

## Fundamentals of Ceramic Powder Processing and Synthesis

T.A. Ring, (Academic Press, San Diego, 1996)

983 pages, \$150.00, ISBN 0-12-588930-5

The term "processing" often carries different meanings depending on the context in which it is being used. Ceramic powder processing is generally held to involve four qualitatively distinct steps: raw materials preparation, forming/shaping, high-temperature processing, and finishing. Raw materials preparation involves both beneficiation of natural raw minerals and synthesis of novel powders. The details of the processes involved determine the chemical make-up and both the size and shape distributions of a given powder. All are important to the success of the process. The step that imparts the geometrical information (i.e., the desired shape) also determines the average and variance of many properties of the green microstructure (e.g., the green density of the powder compact and the coordination number of particles). High-temperature processing, or "firing," usually involves loss of some materials (organics and water), densification or sintering, and one or more chemical reactions including both solid-state and gas-solid reactions. Post-process finishing steps include machining (contrary to the common assertion, ceramics are readily and commonly machined using diamond-based abrasives), application of glazes or other coatings, or heat treatment to alter microstructure (via grain growth or change in phase distribution). Different texts that employ the term "ceramic processing" can have a very different emphasis.

Ring's book clearly emphasizes synthesis. This is a massive tome broken down into six sections. The second section, which is devoted to synthesis, is the largest, encompassing nearly one-third of the book. Considerably more than half of the book is occupied when the sections on characterization of powders and colloidal chemistry are added together with the section on synthesis. Forming, thermal processing (drying, binder burnout, and sintering), and finishing make up the minor fraction of the book. The title could be reversed to read "Synthesis of Ceramic Powders and Their Processing."

The construction and content of the book are both reminiscent of a college-level chemical engineering text. The author states that one goal of the text is to give a more formal and rigorous mathematical treatment than is customary in discussions of ceramic processing. It succeeds very well in meeting this goal. Potential readers should be aware that a working knowledge of partial differential equations is assumed. Exclusive of the first and last chapters, there is an average of 84 mathematical expressions per chapter, and three appendices are included on differential operators.

The book's strengths include the level of rigor in the analyses presented, the depth of coverage of synthesis and colloidal chemistry, and the up-to-date references. However, the expectations of the readers are high, and those without the benefit of a sound background in mathematics or outside help (such as a qualified instructor) will likely struggle to extract these benefits. Pleased with the content and presentation in this book, I have used it as the primary text for a graduate-level ceramic processing course, with success. I suspect, though, that the book works better in educating students with a chemical engineering background about ceramics than it does as a mainline ceramic engineering text competing with I.J. McColm and N.J. Clark's book, *Forming, Shaping, and Working of High Performance Ceramics* (Chapman & Hall, New York, 1986), or the widely used *Principles of Ceramic Processing*, by J.S. Reed (2nd ed., Wiley & Sons, New York, 1995).

*Reviewer: James D. Cawley received both his BS and PhD degrees in ceramic engineering. He taught on the faculty of the Ohio State University Ceramics Program for seven years before joining the faculty of Case Western Reserve University as the Great Lakes Professor for Ceramic Processing in 1991.*

# Find a Wider World of Research with AIP

## Save with New Online-Only Subscriptions

AIP will continue to offer free online editions with print subscriptions in 1999. For the first time we will also offer online-only subscriptions at a reduced rate—saving MRS Members up to 40%. Also new for 1999: individual online subscriptions to AIP-distributed Russian translation journals.

Visit  
booth U212  
in  
Boston!

## Expand Your Access with New Online Features

To help you reach beyond the pages of a single journal—even beyond the pages of all AIP journals—we've developed powerful new enhancements to let you:

- **Link from Citations to Thousands of Abstracts**—Just click on an article citation and link to the referenced article's abstract in databases such as INSPEC and SPIN. Citations also link to the full text of articles in other AIP online journals to which you subscribe.
- **Receive Documents Online**—Now you can order online any of nearly 100,000 articles from 33 of the most prestigious physics journals. You'll find the articles you need by browsing AIP's SPIN database, available with any AIP journal subscription. Articles are inexpensive and ordering by credit card is fast via our secure online service, Articles In Physics.

## The Industrial Physicist— Now two more issues per year!

### Sign up for your free subscription

*The Industrial Physicist* is where physics gets down to business. From emerging equipment trends to advances in research and development to career leads and advice, *TIP* is your expert guide to the industrial applications of physics. And, in 1999, *TIP* increases in frequency to six issues. That gives you greater coverage of areas including semiconductors, testing, imaging, computing, chemical, automotive, aerospace, optics, robotics, biotech, electronics, and more.

