



## Standard Guide for Preparation of Metallographic Specimens<sup>1</sup>

This standard is issued under the fixed designation E 3; the number immediately following the designation indicates the year of original adoption or, in the case of revisions, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon ( $\epsilon$ ) indicates an editorial change since the last revision or reapproval.

This standard has been approved for use by agencies of the Department of Defense.

### 1. Scope

1.1 The primary objective of metallographic examinations is to reveal the constituents and structure of metals and their alloys by means of a light optical or scanning electron microscope. In special cases, the objective of the examination may require the development of less detail than in other cases but, under nearly all conditions, the proper selection and preparation of the specimen is of major importance. Because of the diversity in available equipment and the wide variety of problems encountered, the following text presents for the guidance of the metallographer only those practices which experience has shown are generally satisfactory; it cannot and does not describe the variations in technique required to solve individual specimen preparation problems.

Note 1—For a more extensive description of various metallographic techniques, refer to Samuels, L. E., *Metallographic Polishing by Mechanical Methods*, American Society for Metals (ASM) Metals Park, OH, 3rd Ed., 1982; Petros, G., *Metallographic Etching*, ASM, 1978; and Vanderhoff, G., *Metallography: Principles and Practice*, McGraw-Hill, NY, 2nd Ed., 1969.

1.2 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:

- A 90/A 90M Standard Test Method for Weight (Mass) of Coating on Iron and Steel with Zinc or Zinc-Alloy Coatings
- E 7 Terminology Relating to Metallography<sup>2</sup>
- E 45 Practice for Determining the Inclusion Content of Steel<sup>2</sup>
- E 340 Test Method for Macroetching Metals and Alloys<sup>2</sup>
- E 407 Test Methods for Microetching Metals and Alloys<sup>2</sup>
- E 768 Practice for Preparing and Evaluating Specimens for Automatic Inclusion Assessment of Steel<sup>2</sup>

- E 1077 Test Method for Estimating the Depth of Decarburization of Steel Specimens<sup>2</sup>
- E 1122 Practice for Obtaining JK Inclusion Ratings Using Automatic Image Analysis<sup>2</sup>
- E 1245 Practice for Determining the Inclusion or Second-Phase Constituent Content of Metals by Automatic Image Analysis<sup>2</sup>
- E 1268 Practice for Assessing the Degree of Banding or Orientation of Microstructures<sup>2</sup>
- E 1558 Guide to Electrolytic Polishing of Metallographic Specimens<sup>2</sup>
- E 1920 Guide for Metallographic Preparation of Thermal Sprayed Coatings<sup>2</sup>

### 3. Terminology

#### 3.1 Definitions:

3.1.1 For definitions used in this practice, refer to Terminology E 7.

#### 3.2 Definitions of Terms Specific to This Standard:

3.2.1 *castable mount*—a metallographic mount generally made from a two component castable plastic. One component is the resin and the other hardener. Both components can be liquid or one liquid and a powder. Castable mounts generally do not require heat and pressure to cure.

3.2.2 *compression mount*—a metallographic mount made using plastic that requires both heat and pressure for curing.

3.2.3 *planar grinding*—is the first grinding step in a preparation procedure used to bring all specimens into the same plane of polish. It is unique to semi or fully automatic preparation equipment that utilize specimen holders.

3.2.4 *rigid grinding disc*—a non-fabric support surface, such as a composite of metal/ceramic or metal/polymer charged with an abrasive (usually 6 to 15 $\mu$ m diamond particles), and used as the fine grinding operation in a metallographic preparation procedure.

### 4. Significance and Use

4.1 Microstructures have a strong influence on the properties and successful application of metals and alloys. Determination and control of microstructure requires the use of metallographic examination.

4.2 Many specifications contain a requirement regarding microstructure; hence, a major use for metallographic examination is inspection to ensure that the requirement is met. Other

<sup>1</sup> This guide is under the jurisdiction of ASTM Committee E04 on Metallography and is the direct responsibility of Subcommittee E04.01 on Sampling, Specimen Preparation, and Photography.

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<sup>2</sup> Annual Book of ASTM Standards, Vol 03.02.

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**RD Boyd**



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## **Table of Contents Astm E3 Standard**

1. Understanding the eBook Astm E3 Standard
  - The Rise of Digital Reading Astm E3 Standard
  - Advantages of eBooks Over Traditional Books
2. Identifying Astm E3 Standard
  - Exploring Different Genres
  - Considering Fiction vs. Non-Fiction
  - Determining Your Reading Goals
3. Choosing the Right eBook Platform
  - Popular eBook Platforms
  - Features to Look for in an Astm E3 Standard
  - User-Friendly Interface
4. Exploring eBook Recommendations from Astm E3 Standard
  - Personalized Recommendations

- Astm E3 Standard User Reviews and Ratings
- Astm E3 Standard and Bestseller Lists
- 5. Accessing Astm E3 Standard Free and Paid eBooks
  - Astm E3 Standard Public Domain eBooks
  - Astm E3 Standard eBook Subscription Services
  - Astm E3 Standard Budget-Friendly Options
- 6. Navigating Astm E3 Standard eBook Formats
  - ePub, PDF, MOBI, and More
  - Astm E3 Standard Compatibility with Devices
  - Astm E3 Standard Enhanced eBook Features
- 7. Enhancing Your Reading Experience
  - Adjustable Fonts and Text Sizes of Astm E3 Standard
  - Highlighting and Note-Taking Astm E3 Standard
  - Interactive Elements Astm E3 Standard
- 8. Staying Engaged with Astm E3 Standard
  - Joining Online Reading Communities
  - Participating in Virtual Book Clubs
  - Following Authors and Publishers Astm E3 Standard
- 9. Balancing eBooks and Physical Books Astm E3 Standard
  - Benefits of a Digital Library
  - Creating a Diverse Reading Collection Astm E3 Standard
- 10. Overcoming Reading Challenges
  - Dealing with Digital Eye Strain
  - Minimizing Distractions
  - Managing Screen Time
- 11. Cultivating a Reading Routine Astm E3 Standard
  - Setting Reading Goals Astm E3 Standard
  - Carving Out Dedicated Reading Time
- 12. Sourcing Reliable Information of Astm E3 Standard
  - Fact-Checking eBook Content of Astm E3 Standard

- Distinguishing Credible Sources
13. Promoting Lifelong Learning
    - Utilizing eBooks for Skill Development
    - Exploring Educational eBooks
  14. Embracing eBook Trends
    - Integration of Multimedia Elements
    - Interactive and Gamified eBooks

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