badly damaged plane, one death resulted from the accident. Since then engineers have focused on advanced techniques to detect multiple-site damage in existing aircraft (through ultrasound and tomographic methods), and on the refinement of multiple-site damage/fracture mechanics models. The accident has also spurred both government and industry scientists to take renewed interest in the problems of maintaining the nation's aging aircraft.

Many basic questions remain in the study of fracture. Why do cracks bifurcate? When is linear crack propagation stable, and when unstable? Why do some materials fracture in a brittle fashion while others are ductile and cannot sustain a sharp crack? Why are metals embrittled by hydrogen? How does a crack interact with the underlying microstructure of a solid, or with interfaces in a composite or layered material? A U.S. government study estimated that in 1978, fracture cost the U.S. economy $119 billion (in 1982 dollars). Further research efforts in the area of fracture mechanics thus have the potential to both prevent needless deaths and injuries and to improve the nation's economic well-being.

ROBIN L. BLUMBERG SELINGER

FOR FURTHER READING: T.L. Anderson, *Fracture Mechanics: Fundamentals and Applications*, Chapter 1 (CRC Press, Boca Raton, 1995); and John M. Barsom, ed., *Fracture Mechanics Retrospective: Early Classic Papers (1913-1965)* (American Society for Testing and Materials, Philadelphia, 1987).

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Chemical Processing of Ceramics

Edited by B.I. Lee and E.J.A. Pope
(Marcel Dekker, 1994)
ISBN: 0-8247-9244-0

Chemical Processing of Ceramics is an eclectic collection of articles on various aspects of the use of chemistry in preparing materials. The book has six sections: Precursor Chemistry, Powder Synthesis and Characterization, Powder Processing, Sol-Gel Processing, Ceramics via Polymer Chemistry, and Processing of Specialty Ceramics. Each contains a number of chapters devoted to specific subjects. As noted in the foreword by P.E.D. Morgan, the use of chemical routes to materials synthesis is often viewed as costly. Yet, he comments that industrial processes can often overcome such difficulties and notes that the largest volume of silicon nitride is currently produced by the chemical reaction of silicon tetrachloride and ammonia.

The book considers many of the major chemical processing routes to ceramic materials with sufficient detail to give the reader an appreciation for each subject. Rather than a manual for proceeding to utilize the approaches, which no realistic single book could accomplish, it provides a clear assessment of the potential of the techniques. Thus it is an invitation to the reader to begin to assess the alternatives and take seriously the attractive attributes of chemical processing.

One of the major advantages of chemical processing is the atomic level mixing of constituents that allows processing at lower temperatures. This theme recurs in the book, with many of the discussions focused on materials having two or more metal components. For example, in the chapter entitled "Chemical Synthesis of Metal Oxide Powders," C.N.R. Rao emphasizes the preparation of complex, multicomponent oxide powders with controlled stoichiometry.

The specificity of the chapters varies widely, ranging from broad coverage such as in "Molecular Design of Transition Metal Alkoxide Precursors" to the very narrow, such as "Metal Alkoxides for Electrooptical Ceramics." The chemical route to powder synthesis, characterization, and processing is fundamental to ceramics as an alternative to the "brute-force" processing of mechanical mixing and high temperature reaction. Chemical techniques, however, yield greater control over composition, morphology, particle size and distribution, and surface chemistry. Additionally, chemical synthesis allows preparation of nanoscale materials impossible to obtain by most other means.

In the coverage of sol-gel and polymer processing we see the substantial advantages of these routes for specific materials. Through chemical control we may create not only the materials of interest, but may fairly easily tailor their micro- and macrostructure. Thus, we are able to fabricate useful materials ranging from thin films to fiber-reinforced composites.

The final section contains an interesting mix of ceramics prepared via chemical routes for very specific applications. The six chapters cover materials such as lead-based dielectrics, magnetic particles, and ceramic membranes. Examples such as how surface charge affects the packing of nanoscale particles, and thus the permeability of a membrane, are particularly enlightening.

One area of chemical processing that was largely ignored was chemical vapor processes. The technique and its variants is a mainstay of processing for many electronic materials. Alas, however, no book can cover every topic.

Reviewer: T.M. Besmann is a group leader in the Metals and Ceramics Division at Oak Ridge National Laboratory. His research interests are in the vapor phase processing of ceramic films and composites, and thermochemical analysis and phase equilibria.

