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Nondestructive Evaluation of Materials

Sagamore Army Materials Research Conference Proceedings 23

Springer Science & Business Media *The Army Materials and Mechanics Research Center of Water town, Massachusetts in cooperation with the Materials Science Group of the Department of Chemical Engineering and Materials Science of Syracuse University has conducted the Sagamore Army Materials Research Conference since 1954. The main purpose of these conferences has been to gather together over 150 scientists and engineers from academic institutions, industry and government who are uniquely qualified to explore in depth a subject of importance to the Department of Defense, the Army and the scientific community. This volume NONDESTRUCTIVE EVALUATION OF MATERIALS, addresses the areas of x-ray, ultrasonics and other methods of nondestructive testing. We wish to acknowledge the dedicated assistance of Joseph M. Bernier of the Army Materials and Mechanics Research Center and Helen Brown DeMascio of Syracuse University throughout the stages of the conference planning and finally the publication of this book. Their help is deeply appreciated. Syracuse University Syracuse, New York The Editors Contents SESSION I X-RAY S. Heissman, Moderator H. K. Herglotz, Moderator 1. Overview of X-Ray Diffraction Methods for Nondestructive Testing • • • • • • • • ••• 1 L. V. Azaroff 2. Detection of Fatigue Damage by X-Rays 21 S. Taira and K. Kamachi 3. A Historical Example of Fatigue Damage • • • • • • • 55 H. K. Herglotz 4. The Application of X-Ray Topography to Materials Science . . . . . 69 S. Weissman 5.*

Surfaces and Interfaces

Proceedings of the 13th Sagamore Army Materials Research Conference, Held at Sagamore Conference Center, Raquette Lake, New York, August 23-26, 1966. Chemical and physical characteristics. I

Chemical and Physical Characteristics

Proceedings of the 13th Sagamore Army Materials Research Conference. Held at Sagamore Conference Center, Raquette Lake, New York, August 23-26, 1966. Sponsored by Army Materials Research Agency, Watertown, Mass., in Cooperation with Syracuse University. Organized and Directed by Army Materials Research Agency in Cooperation with Syracuse University

Surfaces and Interfaces

Chemical and Physical Characteristics : Proceedings of the 13th Sagamore Army Materials Research Conference, Held at Sagamore Conference Center, Raquette Lake, New York, August 23-26, 1966

Ultrafine Grain Ceramics

Proceedings of the 15th Sagamore Army Materials Research Conference, Held at Sagamore Conference Center, Raquette Lake, New York, August 20-23, 1968

Ultrafine-grain Metals

Proceedings of the 16. Sagamore Army Materials Research Conference, Held at Sagamore Conference Center, Raquette Lake, NY, Aug. 20 - 23 1968 ...

Ultrafine Grain Ceramics

Proceedings of the 15th Sagamore Army Materials Research Conference, Held at Raquette Lake, New York, August 20-23, 1968, Sponsored by Army Materials and Mechanics Research Center, Watertown, Mass

Surfaces and Interfaces

Proceedings of the 13th Sagamore Army Materials Research Conference, Held at Sagamore Conference Center, Raquette Lake, New York, August 23-26, 1966

Surface and interfaces I

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Surfaces and Interfaces I

Chemical and Physical Characteristics : Proceedings of the 13th Sagamore Army Materials Research Conference, Held at Sagamore Conference Center, Raquette Lake, New York, August 23-26, 1966

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Nondestructive Evaluation of Materials , Proceedings of the 23rd Sagamore Army Materials Research Conference of the same name, Raquette Lake, NY, August 1976

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Mechanisms Operating in Metals at Elevated Temperatures

Proceedings of the Eighth Sagamore Ordnance Materials Research Conference

High Temperature Materials, Their Strength Potentials and Limitations

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High Temperature Materials

Their Strength Potentials and Limitations, Conducted at Sagamore Conference Center, Raquette Lake, New York, August 21-23, 1957

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Nondestructive Evaluation of Materials

Proceedings of the Twenty-third Sagamore Army Materials Research Conference on

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Material Behavior Under High Stress and Ultrahigh Loading Rates

Springer Science & Business Media *The Army Materials and Mechanics Research Center in coopera tion with the Materials Science Group of the Department of Chemical Engineering and Materials Science of Syracuse University has been conducting the Annual Sagamore Army Materials Research Conference since 1954. The specific purpose of these conferences has been to bring together scientists and engineers from academic institutions, industry, and government who are uniquely qualified to explore in depth a subject of importance to the Department of Defense, the Army, and the scientific community. The proceedings of this conference, entitled MATERIAL BEHAVIOR UNDER HIGH STRESS AND ULTRAHIGH LOADING RATES, will be published in two parts. The topics covered in the present volume include dynamic plasticity, adiabatic shear/localized deformation, and dynamic fracture mechanics. Papers dealing with ordnance applica tions, projectile launch environment, and recent work-in-progress will appear as an AMMRC Technical Report and will have more limited distribution in accordance with recent Army guidelines. The Conference Chairmen are particularly grateful to the members of the Program Committee. We wish also to acknowledge the assistance of Mr. Charles Polley of the Army Materials and Mechanics Research Center, Mr. Robert Sell, Ms. Helen Brown DeMascio, and Ms. Mary Ann Holmquist of Syracuse University throughout the con ference planning stages and the publication of the text. The continued active interest in and support of these confer ences by Dr. E. Wright and Col. George Sibert, Direct and Deputy Director/Commander, respectively, of the Army Materials and Mechan ics Research Center, is appreciated.*

