



Standard Practice for Assessing the Degree of Banding or Orientation of Microstructures¹

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INTRODUCTION

Segregation occurs during the dendritic solidification of metals and alloys and is aligned by subsequent deformation. Solid-state transformations may be influenced by the resulting microsegregation pattern leading to development of a layered or banded microstructure. The most common example of banding is the layered ferrite-pearlite structure of wrought low-carbon and low-carbon alloy steels. Other examples of banding include carbide banding in hypereutectoid tool steels and martensite banding in heat-treated alloy steels. This practice covers procedures to describe the appearance of banded structures, procedures for characterizing the extent of banding, and a microindentation hardness procedure for determining the difference in hardness between bands in heat treated specimens. The stereological methods may also be used to characterize non-banded microstructures with second phase constituents oriented (elongated) in varying degrees in the deformation direction.

1. Scope

1.1 This practice describes a procedure to qualitatively describe the nature of banded or oriented microstructures based on the morphological appearance of the microstructure.

1.2 This practice describes stereological procedures for quantitative measurement of the degree of microstructural banding or orientation.

NOTE 1—Although stereological measurement methods are used to assess the degree of banding or alignment, the measurements are only made on planes parallel to the deformation direction (that is, a longitudinal plane) and the three-dimensional characteristics of the banding or alignment are not evaluated.

1.3 This practice describes a microindentation hardness test procedure for assessing the magnitude of the hardness differences present in banded heat-treated steels. For fully martensitic carbon and alloy steels (0.10–0.65 %C), in the as-quenched condition, the carbon content of the matrix and segregate may be estimated from the microindentation hardness values.

1.4 This standard does not cover chemical analytical methods for evaluating banded structures.

1.5 This practice deals only with the recommended test methods and nothing in it should be construed as defining or establishing limits of acceptability.

1.6 The measured values are stated in SI units, which are regarded as standard. Equivalent inch-pound values, when listed, are in parentheses and may be approximate.

1.7 *This standard does not purport to address all of the safety problems, 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:

- A 370 Test Methods and Definitions for Mechanical Testing of Steel Products²
- A 572/A 572M Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel³
- A 588/A 588M Specification for High-Strength Low-Alloy Structural Steel with 50 ksi [345 MPa] Minimum Yield Point to 4 in. [100 mm] Thick³
- E 3 Methods of Preparation of Metallographic Specimens⁴
- E 7 Terminology Relating to Metallography⁴
- E 140 Hardness Conversion Tables for Metals⁴
- E 384 Test Method for Microhardness of Materials⁴
- E 407 Test Methods for Microetching Metals and Alloys⁴
- E 562 Practice for Determining Volume Fraction by Systematic Manual Point Count⁴

¹ This practice is under the jurisdiction of ASTM Committee E04 on Metallography and is the direct responsibility of Subcommittee E04.14 on Quantitative Metallography.

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² *Annual Book of ASTM Standards*, Vol 01.03.

³ *Annual Book of ASTM Standards*, Vol 01.04.

⁴ *Annual Book of ASTM Standards*, Vol 03.01.