Glassy Metals III: Amorphization Techniques, Catalysis, Electronic and Ionic Structure

Edited by H. Beck and H-J. Güntherodt
(Springer-Verlag, 1994)
ISBN: 0-387-57440-9

Glassy Metals III follows the first two volumes in this series, *Glassy Metals I* and *II*, which appeared in 1981 and 1983, respectively. The first two volumes appeared at a time when rapid solidification, as the leading technique to prepare metallic glasses, was still a major research topic in materials science. In 1983 three observations of solid-state amorphization, i.e., interdiffusion of thin film diffusion couples, hydrogenation, and mechanical attrition, stimulated research in this area, and much of the new research on amorphous alloys has focused on solid-state amorphization. Chapter 2 in this volume gives an overview of solid-state amorphization which adequately covers the field but provides information already available elsewhere. The same may be said for Chapter 3, which concentrates on the method of mechanical attrition.

The study of amorphous alloys as catalytic materials has also been a major topic of research for about 10 years. The author of this chapter (4) excellently describes the motivation for using metallic glasses in catalysis. A useful table gives the variety of glassy alloys studied and major reaction products which they catalyze. Glassy alloys in the as-quenched state and where they were subjected to various pretreatments (such as reduction in hydrogen, etching, and oxidation) and serve as precursors to catalytically active materials are

both discussed. It is stressed that so far little effort has been aimed at developing amorphous alloys specifically for catalytic applications. Specifically designed glassy metals could result in outstanding catalytic materials.

An approach to understanding the structural and electronic-magnetic properties of amorphous alloys is given in Chapter 5. Evidence is given from data on (Au,Ag,Cu)-Sn and (Au,Fe)-Sb metallic glasses as model systems. Many properties are found to scale with Z, the mean electron per atom ratio. An analogy is drawn with the crystalline so-called electron or Hume-Rothery phases. Remarkable properties occur for compositions where the peak of the structure factor and the diameter of the Fermi sphere are very close.

The final chapter (6) describes a model for the structure of amorphous solids—the polycluster concept of amorphous solids. This model considers a set of coordination polyhedra for each atom determined by its nearest neighbors and therefore the bonding. Equivalent polyhedra form clusters—locally regular clusters. Atoms with different coordination polyhedra are at the boundaries between clusters of regular atoms. The polycluster model resembles earlier stereochemical models for the amorphous structure. The model allows for the identification and classification of point and line defects. The polycluster concept helps explain phenomena in amorphous solids such as diffusion, the liquid/glass transition, and elastic and plastic behavior.

In general, this book presents excellent reviews of the five topics which represent important areas of research on amorphous alloys in the last 10 years. The book can be recommended for researchers who desire a concise but complete overview of the limited areas covered.

Reviewer: Carl C. Koch is professor and associate department head of the Materials Science and Engineering Department at North Carolina State University. His research interests focus on metastable materials prepared by nonequilibrium processes such as rapid solidification and mechanical attrition.

The following recently published books and journals, relevant to materials science, have come to the *MRS Bulletin's* attention. Some of the books listed here may be reviewed in future issues of the *MRS Bulletin.*

Books

Adhesion Measurement of Films and Coatings, K.L. Mittal, ed. VSP, Utrecht, 1994. Cloth, 434 pp, $96.00, ISBN 90-6764-182-0.

Atomic Force Microscopy/Scanning Tunneling Microscopy, S.H. Cohen, M.T. Bray, and M.L. Lightbody, eds. Plenum Press, New York, 1994. Cloth, 463 pp, $125.00, ISBN 0-306-44890-4.

Cold Plasma in Materials Fabrication: From Fundamentals to Applications, A. Grill. IEEE, Brussels, 1994. Cloth, 272 pp, $69.95, $56.00 for IEEE members, ISBN 0-7803-1055-1.

Dynamics of the Liquid State, U. Balucani and M. Zoppi. Oxford, New York, 1994. Cloth, 352 pp, $95.00, ISBN 0-19-851739-4.

Elliptical Fiber Waveguides, R.B. Dyott. Artech House, Boston, 1995. Cloth, 229 pp, $79.00, ISBN 0-89006-477-6.

