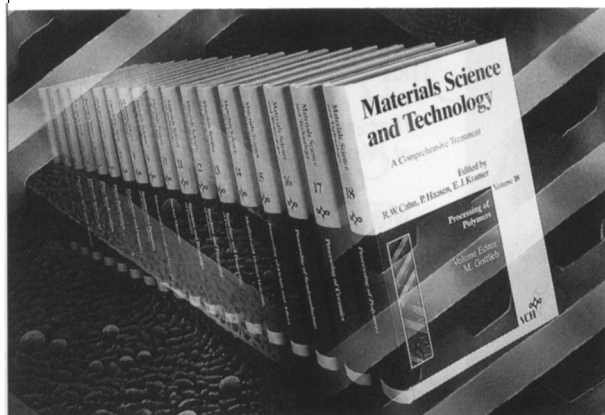


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BOOK REVIEWS

Fatigue of Materials

S. Suresh

(Cambridge University Press, 1991,
520 pages).

ISBN: 0-521-36510-4

This comprehensive, up-to-date textbook includes a substantial treatment of fatigue in ceramics and polymers as well as in metallic materials. The emphasis is on the basic science of fatigue, although the short but useful final chapter includes design considerations and case studies. A basic knowledge of dislocations is assumed, but there is a brief introduction to continuum mechanics, a more substantial introduction to linear elastic fracture mechanics, and a helpful initial overview. Topics on which much attention has been focused in recent years are well covered, such as crack closure, threshold conditions, and the short crack problem. The extensive bibliography indicates that this is a very comprehensive and up-to-date treatment, especially from the fundamental and mechanistic points of view of the subject. Indeed, if used in a course on fatigue, some degree of selection and possibly reordering of the material would probably be required. However, this well-written book certainly will be a major reference in a field

that continues to be of major importance in engineering and materials science.

Reviewer: G.W. Groves is a lecturer in the Department of Materials at the University of Oxford.

Sol-Gel Science: The Physics and Chemistry of Sol-Gel Processing

C. Jeffrey Brinker and George W. Scherer

(Academic Press, 1990, 881 pages).

ISBN: 0-12-134970-5

Over the past 15 years, sol-gel processing and synthesis of materials has grown from oddity status into a major interdisciplinary research and technological activity encompassing chemistry, physics, chemical engineering, and materials science. The rapid emergence of the field has resulted in the dispersion of its archival literature in a variety of conference proceedings and journals.

In this book, the authors have admirably accomplished their objective of presenting "a coherent account of the principles of sol-gel processing." As the first textbook-quality publication describing the entire field of sol-gel science, the authors have

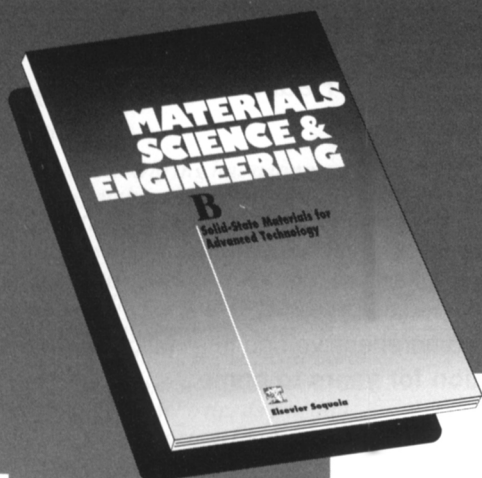
had the opportunity (or onerous task) of presenting the fundamental principles underlying the unique characteristics of sol-gel systems.

The book is organized in the order of sol-gel processing, with the early chapters describing the chemical synthesis principles underlying hydrolysis and condensation. Subsequent chapters progress through gelation, aging of gels, deformation and flow, drying, structural evolution, surface chemistry, chemical modification, and sintering. The last three chapters discuss more specialized topics, such as comparisons of gel-derived and conventionally produced ceramics, film formation, and applications. The phenomenology and fundamentals of each topic are thoroughly discussed and extensively referenced with more than 100 references following every chapter.

Each chapter is an excellent account of the specific topic, not surprising since the authors are pioneers in the sol-gel field and have contributed greatly to the development of its scientific foundations. A noteworthy feature is the critical analysis of topics and the authors' attempt to point out areas of controversy as well as those requiring more research.

At \$140, the book is somewhat expensive

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for students but should be in the personal library of anyone doing research in the field. The time and money saved by first reading this book makes it well worth the price.

Reviewer: Gary L. Messing is professor of ceramic science and engineering and director of the Center for Particle Science and Engineering at Pennsylvania State University.

Materials and the Designer

E.H. Cornish
(Cambridge University Press, 1991, 273 pages).
ISBN: 0-521-38580-6

The first point of interest about this book is that the author works in industry (STC, United Kingdom) and, as an industrialist, gives the book's content and style a distinctly different slant from other standard textbooks written by academics on the selection and use of materials. The major difference is that there is considerably less emphasis on the property/microstructure relation than in previous books, and a greater proportion of this book deals with general properties of material classes, their responses to service environments, and their processability. The economic decisions made during design are highlighted, and a number of general graphical techniques are illustrated to aid the selection process, as used by the author's company. I was slightly disappointed by the author's lack of specific examples illustrating his points. However, by emphasizing the importance of decisions about machining and other processing specifications, the book shows how industry considers materials selection as part of design for manufacture rather than an exercise in its own right.

In some areas the book is slightly old-fashioned. The choice of metals used in the chapter on general metal properties reflects some of the concerns appropriate 10 years ago. There are similar lapses in the section on ceramics, with only the briefest description of the importance of statistical techniques in design and little on the importance of damage in determining strength. The chapters on sources of material information are useful as a general guide and cover both U.K. and U.S. sources of data in English. There is perhaps a slight overemphasis on U.K. sources due to the author's nationality.

To conclude, I found this an interesting, different perspective on materials selection showing some of the basic concerns of industry. As an undergraduate or graduate textbook, it is better suited for mechanical engineers than for materials science students. It is clearly not a book around which to base a course but is probably a useful addition to a library.

Reviewer: Brian Derby is a university lecturer in the Department of Materials, Oxford University.


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