Designation: A 892 – 06

Standard Guide for Defining and Rating the Microstructure of High Carbon Bearing Steels[1]

This standard is issued under the fixed designation A 892; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope*

1.1 This guide covers the description of carbide structures in annealed high carbon bearing steels.

1.2 Included is a guide for rating steel specimens by a graded series of photomicrographs showing the incidence of certain conditions.

1.3 The reference photomicrographs are graded illustrations of annealed carbides categorized by size, network, and lamellar content (shape).

1.4 This guide is to facilitate communication and description of microstructure. It does not establish limits of acceptability. Such limits are a matter of agreement between user and producer.

1.5 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:* [2]

E 3 Guide for Preparation of Metallographic Specimens

E 407 Practice for Microetching Metals and Alloys

E 1245 Practice for Determining the Inclusion or Second-Phase Constituent Content of Metals by Automatic Image Analysis

3. Apparatus

3.1 In order to adequately compare the structure of a specimen with the photomicrographs, it will be necessary to view a properly prepared sample at 1000× magnification with good resolution.

4. Specimen Preparation

4.1 Samples that represent a portion of the cross section of the material shall be prepared using the practices described in Guide E 3. The size of the sample shall be negotiated between the user and the producer. It may be a full cross section but should not be too large for practical handling in the polishing operation.

4.2 The properly polished specimens shall be etched in a suitable etchant which will clearly delineate the annealed carbide structure of the material being examined as described in Practice E 407. Nital (2 %) will frequently be an adequate etchant for routine examination. When critical or detailed analysis of structures is required, the recommended etchant is Picral (saturated).

5. Description

5.1 The reference photomicrographs are arranged into three categories, as follows: carbide size (CS), carbide network (CN), and lamellar content (LC).

5.2 Six photomicrographs for each category are provided and are identified by category and number, for example, CS1-CS6, CN1-CN6, and LC1-LC6 as shown in Figs. 1-3. Higher numbers indicate a larger number or greater degree of severity of the category being rated.

5.2.1 Actual counted number of carbides per 400 μm^2 determined from the carbide size series of photomicrographs is as follows (reported counts are the average of three measurements):

CS1 508
CS2 419
CS3 324
CS4 234
CS5 165
CS6 115

6. Procedure for Evaluation

6.1 Using an optical metallograph and a magnification of 1000×, examine a properly prepared and etched specimen. Select a field which is representative of the category to be graded and compare it to the photomicrographs which are part of this method. The rating will be the number of that photo that

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[2] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

***A Summary of Changes section appears at the end of this standard.**

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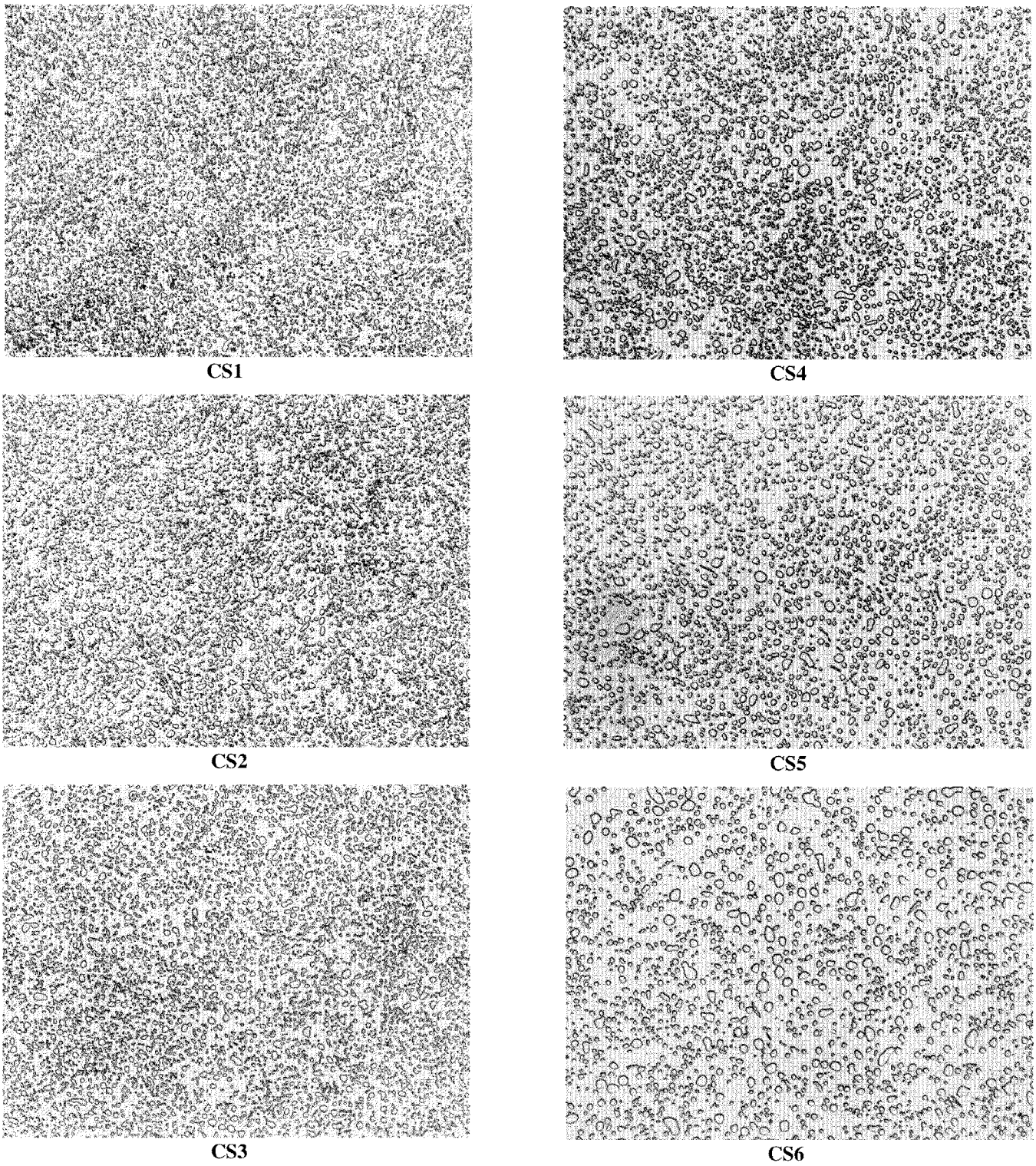


