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Standard Guide for Preparation of Metallographic Specimens[1]

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; Petzow, G., *Metallographic Etching*, ASM, 1978; and Vander-Voort, G., *Metallography: Principles and Practice*, McGraw Hill, NY, 2nd Ed., 1999.

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[2]

E 45 Practice for Determining the Inclusion Content of Steel[2]

E 340 Test Method for Macroetching Metals and Alloys[2]

E 407 Test Methods for Microetching Metals and Alloys[2]

E 768 Practice for Preparing and Evaluating Specimens for Automatic Inclusion Assessment of Steel[2]

E 1077 Test Method for Estimating the Depth of Decarburization of Steel Specimens[2]

E 1122 Practice for Obtaining JK Inclusion Ratings Using Automatic Image Analysis[2]

E 1245 Practice for Determining the Inclusion or Second-Phase Constituent Content of Metals by Automatic Image Analysis[2]

E 1268 Practice for Assessing the Degree of Banding or Orientation of Microstructures[2]

E 1558 Guide to Electrolytic Polishing of Metallographic Specimens[2]

E 1920 Guide for Metallographic Preparation of Thermal Sprayed Coatings[2]

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 03.01.

Standard Guide For Preparation Of Metallographic Specimens

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Standard Guide For Preparation Of Metallographic Specimens:

Standard Guide for Preparation of Metallographic Specimens ,2007 **ASTM E3-01** ,2009 Metallographer's Guide B. L. Bramfitt,A.O. Benscoter,2001-01-01 This book provides a solid overview of the important metallurgical concepts related to the microstructures of irons and steels and it provides detailed guidelines for the proper metallographic techniques used to reveal capture and understand microstructures This book provides clearly written explanations of important concepts and step by step instructions for equipment selection and use microscopy techniques specimen preparation and etching Dozens of concise and helpful metallographic tips are included in the chapters on laboratory practices and specimen preparation The book features over 500 representative microstructures with discussions of how the structures can be altered by heat treatment and other means A handy index to these images is provided so the book can also be used as an atlas of iron and steel microstructures **Handbook of Engineering Practice of Materials and Corrosion** Jung-Chul (Thomas) Eun,2020-09-04 This handbook is an in depth guide to the practical aspects of materials and corrosion engineering in the energy and chemical industries The book covers materials corrosion welding heat treatment coating test and inspection and mechanical design and integrity A central focus is placed on industrial requirements including codes standards regulations and specifications that practicing material and corrosion engineers and technicians face in all roles and in all areas of responsibility The comprehensive resource provides expert guidance on general corrosion mechanisms and recommends materials for the control and prevention of corrosion damage and offers readers industry tested best practices rationales and case studies Handbook of Measurement in Science and Engineering, Volume 2 Myer Kutz,2015-12-03 A multidisciplinary reference of engineering measurement tools techniques and applications Volume 2 When you can measure what you are speaking about and express it in numbers you know something about it but when you cannot measure it when you cannot express it in numbers your knowledge is of a meager and unsatisfactory kind it may be the beginning of knowledge but you have scarcely in your thoughts advanced to the stage of science Lord Kelvin Measurement falls at the heart of any engineering discipline and job function Whether engineers are attempting to state requirements quantitatively and demonstrate compliance to track progress and predict results or to analyze costs and benefits they must use the right tools and techniques to produce meaningful useful data The Handbook of Measurement in Science and Engineering is the most comprehensive up to date reference set on engineering measurements beyond anything on the market today Encyclopedic in scope Volume 2 spans several disciplines Materials Properties and Testing Instrumentation and Measurement Standards and covers Viscosity Measurement Corrosion Monitoring Thermal Conductivity of Engineering Materials Optical Methods for the Measurement of Thermal Conductivity Properties of Metals and Alloys Electrical Properties of Polymers Testing of Metallic Materials Testing and Instrumental Analysis for Plastics Processing Analytical Tools for Estimation of ParticulateComposite Material Properties Input and Output Characteristics Measurement Standards and Accuracy Tribology Measurements

