proposal is not original material; its source (if known) is as follows:** _____

Note 1: Type or print legibly in black ink.
Note 2: If supplementary material (photographs, diagrams, reports, etc.) is included, you may be required to submit sufficient copies for all members and alternates of the technical committee.

*I hereby grant NFPA the non-exclusive, royalty-free rights, including non-exclusive, royalty-free rights in copyright, in this proposal and I understand that I acquire no rights in any publication of NFPA in which this proposal in this or another similar or analogous form is used.*

John B. Smith
Signature (Required)

**PLEASE USE SEPARATE FORM FOR EACH PROPOSAL**

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**For technical assistance, please call NFPA at 617-770-3000**

Please indicate in which format you wish to receive your ROP/ROC: ☐ electronic or ☐ paper

**Date** _____ **Name** _____ **Tel. No.** _____

**Company** _____

**Street Address** _____

**Please Indicate Organization Represented (if any)** _____

**1. a) NFPA Document Title** _____ **NFPA No. & Year** _____

**b) Section/Paragraph** _____

**2. Proposal Recommends: (Check one)**
- ❑ **new text**
- ❑ **revised text**
- ❑ **deleted text**

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**Log #** _____
**Date Rec'd** _____

**3. Proposal (include proposed new or revised wording, or identification of wording to be deleted):** (Note: Proposed text should be in legislative format: i.e., use underscore to denote wording to be inserted (inserted wording) and strike-through to denote wording to be deleted (~~deleted wording~~).

**4. Statement of Problem and Substantiation for Proposal:** (Note: State the problem that will be resolved by your recommendation; give the specific reason for your proposal including copies of tests, research papers, fire experience, etc. If more than 200 words, it may be abstracted for publication.)

**5. ❑ This Proposal is original material.** (Note: Original material is considered to be the submitter's own idea based on or as a result of his/her own experience, thought, or research and, to the best of his/her knowledge, is not copied from another source.)

**❑ This Proposal is not original material; its source (if known) is as follows:** _____

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_____
Signature (Required)

**PLEASE USE SEPARATE FORM FOR EACH PROPOSAL**

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# Bibliography of NFPA Standards