To learn more, stop by booth U212 or visit our website: [www.aip.org](http://www.aip.org)

AMERICAN  
INSTITUTE  
OF PHYSICS

500 Sunnyside Boulevard  
Woodbury, NY 11797  
Phone: (516) 576-2411 • Fax: (516) 576-2374

Circle No. 5 on Reader Service Card.

## FERROELECTRICS REVIEW

[http://www.gbhap.com/Ferroelectrics\\_Review/](http://www.gbhap.com/Ferroelectrics_Review/)  
 Editors: **George W. Taylor and Amar S. Bhalla**

*Ferroelectrics Review* is designed to allow scientists and engineers to keep abreast of developments that parallel and complement their own specialties within the rapidly growing and diversified field of ferroelectrics and related materials.

*Ferroelectrics Review* will publish, on a quarterly basis, authoritative review articles on all aspects of ferroelectricity and related phenomena. These articles are both invited and contributed and cover theory, measurements and applications.

The review articles will be on significant and active topics. Particular attention will be paid to ensure that the reviews are well written and strike a good balance between being comprehensive and concise.

The editors invite authors to submit review articles on all aspects of ferroelectrics and related materials for possible publication in *Ferroelectrics Review*. Review articles should typically range in size from 30 to 100 printed journal pages, depending on the topic.

SUBSCRIPTION INFORMATION  
 ISSN: 1025-580X • 4 issues per volume • Gordon and Breach

## PHYSICS OF MATERIALS

**Y. Quééré**, *Académie des Sciences, Paris, France*

Few areas of science are as interdisciplinary as materials science. Chemistry, physics, mechanical engineering, and mathematics each play a part within it. The role of physics is to describe the objects, effects and phenomena at different scales (micro-, meso-, and macroscopic) as precisely as possible.

*Physics of Materials* addresses this description at the elementary level. Based on an undergraduate level course taught at the Ecole Polytechnique, France, the main emphasis is on the conduction related phenomena (electronic properties) and the plastic behavior (ionic properties) of materials, such as metals and alloys, semiconductors, and ceramics. It assumes a basic grounding in statistical physics,

quantum mechanics and elasticity but does not require prior knowledge of solid-state physics, to which it will serve as a useful introduction.

The presentation of the course is followed by several examination problems, with solutions, covering various specific applications of the general concepts and which will enable readers to test their understanding of these concepts.

1998 • 463pp • Cloth • ISBN 90-5699-118-3 • US\$60 / £38 / ECU55  
 Paperback • ISBN 90-5699-119-1 • US\$25 / £16 / ECU22 • Gordon and Breach

## BIOCERAMICS

**James F. Shackelford**, *Division of Science and Engineering, University of California, Davis, USA*

Presents a comprehensive survey of the field of bioceramics, from the history of biomaterials, in general, and bioceramics, in particular, to the modern studies of biomimetics. The main sections/chapters of the book focus on the composition of nine types of bioceramics ( $Al_2O_3$ -based,  $ZrO_2$ -based, other simple oxides, hydroxyapatite, other calcium salts, silicate ceramics, silicate glasses, glass ceramics, ceramic-matrix composites) and the medical applications of these materials in orthopaedics, dentistry and the treatment of cancerous tumors. *Bioceramics* will appeal to ceramic and mechanical engineers, medical and dental professionals, and students of advanced-level courses in related fields.

1998 • 80pp • Cloth • ISBN 90-5699-612-6 • US\$35 / £23 / ECU29  
*Advanced Ceramics, Volume 1* • Gordon and Breach