Engineering Plastics: A Handbook of Polyarylethers, R.J. Cotter. Gordon & Breach, Amsterdam, 1995. Cloth, 375 pp, $120.00, ISBN 2-88449-112-0.

High-Temperature Superconducting Materials Science and Engineering: New Concepts and Technology, D. Shi, ed. Pergamon/Elsevier, Oxford, 1995. Cloth, 497 pp, $120.00, ISBN 0-08-0421512.

Laser Communications in Space, S.G. Lambert and W.L. Casey. Artech House, Boston, 1995. Cloth, 410 pp, $99.00, ISBN 0-89006-722-8.

Oxygen in Silicon, F. Shimura, ed. Academic Press, San Diego, 1994. Cloth, 710 pp, $169.00, ISBN 0-12-752142-9.

Plasma Surface Modification of Polymers: Relevance to Adhesion, M. Strobel, C.S. Lyons, and K.L. Mittal, eds. VSP, Utrecht, 1994. Cloth, 290 pp, $79.00, ISBN 90-6764-164-2.

Properties of Narrow Gap Cadmium-Based Compounds, P. Capper, ed. IEE, London, 1994. Cloth, 639 pp, $295.00, ISBN 0-85296-880-9.

Review of Progress in Quantitative Nondestructive Evaluation, *Vol. 14A–14B,* D.O. Thompson and D.E. Chimenti, eds. Plenum, New York, 1995. Cloth, 2515 pp, $365, ISBN 0-306-45062-3.

Self-Organizing Maps, Springer Series in Information Sciences, T. Kohonen. Springer-Verlag, Berlin, 1995. Cloth, 377 pp, $49.50, ISBN 3-540-58600-8.

Sol-Gel Processing and Applications, Y.A. Attia, ed. Plenum, New York, 1994. Cloth, 406 pp, $115.00, ISBN 0-306-44837-8.

Statistical Mechanics and Thermodynamics, C. Garrod. Oxford University Press, New York, 1995. Cloth, 638 pp, $45.00, ISBN 0-19-508523-X.

Thin-Film Deposition: Principles and Practice, D.L. Smith. McGraw Hill, New York, 1995. Cloth, 639 pp, $65.00, ISBN 0-07-058502-4.

Ultrafast Diode Lasers: Fundamentals and Applications, P. Vasil'ev. Artech House, Boston, 1995. Cloth, 283 pp, $88.00, ISBN 0-89006-736-8.

VossPlot: A Software Tool for Scientific and Technical Graphics, R.F. Voss. Springer-Verlag, New York, 1995. Paper, 211 pp, $29.95, ISBN 0-387-14215-0.

Journals

The Chemical Intelligencer, Springer-Verlag New York, Inc., Journals Department, 175 Fifth Avenue, New York, NY 10010; 1-800-SPRINGER, ext. 9; 201-348-4033; fax 201-348-4505. Quarterly; first issue: January 1995. Subscription rate: $29.00.

Compound Semiconductor, Franklin Publishing, 250 Selby Avenue, Suite 48, Saint Paul, MN 55102; 612-227-5397; fax 612-227-5499; e-mail editor@compsem.com. Six issues; first issue: July 1995. Distributed free to qualified engineers, managers, and scientists.

Current Opinion in Colloid and Interface Science, Current Biology Ltd., 400 Market Street, Suite 700, Philadelphia, PA 19106; 800-552-5866. Six issues; first issue: February 1996. Subscription rate: $199.00; student/postdoc: $85.00.

Current Opinion in Solid State and Materials Science, Current Biology Ltd., 400 Market Street, Suite 700, Philadelphia, PA 19106; 800-552-5866. Six issues; first issue: February 1996. Subscription rate: $199.00; student/postdoc: $85.00.

The Industrial Physicist, Charles Harris, publisher, American Institute of Physics, 1 Physics Ellipse, College Park, MD 20740; Kenneth McNaughton 301-209-3051; fax 301-209-0842; e-mail km3@aip.org. Quarterly in 1996; first issue: July 1995. Distributed free to qualified materials scientists in industry or industry-supported research.

Innovations in Materials Science, World Scientific Publishing Co. Inc., 1060 Main Street, River Edge, NJ 07661; 1-800-227-7562; 201-487-9655; fax 201-487-9656. Four issues in 1995; six issues in 1996; first issue: July 1995. Subscription rate: $85.00 for 1995; $120.00 for 1996. □

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