Transformations Selected Works of G.B. Olson on Materials, Microstrucutre, and Design

ASM International *ASM International and The Minerals, Metals and Materials Society (TMS) have collaborated to present a collection of the selected works of Dr. Greg B. Olson in honor of his 70th birthday in 2017. This collection highlights his influential contributions to the understanding of martensite transformations and the development and application of a systems design approach to materials. Part I: Martensite, with an Introduction by Sir Harry Bhadeshia, emphasizes Dr. Olson's work to develop a dislocation theory for martensite transformations, to improve the understanding of the statistical nature of martensite nucleation, and to expand use of quantitative microscopy to characterize phase transformations. Part II: Materials Design, with an Introduction by Dr. Charles Kuehmann, focuses on the application of a systems design approach to materials and the development of integrated computational design curriculum for undergraduate education. Part II includes several examples of the systems design approach to a variety of applications. The papers chosen for this collection were selected by the editors with input from Dr. Olson.*

Quality Technology Handbook

Butterworth-Heinemann *Quality Technology Handbook, Fourth Edition offers a wide discussion on technology and its related subtopics. After giving some information on its background, content, and authors, the book then informs the readers about the quality problem check-list and enumerates the questions one has to ask to ensure that a problem will be solved. This part is followed by a discussion on non-destructive testing (NDT) and the several committees formed for it, among which are the British National Committee and the Harwell NDT Center. The book also includes information on two organizations that are closely related to the topic, the Institute of Quality Assurance (IQA) and The Welding Institute (TWI). A directory of international organizations related to quality assurance and non-destructive testing is provided in the latter part of the text. The book serves as valuable reference to undergraduates or postgraduates of courses that are related to science and technology.*

Innovations in Materials Processing

Springer Science & Business Media *The Army Materials and Mechanics Research Center in cooperation with the Office of Sponsored Programs of Syracuse University has been conducting the Annual Sagamore Army Materials Research Conferences since 1954. The specific purpose of these conferences has been to bring together scientists and engineers from academic institutions, industry and government to explore in depth a subject of importance to the Department of Defense, the Army, and the scientific community. This 30th Sagamore Conference, entitled Innovations in Materials Processing, has attempted to focus on the inter disciplinary nature of materials processing, looking at recent advancements in the development of unit processes from a range of standpoints from the understanding and control of the under lying mechanisms through their application as part of a manufactur ing sequence. In between, the classic link between processing and materials properties is firmly established. A broad range of materials are treated in this manner: metals, ceramics, plastics, and composites. The interdisciplinary nature of materials processing exists through its involvement with the basic sciences, with, process and product design, with process control, and ultimately with manufacturing engineering. Materials processing is interdisciplinary in another sense, through its application within all materials disciplines. The industrial community (and the Army as its customer) is becoming increasingly concerned with producibility/reliability/ affordability issues in advanced product development. These concerns will be adequately addressed only by employing the full range of disciplines encompassed within the field of materials processing.*

Mechanics of Nondestructive Testing

Springer Science & Business Media *The synergism of the mechanics of nondestructive testing and the mechanics of materials response has great potential value in an era of rapid development of new materials and new applications for con ventional materials. The two areas are closely related and an advance in one area often leads to an advance in the other. As our understanding of basic principles increases, nondestructive testing is outgrowing the image of "black box techniques" and is rapidly becoming a legitimate technical area of science and engineering. At the present time, however, an understanding of the mechanics of nondestructive testing is lagging behind other advances in the field. The key to further development in the mechanics of nondestructive testing lies in the mechanics of the phenomena or response being investigated - a better understanding of materials response suggests better nondestructive test methods to investigate the response which, in turn, advances our understanding of materials response, and so on. With this approach in mind, the Materials Response Group of the Engineering Science and Mechanics Department at Virginia Polytechnic Institute and State University hosted a Conference on the Mechanics of Nondestructive Testing on September 10 through 12, 1980. Sponsors of the conference were the Army Research Office, the National Science Foundation, and the Engineering Science and Mechanics Department.*