**TO ORDER: North/South America** (BOOKS) PTT, PO Box 566, Williston, VT 05495-0080, USA  
 Tel: +1 800 396 8917 • Fax: +1 802 864 7626 • [book.orders@aidcvt.com](mailto:book.orders@aidcvt.com) (JOURNALS) IPD, PO Box 32160, Newark, NJ 07102, USA • Tel: +1 800 545 8398 • Fax: +1 215 750 6343 • [info@gbhap.com](mailto:info@gbhap.com)  
**Europe/Middle East/Africa** (BOOKS) Marston Book Services, Ltd., PO Box 269, Abingdon, Oxon OX14 4YN, UK • Tel: +44 123 546 5500 • Fax: +44 123 546 5555 • [direct.order@marston.co.uk](mailto:direct.order@marston.co.uk)  
 (JOURNALS) IPD Marketing Services Ltd., PO Box 310, St. Helier, Jersey JE4 0TH, Channel Islands  
 Tel: +44 118 956 0080 • Fax: +44 118 956 8211 • [info@gbhap.com](mailto:info@gbhap.com)  
**Asia** (BOOKS & JOURNALS) International Publishers Distributor, Kent Ridge, PO Box 1180, Singapore 911106 • Tel: +65 741 6933 • Fax: +65 741 6922 • [ipdmtk@sg.gbhap.com](mailto:ipdmtk@sg.gbhap.com)  
**Australia/New Zealand** (BOOKS & JOURNALS) For a separate Australian Dollar price please contact our distributor: Fine Arts Press, Level 1, Tower A, 119 Talavera Road, North Ryde, NSW 2113, Australia  
 Tel: +61 2 9878 8922 • Fax: +61 2 9878 8122 • [info@gbpub.com.au](mailto:info@gbpub.com.au)  
**Japan** (BOOKS & JOURNALS) For a separate Yen price please contact our exclusive agent in Japan: YOHAN (Western Publications Distribution Agency), 3-14-9, Okubo, Shinjuku-ku, Tokyo 169-0072, Japan • Tel: +81 3 3208 0186 • Fax: +81 3 3208 5308 • [yohansg@infoweb.ne.jp](mailto:yohansg@infoweb.ne.jp)

All prices are tentative and subject to change

Gordon and Breach • <http://www.gbhap.com>



## Crystal Fire: The Birth of the Information Age

**M. Riordan and L. Hoddeson**

(*W.W. Norton and Company, New York, 1997*)

352 pages, \$27.50, ISBN 0-393-04124-7

Here is by far the best book I have seen about the events that led to the invention, 50 years ago, of the transistor. It is, in essence, a combined biography of the three progenitors, John Bardeen, Walter Brattain, and William Shockley, their scientific insights and struggles, and their complex interaction with each other and with the other scientists and research managers who played crucial roles. The fourth object of this biographical *tour de force* is Bell Laboratories with its fierce manager, Mervin Kelly.

The first author, who holds appointments at two Californian universities, has degrees in physics and long experience of popularizing the field; the second is a historian of science, who holds appointments in both the department of history and that of physics at the University of Illinois and is renowned for her organizational and editing achievements for the International Project on the History of Solid-State Physics that led to the publication of a major historical overview, *Out of the Crystal Maze*. In the book here under review, Professor Hoddeson's expertise in combining archives, publications, and interviews is combined with Professor Riordan's expertise in physics and popularization.

*Crystal Fire* weaves together a sketch of the invasion of the United States by quantum theory and wave mechanics in the 1920s with the personal development of the three prime progenitors and the various precursors of work on diverse semiconductors that came together on that fateful day at Bell Labs in December 1947, and the further crucial improvement in the course of the next few years. There is a vivid account of the standoff between Bardeen and Shockley that led Bardeen to redirect his ultra-acute mind toward superconductors and impelled Shockley to his ill-fated industrial adventures (that nevertheless led him to found Silicon Valley). Altogether, the personalities of all the protagonists, major and minor, are depicted with the skills of experienced biographers, and one is drawn by degrees to a recognition of Shockley's character defects and shown how they drove him in the end to personal disaster, his Nobel Prize notwithstanding.

The origins of Texas Instruments and other companies, and the emergence of integrated circuits are also recorded in some detail, throughout with special attention to the reactions of the media.

Let I leave the impression that this is only a biographical and sociological treatment, I want to emphasize that the stages of scientific confusion and progressive understanding; the technological leaps that led to single-crystal growth of germanium and silicon, to zone-refining and to progressive miniaturization; all these are presented with clarity and with scrupulous attention to sources and evidence. Frederick Seitz, to whom the book is dedicated, has asserted in *Nature* that "the historical research on which [the book] is based is impeccably sound, unlike many books of this kind." He calls the work "an enduring classic"—amen to that.

*Reviewer: Robert Cahn is a physical metallurgist turned materials scientist, currently attached in nominal retirement to Cambridge University. He has researched on intermetallics and many other metallurgical themes, has edited a number of journals and book series devoted to materials science, and has striven over the years to popularize materials science in the pages of Nature. He is a member of the Editorial Board of MRS Bulletin. This review originally appeared in Contemporary Physics 39 (1998) p. 203, and is reprinted with permission of Taylor & Francis.*

Circle No. 15 on Reader Service Card.