FIG. 1 Carbide Size

most closely resembles the appearance of the specimen. A separate field may be used for each category or a single field may be rated for more than one category. An example rating is CS4, CN2, LC1.

6.2 As an alternate method, the rating of carbide size by automatic image analysis shall be conducted in accordance with Practice E 1245. The rating shall be defined by the following equation:

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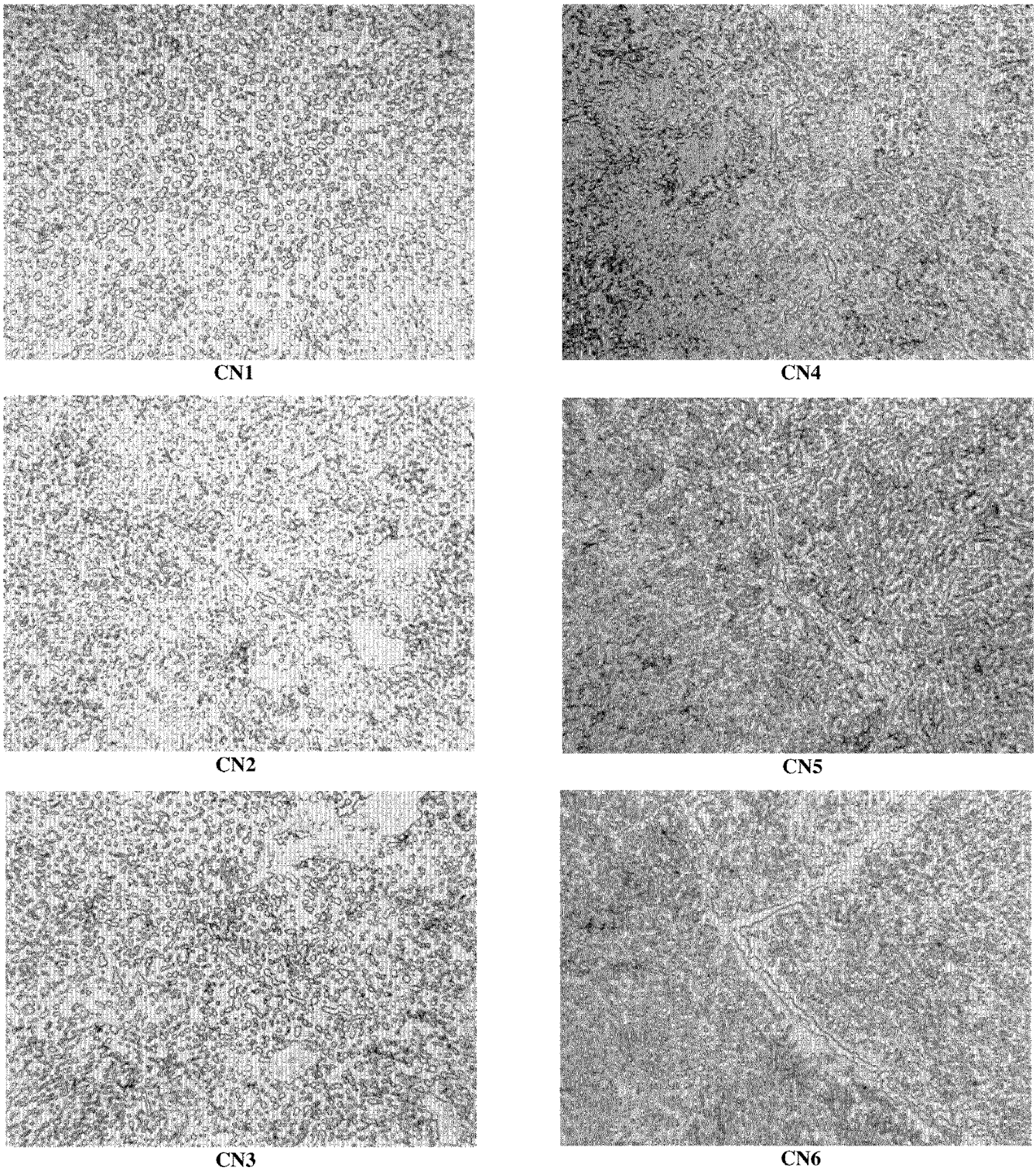


FIG. 2 Carbide Network

$$\text{Rating} = 6.7888 - 4.5924\,(10^{-6}) * n_A \quad (1)$$

where n_A = number of carbides per mm^2.