Materials Characterization for Systems Performance and Reliability

Springer Science & Business Media *The Sagamore Army Materials Research Conferences have been held in the beautiful Adirondack Mountains of New York State since 1954. Organized and conducted by the Army Materials and Mechanics Research Center (Watertown, Massachusetts) in cooperation with Syracuse University, the Conferences have focused on key issues in Materials Science and Engineering that impact directly on current or future Army problem areas. A select group of speakers and attendees are assembled from academia, industry, and other parts of the Department of Defense and Government to provide an optimum forum for a full dialogue on the selected topic. This book is a collection of the full manuscripts of the formal presentations given at the Conference. The emergence and use of nontraditional materials and the excessive failures and reject rates of high technology, materials intensive engineering systems necessitates a new approach to quality control. Thus, the theme of this year's Thirty-First Conference, "Materials Characterization for Systems Performance and Reliability," was selected to focus on the need and mechanisms to transition from defect interrogation of materials after production to utilization of materials characterization during manufacturing. The guidance and help of the steering committee and the dedicated and conscientious efforts of Ms. Karen Ka100stian, Con ference Coordinator, and Mr. William K. Wilson, and Ms. Mary Ann Holmquist are gratefully acknowledged. The continued active interest and support of Dr. Edward S. Wright, Director, AMMRC; Dr. Robert W. Lewis, Associate Director, AMMRC; and COL L. C. Ross, Commander/ Deputy Director, AMMRC; are greatly appreciated.*

23nd Annual Conference on Composites, Advanced Ceramics, Materials, and Structures - A

John Wiley & Sons *This volume is part of the Ceramic Engineering and Science Proceeding (CESP) series. This series contains a collection of papers dealing with issues in both traditional ceramics (i.e., glass, whitewares, refractories, and porcelain enamel) and advanced ceramics. Topics covered in the area of advanced ceramic include bioceramics, nanomaterials, composites, solid oxide fuel cells, mechanical properties and structural design, advanced ceramic coatings, ceramic armor, porous ceramics, and more.*

Fracture Toughness Testing and Its Applications

A Symposium Presented at the 67th Annual Meeting [of The] American Society for Testing and Materials

ASTM International

Fracture Toughness Testing and Its Applications

ASTM International

Nuclear Science Abstracts

Measurement of Residual and Applied Stress Using Neutron Diffraction

Springer Science & Business Media *The accurate, absolute, and non-destructive measurement of residual stress fields within metallic, ceramic, and composite engineering components has been one of the major problems facing engineers for many years, and so the extension of X-ray methods to the use of neutrons represents a major advance. The technique utilizes the unique penetrating power of the neutron into most engineering materials, combined with the sensitivity of diffraction, to measure the separation of lattice planes within grains of polycrystalline engineering materials, thus providing an internal strain gauge. The strain is then converted to stress using calibrated elastic constants. It was just over ten years ago that the initial neutron diffraction measurements of residual stress were carried out, and during the ensuing decade measurements have commenced at most steady state reactors and pulsed sources around the world. So swift has been the development of the field that, in addition to fundamental scientific studies, commercial measurements have been made on industrial components for several years now. The use of neutrons is ideally suited to the determination of triaxial macrostress tensors, macrostress gradients, and microstresses in composites and multiphase alloys as well as deformed, plastically anisotropic metals and alloys. To date, it has been used to investigate welded and heat-treated industrial components, to characterize composites, to study the response of material under applied loads, to calibrate more portable methods such as ultrasonics, and to verify computer modelling calculations of residual and applied stress.*

Bibliographic Guide to Conference Publications

Vols. for 1975- include publications cataloged by the Research Libraries of the New York Public Library with additional entries from the Library of Congress MARC tapes.

Journal of Research of the National Bureau of Standards

Physics and chemistry

Monthly Catalogue, United States Public Documents

Monthly Catalog of United States Government Publications

National Union Catalog

A Cumulative Author List Representing Library of Congress Printed Cards and Titles Reported by Other American Libraries

Applied Mechanics Reviews

List of Bureau of Mines Publications and Articles ... with Subject and Author Index

ERDA Energy Research Abstracts

Proceedings

Ultrafine-Grain Ceramics

Springer Science & Business Media *The Army Materials and Mechanics Research Center has conducted the Saga more Army Materials Research Conferences, in cooperation with the Metallurgi cal Research Laboratories of the Department of Chemical Engineering and Metallurgy of Syracuse University, since 1954. The purpose of the conferences has been to gather together scientists and engineers from academic institutions, industry, and government who are uniquely qualified to explore in depth a sub ject of importance to the Army, the Department of Defense and the scientific community. Grain size and its control is a major factor governing the behavior of materi als. Knowledge that one can obtain grain sizes in the 10 micron down to sub micron range has established the basis for a new technology. This volume, Ultrafine-Grain Ceramics, addresses itself to the broad areas of: realization of fine-grain ceramics; preparation of ultrafine particle size materials; characterization of ultrafine particles and ultrafine-grain ceramics; processing and behavior of ultra fine-grain ceramics. The technical advice provided by Dr. S. K. Dutta of the Army Materials and Mechanics Research Center during the editing of this book is acknowledged. The continued active interest and support of these conferences by Dr. E. Scala, Director, Lt. Col. Joseph B. Mason, Commanding Officer, and J. F. Sullivan, Deputy Technical Director, of the Army Materials and Mechanics Re search Center is appreciated.*