1 Fire Prevention Code
10 Portable Extinguishers
10R Portable Fire Extinguishing Equipment in Dwellings
11 Low-Expansion Foam
11A Medium- and High-Expansion Foam Systems
11C Mobile Foam Apparatus
12 Carbon Dioxide Systems
12A Halon 1301 Systems
13 Sprinkler Systems
13D Sprinkler Sys., Dwellings
13E Sprinkler Prop., F.D. Operations in
13R Sprinkler Sys., Res. Occ. up to and Including 4 Stories
14 Standpipe, Hose Systems
15 Water Spray Fixed Systems
16 Deluge Foam-Water Systems
16A Closed Head Foam-Water Sprinkler Systems
17 Dry Chem. Ext. Systems
17A Wet Chem. Ext. Systems
18 Wetting Agents
20 Centrifugal Fire Pumps
22 Water Tanks
24 Private Fire Service Mains
25 Water-Based Fire Prot. Systems
30 Flam. Liquids Code
30A Automotive and Marine Service Station Code
30B Aerosol Products
31 Oil-Burning Equipment
32 Drycleaning Plants
33 Spray Application
34 Dipping and Coating Processes
35 Organic Coatings
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45 Laboratories Using Chemicals
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50B Liquefied Hydrogen Systems
51 Welding, Cutting and Allied Processes
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51B Cutting and Welding Processes
52 CNG Vehicular Fuel Systems
53 Oxy. Atmospheres, Fires in
54 Nat'l Fuel Gas Code
55 Compressed and Liquefied Gases in Portable Cylinders
57 LNG Vehicular Fuel Systems
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59A LN-Gas. Stg., Handling
61 Agricultural and Food Products Facilities
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69 Explosion Prev. Systems
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70B Elect. Equip. Maint.
70E Electrical Safety in Employee Work
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73 Residential Elect. Maint. for Dwellings
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79 Elect. Std. for Ind. Machinery
80 Fire Doors and Fire Windows
80A Exterior Fire Exposure, Prot. from
82 Incinerators, Systems & Equip.
86 Ovens and Furnaces
86C Ind. Furn., Sp. Processing
86D Ind. Furnaces, Vacuum
88A Parking Structures
88B Repair Garages
90A Air Conditioning Systems
90B Warm Air Htg., Air Cond.
91 Exhaust Syst. for Air Conveying of Materials
92A Smoke-Control Systems
92B Smoke Mgmt. Syst. in Malls, Atria, Large Areas
96 Commercial Cooking Operations
97 Heating Terms, Glossary
99 Health Care Facilities
99B Hypobaric Facilities
*101® Life Safety Code*
101A Alt. Approaches to Life Safety
102 Grandstands, Folding/Telescopic Seating, Tents, and Membrane Struct.
105 Smoke-Control Door Assemblies
110 Emer., Standby Power Systems
111 Stored Electrical Energy Emer. & Standby Power Systems
115 Laser Fire Protection
120 Coal Preparation Plants
121 Self-Propelled & Mobile Surface Mining Equip.
122 Underground Metal and Nonmetal Mines
123 Undergr. Bituminous Coal Mines
130 Fixed Guideway Transit Systs.
150 Racetrack Stables
170 Fire Safety Symbols
203 Roof Coverings/Roof Deck
204M Smoke, Heat Venting
211 Chimneys, Fireplaces, Vents
214 Water Cooling Towers
220 Types Bldg. Construction
231 General Storage
231C Rack Storage of Mat'ls.
231D Rubber Tires, Storage
231E Baled Cotton, Storage
231F Roll Paper, Storage
232 Records, Prot.
232A Archives and Records Centers
241 Construction, Alteration, and Demolition Operations
251 Bldg. Constr. & Mat'ls., Fire Tests
252 Door Assem., Fire Tests of
253 Floor Covering Systems, Test for
255 Bldg. Mat'ls., Burning Character
256 Roof Coverings, Tests of
257 Window Assemblies, Tests of
258 Smoke Generation, Test of
259 Heat of Bldg. Mat'ls., Test for
260 Cig. Ignition Resistance—Components of Furniture, Tests for
261 Cig. Ignition Resistance—Uphol. Furn. Assem., Tests for
262 Wires and Cables, Test for Fire and Smoke Char. of
263 Heat & Smoke Release Rates, Test for
264 Heat-Release Rates Using Oxygen-Consumption Calorimeter, Test for
264A Heat Release Rates—Uphol. Furn. Comp. & Mattresses
265 Textile Wall Coverings—Room Fire Growth Contribution, Tests for
266 Uphol. Furn. Exp. to Flaming Ignition Sources, Test for
267 Mattress and Bedding Exp. to Flaming Ignition Source, Test for
268 Ignitibility of Exterior Wall Assemblies, Test for
269 Toxic Potency Data for Fire Hazard Modeling, Test for
291 Fire Hydrants
295 Wildfire Control
297 Communications Systems
298 Foam Chem. for Class A Fuels/Rural Suburban
299 Wildfire, Protection Life and Property from
302 Pleasure and Comm. Motor Craft
303 Marinas and Boatyards
306 Vessels, Gas Hazards on
307 Marine Terminals, Piers, Wharves
312 Vessels, Constr., Repair
318 Cleanrooms
325 Prop. of Flam. Liquids, Gases, Solids
326 Underground Storage Tanks, Safe Entry
327 Cleaning Small Tanks
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329 Flam. and Com. Liquid, Underground Releases
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395 Farms, Storage Flam. Liquids