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mentioned areas of modern engineering design application Different engineering disciplines such as mechanical materials computer and process engineering provide the foundation for the design and development of improved structures materials and processes The modern design cycle is characterized by an interaction of different disciplines and a strong shift to computer based approaches where only a few experiments are performed for verification purposes A major driver for this development is the increased demand for cost reduction which is also connected to environmental demands In the transportation industry e g automotive this is connected with the demand for higher fuel efficiency which is related to the operational costs and the lower harm for the environment One way to fulfil such requirements are lighter structures and or improved processes for energy conversion Another emerging area is the interaction of classical engineering with the health medical and environmental sectors TMS 2020 149th Annual Meeting & Exhibition Supplemental Proceedings The Minerals, Metals & Materials Society,2020-02-13 This collection presents papers from the 149th Annual Meeting Exhibition of The Minerals Metals Materials Society Predicting the Future Fernando Sánchez Lasheras,2020-12-29 Due to the increased capabilities of microprocessors and the advent of graphics processing units GPUs in recent decades the use of machine learning methodologies has become popular in many fields of science and technology This fact together with the availability of large amounts of information has meant that machine learning and Big Data have an important presence in the field of Energy This Special Issue entitled Predicting the Future Big Data and Machine Learning is focused on applications of machine learning methodologies in the field of energy Topics include but are not limited to the following big data architectures of power supply systems energy saving and efficiency models environmental effects of energy consumption prediction of occupational health and safety outcomes in the energy industry price forecast prediction of raw materials and energy management of smart buildings **Advances in Material Sciences and Engineering** Mokhtar Awang,Seyed Sattar Emamian,Farazila Yusof,2019-09-19 This book presents selected papers from the 4th International Conference on Mechanical Manufacturing and Plant Engineering ICMMPE 2018 which was held in Melaka Malaysia from the 14th to the 15th of November 2018 The proceedings discuss genuine problems concerning joining technologies that are at the heart of various manufacturing sectors In addition they present the outcomes of experimental and numerical works addressing current problems in soldering arc welding and solid state joining technologies **Surface Modification Technology: Principles, Processes, and Industrial Application** Yuli Panca Asmara,2025-08-22 Surface engineering plays a vital role in enhancing the durability performance and reliability of materials used in various industrial applications This book Surface Modification Technology Principles and Industrial Applications offers a comprehensive exploration of key surface treatment techniques and their role in protecting engineering components from corrosion mechanical damage and environmental degradation Beginning with the fundamentals of surface degradation the book examines methods such as electropolishing coatings painting and electroplating anodizing and vapor deposition PVD CVD detailing their principles processes materials

and real world applications Mechanical techniques like shot peening and surface hardening are also discussed for their effectiveness in improving fatigue strength The book concludes with a focus on heat treatment of carbon steel and the evaluation methods used to assess surface treatment effectiveness Current Trends in Friction Stir Welding (FSW) and Friction Stir Spot Welding (FSSW) Mukuna Patrick Mubiayi,Esther Titilayo Akinlabi,Mamookho Elizabeth Makhatha,2018-06-14 This book provides an overview of friction stir welding and friction stir spot welding with a focus on aluminium to aluminium and aluminium to copper It also discusses experimental results for friction stir spot welding between aluminium and copper offering a good foundation for researchers wishing to conduct more investigations on FSSW Al Cu Presenting full methodologies for manufacturing and case studies on FSSW Al Cu which can be duplicated and used for industrial purposes it also provides a starting point for researchers and experts in the field to investigate the FSSW process in detail A variant of the friction stir welding process FSW friction stir spot welding FSSW is a relatively new joining technique and has been used in a variety of sectors such as the automotive and aerospace industries The book describes the microstructural evolution chemical and mechanical properties of FSW and FSSW including a number of case studies Advanced Manufacturing Techniques Using Laser Material Processing Akinlabi, Esther Titilayo,Mahamood, Rasheedat Modupe,Akinlabi, Stephen Akinwale,2016-04-14 The use of lasers in material processing has become a useful method for transforming industrial materials into finished products The benefits of laser material processing are vast including increased precision high processing speed and dustless cutting and drilling Advanced Manufacturing Techniques Using Laser Material Processing explores the latest methodologies for using lasers in materials manufacturing and production the benefits of using lasers in industrial settings as well as future outlooks for this technology This innovative publication is an essential reference source for professionals researchers and graduate level students studying manufacturing technologies and industrial engineering **Proceedings of the 13th World Conference on Titanium** Vasisht Venkatesh,Adam L. Pilchak,John E. Allison,Sreeramamurthy Ankem,Rodney R. Boyer,Julie Christodoulou,Hamish L. Fraser,M. Ashraf Imam,Yoji Kosaka,Henry J. Rack,Amit Chatterjee,Andy Woodfield,2016-04-26 This book contains the Proceedings of the 13th World Conference on Titanium Surface Modification of Metals and Alloys Oriol Rius-Ayra,Nuria Llorca-Isern,2021-08-31 Over the past four decades there has been increased attention given to the research of fluid mechanics due to its wide application in industry and phycology Major advances in the modeling of key topics such Newtonian and non Newtonian fluids and thin film flows have been made and finally published in the Special Issue of coatings This is an attempt to edit the Special Issue into a book Although this book is not a formal textbook it will definitely be useful for university teachers research students industrial researchers and in overcoming the difficulties occurring in the said topic while dealing with the nonlinear governing equations For such types of equations it is often more difficult to find an analytical solution or even a numerical one This book has successfully handled this challenging job with the latest techniques In addition the findings of the simulation are

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