



Standard Test Methods for Characterizing Duplex Grain Sizes¹

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INTRODUCTION

Test methods are well established for the determination of average grain size, and estimation of largest grain size, in products assumed to contain a single log-normal distribution of grain sizes. The test methods in this standard are set forth to characterize grain size in products with any other distributions of grain size.

The term “duplex grain size” is chosen to describe any of these other distributions of grain size, because of its common usage and familiarity. However, the use of that term does not imply that only two grain size distributions exist.

These test methods are equally aimed at describing the nature of the deviation from a single log-normal distribution of grain sizes, and at describing with reasonable accuracy the distributions of sizes that actually exist.

1. Scope

1.1 These test methods provide simple guidelines for deciding whether a duplex grain size exists. The test methods separate duplex grain sizes into one of two distinct classes, then into specific types within those classes, and provide systems for grain size characterization of each type.

1.2 *This standard may involve hazardous materials, operations, and equipment. This standard does not purport to address all of the safety concerns associated with its use. It is the responsibility of the user of this standard to consult appropriate safety and health practices and determine the applicability of regulatory limitations prior to its use.*

2. Referenced Documents

2.1 ASTM Standards:

E 3 Methods of Preparation of Metallographic Specimens²

E 7 Terminology Relating to Metallography²

E 112 Test Methods for Determining the Average Grain Size²

E 407 Practice for Microetching Metals and Alloys²

E 562 Practice for Determining Volume Fraction by Systematic Manual Point Count²

E 883 Guide for Metallographic Photomicrography²

E 930 Test Methods for Estimating the Largest Grain Observed in a Metallographic Section (ALA Grain Size)²

2.2 ASTM Adjuncts:

Comparison Chart for Estimation of Area Fractions³

3. Terminology

3.1 Definitions:

3.1.1 All terms used in these test methods are either defined in Terminology E 7, or are discussed in 3.2.

3.2 Definitions of Terms Specific to This Standard:

3.2.1 *bands or banding*—in grain size, alternating areas of significantly different grain sizes. These areas are usually elongated in a direction parallel to the direction of working.

3.2.2 *grain size*—equivalent in meaning to the average of a distribution of grain sizes.

3.2.3 *necklace or necklace structure*—individual coarse grains surrounded by rings of significantly finer grains.

3.2.4 *topologically varying*—varying nonrandomly, in some definable pattern; that pattern may be related to the shape of the specimen or product being examined.

4. Summary of Test Method

4.1 These test methods provide means for recognizing the presence of duplex grain size. The test methods separate duplex grain sizes into two classes (randomly varying, and topologically varying), and define specific types of duplex grain sizes within these classes. The test methods provide means for estimating area fractions occupied by distinct grain sizes, and offer existing standard methods (Methods E 112, Methods E 930) for determining grain size in specific identified areas.

¹ These test methods are under the jurisdiction of ASTM Committee E04 on Metallography and are the direct responsibility of Subcommittee E04.08 on Grain Size.

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² *Annual Book of ASTM Standards*, Vol 03.01.

³ This comparison chart shows different area percentages of light grains among dark grains. Available from ASTM Headquarters. Order Adjunct: ADJE1181.