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412 Eval., Foam Equip. for Aircraft
414 Aircraft Rescue Vehicles
415 AircraftTerminal Buildings, Fueling Ramp Drainage, Loading Walkways
418 Heliports
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423 Aircraft Engine Test Facilities
424 Airport/Community Emerg. Planning
430 Liquid/Solid Oxidizers
432 Organic Peroxide Formulations
471 Responding to Haz. Mat. Incidents
472 Haz. Mat. Resp. Prof. Comp.
473 Competencies for EMS Personnel
480 Magnesium
481 Titanium
482 Zirconium
485 Lithium Metal
490 Ammonium Nitrate
491 Haz. Chem. Reactions
495 Explosive Materials
496 Purged Enclosures, Elec. Equip.
497 Flam. Liq., Gases, or Vapors and of Haz. Locations for Elec. Inst.
498 Explosives Motor Vehicle Term.
499 Comb. Dusts and of Haz. Locations for Elec. Inst. in Chem. Process Areas
501 Manufactured Housing
501A Manufactured Home Instal., Sites
501C Recreational Vehicles
501D Recreational Vehicle Parks
502 Highways, Tunnels, Bridges
505 Powered Industrial Trucks
512 Truck Fire Protection
513 Motor Freight Terminals
550 Fire Safety Concepts Tree
555 Evaluating Potential for Room Flashover
560 Ethylene Oxide
600 Industrial Fire Brigades
601 Guard Service
650 Pneumatic Conveying Systems
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654 Manufacturing, Processing, and Handling of Combust. Particulate Solids
655 Sulfur Fires and Explosions
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701 Textiles, Films, Fire Tests
703 Fire-Ret. Treat. of Bldg. Mat'ls.
704 Fire Hazards of Materials
705 Field Flame Test for Textiles and Films
750 Water Mist Fire Protection Systems
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801 Radioactive Materials Facilities
802 Nuclear Research Reactors
803 Light Water Nuclear Power Plants
804 Adv. Light Water Reactor Electric Generating Plants
820 Wastewater Facilities
850 Electric Generating Plants
851 Hydroelectric Generating Plants
901 Incident Reporting, Fire Prot. Data
902 Field Incident Manual
903 Property Survey Guide
904 Incident Follow-up Report Guide
906 Fire Incident Field Notes
909 Cultural Resources
914 Fire Prot. in Historic Struc.
921 Fire and Explosion Investigations
1000 Prof. Qual. Accreditation and Cert. Sys.
1001 Fire Fighter Prof Qual.
1002 F.D. Vehicle Driver Prof. Qual.
1003 Airport Fire Fighter Prof. Qual.
1021 Fire Officer Prof. Qual.
1031 Fire Inspector Prof. Qual.
1033 Fire Investigator Prof. Qual.
1035 Public Fire Educator Prof. Qual.
1041 Fire Instructor Prof. Qual.
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1061 Public Safety Telecommunicator Prof. Qual
1122 Model Rocketry
1123 Fireworks Display
1124 Fireworks, Mfg., Trans., Stge
1125 Model Rocket/High Power Rocket Motors, Mfg.
1126 Pyrotechnics Before Proximate Audience
1127 High Power Rocketry
1141 Planned Building Groups
1201 Devel. of FP Services for Public
1221 Public Fire Serv. Comm. Systs.
1231 Suburban & Rural Water Supplies
1401 Training Reports, Records
1402 Building Training Centers
1403 Live Fire Training Evolutions
1404 FD SCBA Program
1405 Land-Based Fire Fighters Who Respond to Marine Vessel Fires
1410 Initial Fire Attack
1420 Warehouse Occupancies
1451 Fire Service Vehicle Operations Training Prog.
1452 Dwelling Fire Safety Surveys
1470 Search and Rescue, Struct. Collapse
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1521 Fire Dept. Safety Officer
1561 F.D. Incident Management Syst.
1581 F.D. Infection Control Program
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1600 Disaster Management
1901 Automotive Fire Apparatus
1906 Wildland Fire Apparatus
1911 Fire Pump Systems on Fire Apparatus, Tests of
1914 F.D Aerial Devices, Testing
1921 Portable Pumping Units
1922 Self-Contained Pumping Units
1931 Fire Dept. Ground Ladders, Design
1932 Fire Dept. Ground Ladders, Use
1961 Fire Hose
1962 Fire Hose Care, Use
1963 Fire Hose Connections
1964 Spray Nozzles (Shutoff and Tip)
1971 Prot. Ensemble, Structural Fire Fighting
1975 Station/Work Uniforms for FF
1976 Prot. Clothing - Proximity Fire Fighting
1977 Prot. Clothing - Wildland Fire Fighting
1981 Open-Circut Self-Contained Breathing App. for Fire Service
1982 Personal Alert Safety Systems for Fire Fighters
1983 Life Safety Rope and Sys. Comp.
1991 Vapor-Protective Suits for Haz. Chem. Emergencies
1992 Liquid Splash-Protective Suits for Haz. Chem. Emergencies
1993 Support Function Prot. Clothing for Haz. Chem. Oper.
1999 Prot. Clothing - Medical Emerg. Oper.
2001 Clean Agent Ext. Systems
8501 Single Burner Boiler Operation
8502 Furnace Explosions/Implosions in Multiple Boilers
8503 Pulverized Fuel Systems
8504 Atmospheric Fluidized-Bed Boiler Operation
8505 Stoker Operation
8506 Heat Recovery Steam Generators



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