The results shall be rounded to the nearest integer value from 1 to 6.

7. Keywords

7.1 antifriction bearings; bearing steel; chromium alloy steel; metallography

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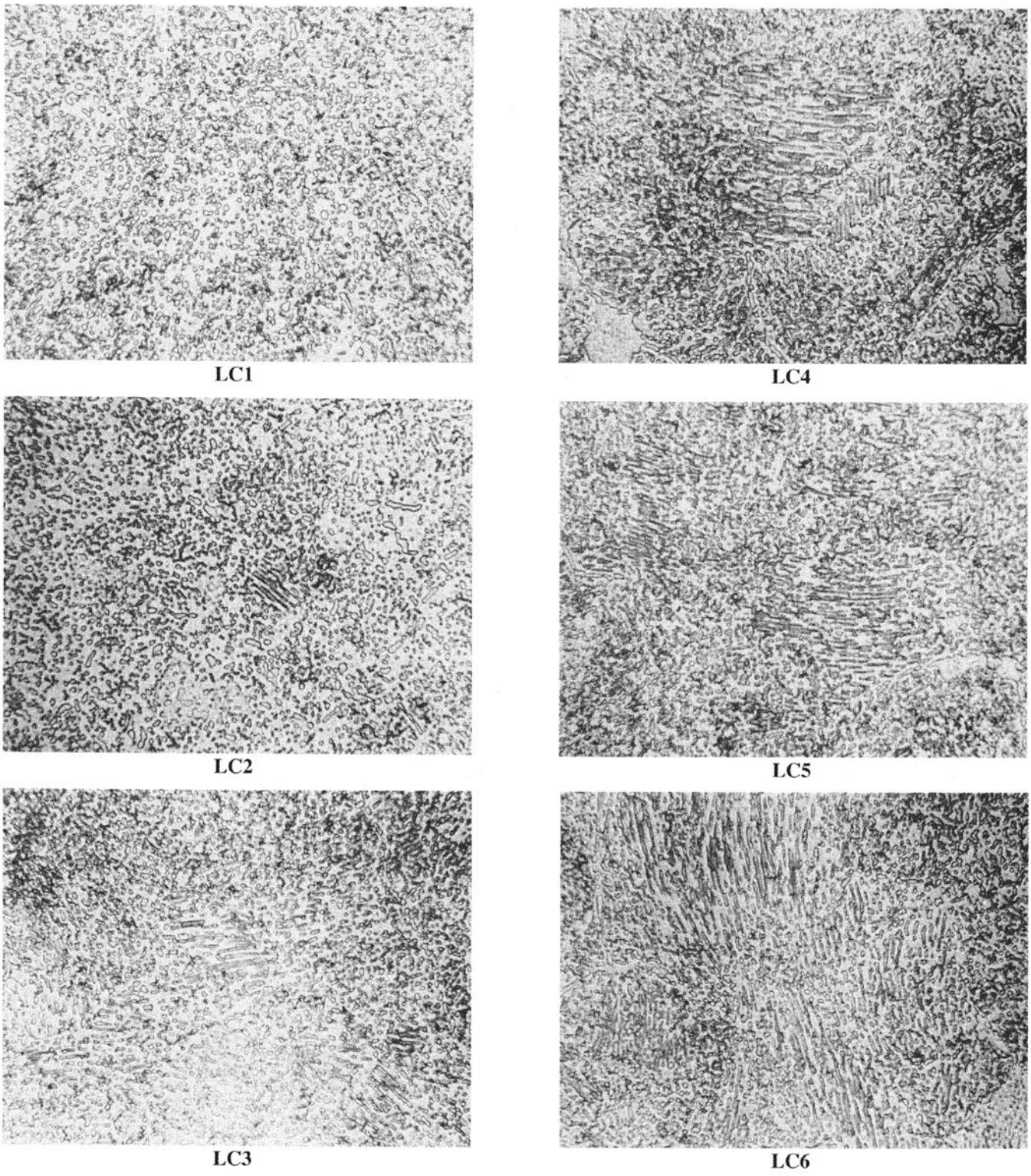


FIG. 3 Lamellar Content

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SUMMARY OF CHANGES

Committee A01 has identified the location of selected changes to this standard since the last issue (A 892 – 88 (2001)) that may impact the use of this standard. (Approved Sept. 1, 2006.)

(*1*) Practice E 1245 was added to the Referenced Documents section.

(*2*) Rating of carbide size by automatic image analysis was added as an alternate method.

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