Failure Analysis of Brittle Materials (Advances in Ceramics, Vol. 28)

Edited by V.D. Frechette
(American Ceramic Society, 1990, 136 pages).
ISBN: 0-944904-30-0

This recent monograph describes briefly (from a practical point of view) and qualitatively the propagation of cracks and the resulting fractography, mainly in glasses. The author presents excellent examples of failure under a variety of conditions and, in many cases, provides simple sketches that help the reader to understand the three-dimensionality of the problem. Although the author states that the book "...is written to help those who are engaged in materials R&D, in manufacturing or in applications engineering, in geology, or in the forensic sciences...," it addresses mainly the latter aspect to prepare a future expert witness for the court battle.

After a short definition of brittle failure, the second chapter defines and describes the origins and appearances of the types of markings on fracture surfaces, including some effects of moist environment. The third chapter, a brief description of the possible crack paths and a qualitative description of crack branching, is followed by a chapter on mechanically induced crack initiation sites such as those induced by particle impact or scratch marks.

The subsequent two chapters address the effects of residual stresses. One chapter serves as a guide to estimating tensile residual stresses from the size of the starting notch. The other considers residual stresses as a consequence of differential thermal expansion between inclusions and the matrix and its effect on crack initiation.

Chapter 7 briefly provides some information on the effects of elastic as well as thermal expansion and thermal diffusivity anisotropies. Prof. Frechette's experience as an expert witness becomes apparent in Chapter 8, where he describes the "Procedures and Techniques" needed to prepare for a court case. Common conditions of failure, several court cases, and some words on what the expert witness should or should not do in court are outlined in the last three chapters.

Overall, this monograph is quite entertaining. The title, however, is much too general. A more appropriate title may have been "How to Prepare Myself as an Expert Witness in Court Cases Involving Cracked Pop Bottles and Windows." On the other hand, the definitions of the different fracture surface markings are quite nice.

Reviewer: Otto Buck is professor of materials science and engineering at Iowa State University and director of the Metallurgy and Ceramics Program at Ames Laboratory. His research focuses on nondestructive evaluation and the mechanical properties of materials.

Fiber-Reinforced Ceramic Composites - Materials, Processing, and Technology

Edited by K.S. Mazdiyasni
(Noyes Publications, 1990, 515 pages).
ISBN: 0-8155-1233-3

This volume is the first comprehensive treatment of the science and technology of fiber-reinforced ceramic composites, an area that has seen dramatic progress during the past 10 years and continues to be a major thrust of materials research and development. For individual constituents, the following topics are covered: fibers, whiskers, and matrix materials; and for the composites as a whole, mechanical behavior, properties and characterization, and processing technology are covered. This book will serve as a source book for researchers as well as an excellent introduction to those not familiar with composites.

The editor, K.S. Mazdiyasni, a widely recognized authority on structural and engineering ceramics, has assembled an impressive group of contributors to review the status of and recent advances in ceramic matrix composites, as well as to discuss issues pertinent to improving composites performance. Of the 29 contributing authors, over half are from industry, with the remainder divided between university and government laboratories.

The topical material is organized into 15 chapters. Mechanical behavior is treated for both continuous-fiber-reinforced and whisker-reinforced composites. Individual chapters deal with characterizing fiber microstructure and mechanical testing. The types of reinforcement materials discussed include non-oxide fibers derived from preceramic polymers, oxide fibers made by various chemical routes, and SiC whiskers produced by the VLS process. Glasses and glass-ceramics, mullite, and polymer-derived ceramics are among the matrix materials evaluated. Processing topics include preparation of the above materials as well as chapters devoted to chemical vapor deposition, chemical vapor infiltration, and melt infiltration techniques. Finally, future opportunities and needs are assessed for ceramic composites in both structural and non-mechanical applications.

Treatment of the subject matter is satisfyingly comprehensive and well balanced. Containing developments as recent as two years old, the presentation is as up-to-date as possible considering publication lag time. With relatively few books devoted to ceramic matrix composites, the review format of this volume is timely and offers depth and perspective that conference proceedings frequently lack. Of special interest are the diversity of materials systems and processes discussed, the analyses of mechanical behavior, and an emphasis in certain chapters on the role of the fiber/matrix interface in obtaining optimum performance. The thermal and oxidative stability of the interface continues to be a subject of current research and a central issue regarding the ability of ceramic matrix composites to realize their potential as structural materials in severe environments.

