



Standard Guide for Preparation of Metallographic Specimens¹

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 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.

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; Peters, 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 Metallography²
- E 45 Practice for Determining the Inclusion Content of Steel²
- E 340 Test Method for Macroetching Metals and Alloys²
- E 407 Test Methods for Microetching Metals and Alloys²
- E 768 Practice for Preparing and Evaluating Specimens for Automatic Inclusion Assessment of Steel²

- E 1077 Test Method for Estimating the Depth of Decarburization of Steel Specimens²
- E 1122 Practice for Obtaining JK Inclusion Ratings Using Automatic Image Analysis²
- E 1245 Practice for Determining the Inclusion or Second-Phase Constituent Content of Metals by Automatic Image Analysis²
- E 1268 Practice for Assessing the Degree of Banding or Orientation of Microstructures²
- E 1558 Guide to Electrolytic Polishing of Metallographic Specimens²
- E 1920 Guide for Metallographic Preparation of Thermal Sprayed Coatings²

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 15µm 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

¹ 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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² Annual Book of ASTM Standards, Vol 03.02.

Astm E3

Sayed A. Nassar, John H. Bickford



Astm E3:

Handbook of Bolts and Bolted Joints John Bickford, 1998-04-28 Presenting time tested standard as well as reliable emerging knowledge on threaded fasteners and joints this book covers how to select parts and materials predict behavior control assembly processes and solve on the job problems It examines key issues affecting bolting in the automotive pressure vessel petrochemical aerospace and structural

NIST Special Publication ,2002 **Materials Metrology and Standards for Structural Performance** B.F. Dyson, S. Loveday, Mark Gee, 1995 Materials metrology is the measurement science used for determining materials property data An essential element is the symbiosis between the understanding of materials behaviour and the development of suitable measurement techniques which through the provision of standards enable design engineers and plant operators to acquire materials data of appropriate precision This book is concerned only with those aspects of materials metrology and standards that relate to the design and performance in service of structures and consumer products It does not consider their important role in the processing of materials The editors are grateful for the commitment and patience of the experts who contributed the various chapters In addition help from staff in the Division of Materials Metrology National Physical Laboratory in assisting with the task of refereeing the chapters is gratefully acknowledged The production of this book was carried out as part of the Materials Measurement Programme of underpinning research financed by the United Kingdom Department of Trade and Industry Brian F Dyson Malcolm S Loveday Mark G Gee Division of Materials Metrology National Physical Laboratory Teddington TW11 0LW UK

CHAPTER 1 Materials metrology and standards an introduction B F Dyson M S Loveday and M G Gee

1 1 MATERIALS ASPECTS OF STRUCTURAL DESIGN Knowledge concerning the behaviour of materials has always been vital for the success of manufactured products but never more so than at the present time

Handbook of Bolts and Bolted Joints Sayed A. Nassar, John H. Bickford, 2025-03-20 Presenting time tested standards as well as validated emerging knowledge on threaded fasteners and bolted joints this updated edition covers how to design select parts and materials control assembly processes predict behavior and solve on the job problems This handbook examines key issues affecting bolting in the automotive pressure vessel petrochemical aerospace energy and structural steel industries The editors have successfully created a useful rather than scholarly handbook with chapters written in a straightforward how to manner Theory is discussed only when necessary and the handbook's logical organization and thorough index enhance its usefulness

Handbook of Bolts and Bolted Joints Second Edition includes updated chapters solved numerical examples and case studies This new edition is an essential handbook for professionals researchers and students in all fields in which threaded joints are used including automotive aerospace structural chemical and naval and ocean engineering as well as agricultural equipment wind turbines and medical devices

General Electric Atomic Power ,1978 *Shape Memory Alloy Engineering* Antonio Concilio, Vincenza Antonucci, Ferdinando Auricchio, Leonardo Lecce, Elio Sacco, 2021-01-13 *Shape Memory Alloy Engineering For Aerospace*

Structural and Biomedical Applications Second Edition embraces new advancements in materials systems and applications introduced since the first edition Readers will gain an understanding of the intrinsic properties of SMAs and their characteristic state diagrams Sections address modeling and design process aspects explore recent applications and discuss research activities aimed at making new devices for innovative implementations The book discusses both the potential of these fascinating materials their limitations in everyday life and tactics on how to overcome some limitations in order to achieve proper design of useful SMA mechanisms Provides a greatly expanded scope looking at new applications of SMA devices and current research activities Covers all aspects of SMA technology from a global state of the art survey to the classification of existing materials basic material design material manufacture and from device engineering design to implementation within actual systems Presents the material within a modular architecture over different topics from material conception to practical engineering realization

High Entropy Materials Yong Zhang, 2023-01-18 High Entropy Materials Microstructures and Properties summarizes recent developments in multicomponent materials It discusses properties processing modeling and applications of high entropy materials including metallic alloys and oxides It also discusses solidification sputtering cryogenic treatments CALPHAD methodology biomedical implants Fe based superconductors Fe rich high entropy alloys and more

Index of Specifications and Standards, 2005 **Proceedings of International Conference on Advances in Tribology and Engineering Systems** Himanshu C. Patel, Gunamani Deheri, Harshvadan S. Patel, Shreya M. Mehta, 2013-10-17 This book contains advanced level research material in the area of lubrication theory and related aspects presented by eminent researchers during the International Conference on Advances in Tribology and Engineering Systems ICATES 2013 held at Gujarat Technological University Ahmedabad India during October 15 17 2013 The material in this book represents the advanced field of tribology and reflects the work of many eminent researchers from both India and abroad The treatment of the presentations is the result of the contributions of several professionals working in the industry and academia This book will be useful for students researchers academicians and professionals working in the area of tribology in general and bearing performance characteristics in particular especially from the point of view of design This book will also appeal to researchers and professionals working in fluid film lubrication and other practical applications of tribology A wide range of topics has been included despite space and time constraints Basic concepts and fundamentals techniques have been emphasized upon while also including highly specialized topics and methods such as nanotribology bio nanotribology Care has been taken to generate interest for a wide range of readers considering the interdisciplinary nature of the subject

NUREG/CR. U.S. Nuclear Regulatory Commission, 1981

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