The level of presentation seems appropriate to the volume's intended application as a reference both for workers in the field and for those not previously exposed to composites. Previous background in materials would be helpful but not essential. A detailed table of contents and index aid navigation through the chapters. Overall, the quality of the book is very high, and I think it succeeds in its goal of being a definitive text on ceramic matrix composites.

Reviewer: Mark S. Spotz is a research associate in materials science and engineering at Northwestern University. His research interests are in materials processing, including ceramic composites and preceramic polymers. □

The *MRS Bulletin* welcomes your opinion on issues of interest to the materials science community.

Write to: Editor, MRS Bulletin
Materials Research Society
9800 McKnight Road
Pittsburgh, PA 15237
Fax (412) 367-4373

https://doi.org/10.1557/S088376940005538X Published online by Cambridge University Press

ANNOUNCEMENT — NEW JOURNAL

MODELLING AND SIMULATION IN MATERIALS SCIENCE AND ENGINEERING

In September 1992 the Institute of Physics' publishing arm, IOP Publishing, will commence publication of this important new journal in response to strong demand from the scientific community.

The journal will be directed and led by an eminent international team of materials scientists, including:

Editor-in-Chief: **M I Baskes, Sandia National Laboratories**
PO Box 969, Livermore, CA 94551-0969, USA
Tel: (510) 294 3226 Fax: (510) 294 3410

Executive Editorial Board includes:

- **C R A Catlow,** The Royal Institution of Great Britain, London UK. Fax: (071) 629 3569
- **M Doyama,** The Nishi-Tokyo University, JAPAN. Fax: (3) 3310 0931
- **B M Klein,** Naval Research Laboratory, Washington DC, USA. Fax: (202) 404 7546
- **L Kubin,** CNRS-ONERA (OM), Chatillon, FRANCE. Fax: (1) 46 54 4706
- **D J Srolovitz,** University of Michigan, Ann Arbor, USA. Fax: (313) 763 4788
- **J Szekely,** Massachusetts Institute of Technology, USA. Fax: (617) 258 6886
- **V Vitek,** University of Pennsylvania, USA. Fax: (215) 898 8296
- **J H Westbrook,** Sci-Tech Knowledge Systems, NY, USA. Fax: (518) 885 8840
- **R Zeller,** Institüt für Festkörperforschung, KFA Jülich, GERMANY. Fax: (49) 24 6161 2410

Scope

The Editor-in-Chief and Executive Board will be supported by an International Editorial Board.

This new journal will cover the whole range of methods and applications of modelling and simulation in materials science and engineering. The journal aims to serve the emerging multidisciplinary materials community through original contributions to modelling methods and applications. The contents will provide an important link between theory and experiment – covering properties, structure and behaviour of all classes of materials at all scales from the atomic to the macroscopic.

Electronic structure/properties of materials determined by ab initio and/or semi-empirical methods, e.g. quantum chemistry, density functional, tight binding, etc.

Atomic level properties of materials, including structural, mechanical, thermodynamic and kinetic properties.

Microstructural level phenomena, including grain growth, sintering, dislocation networks, coarsening, texture, etc.

Continuum level modelling pertaining to materials, including continuum elasticity/plasticity, fracture mechanics, fluid flow, diffusion, heat transfer, phase transitions, etc.

Macroscopic process models e.g. welding, forming, casting, CVD, etc.

Modelling behaviour in service, e.g. lifetime predictions, environmental persistence, degradation.

The journal particularly welcomes papers treating simulation related to the interpretation of experimental observations and linking synergistically theory and experiment.

Papers are also welcomed dealing with data representation, data manipulation, data exchange formats, and other aspects of computerization of the structure, properties, and processing of materials.

Call for papers

Further information about this new journal can be obtained from the Editor-in-Chief, members of the Executive Editorial Board, or the publishers.

Papers should be submitted to the office of the Editor-in-Chief, who will administer the reviewing process for papers in close liaison with members of the Executive Editorial Board.

There will be no page charges.

Managing Editor
Modelling and Simulation in Materials Science and Engineering
IOP Publishing Ltd, Techno House, Redcliffe Way,
Bristol BS1 6NX, ENGLAND
Telephone: (0272) 297481 Telex: 449149 INSTP G Fax: (0272) 294318
Telecom Gold: 87:WQQ563

IOP PUBLISHING

Circle No. 16 on Reader Service Card.

https://doi.org/10.1557/S088376940005538X Published online by Cambridge University Press