Concise Encyclopedia of Composite Materials

Edited by Anthony Kelly
(Pergamon Press and MIT Press, 1989, approximately 317 pages).
ISBN: 0-08-034718-5 (Pergamon)
ISBN: 0-262-11145-4 (MIT)

The *Concise Encyclopedia's* appearance under the general series titled "Advances in Materials Science and Engineering" appears to be a followup project to the major *Encyclopedia of Materials Science* published by Pergamon Press. The idea seems to be to update and enlarge upon specific topics covered in the original treatise and to make them available as compact, relatively inexpensive individual volumes. The *Concise Encyclopedia of Composite Materials* masterfully develops this idea, being both concise in the format of its constituent articles and encyclopedic in its coverage of a very broad range of topics embracing both natural and manmade composites.

The approach in organizing this volume strikes a nice balance between the basic scientific understanding of the factors influencing the performance of different composites and the technologies for their fabrication and exploitation in different industries. The unusually broad range of mechanical properties that can be encompassed in the fiber-reinforced composite systems naturally forces a major focus in this area, and there are excellent articles dealing with many aspects of the fabrication, properties, performance, and utilization of different polymer matrix, metal matrix, and ceramic matrix fiber-reinforced composites.

The current status of available fiber types is very well covered in articles which give a balanced perspective on both the advantages and the problems in each different material type. For the very high performance carbon, polymer and ceramic fibers, the cost factors that tend to limit general usage are well discussed, and some of the advantages of mixed fiber systems that put the most expensive fibers in the most highly stressed areas are very clearly outlined.

For me, it was most interesting to realize the penetration of composites into many common products in everyday use. An excellent article on the sophistication and complexity of the composites in general use in automobile tires was a delight to read. Clear expositions of how biological systems exploit composite structures with a very wide range of internal scales emphasizes the possibility of developing both structural and functional materials out of a limited range of chemical components. For these natural materials it was, however, also a little comforting to see how man improves on nature by applying intelligence, as in the simple lamination of woods used in plywood panels. *(continued on p. 28)*

While the organization of the volume as an alphabetic encyclopedia of topics does lead inevitably to some duplication in the articles, there is extensive cross referencing, and frequently the mode of coverage permits the reader to view the same topic from the very different perspectives of the basic scientist, the design engineer, the material fabricator, and the end user.

Though the topic area is quite small in comparison to the broad usage of the mechanical properties of composites, it was pleasing to see a clear exposition of a number of the different areas in which composites contribute new possibilities for the development and control of magnetic, electrical, and electro-elastic properties. A closely related topic, too recent to be covered in the present volume, is "smart" composites. This material incorporates sensor, control, and actuation functions so as to self-adjust its properties in response to external stimulus. Again, nonmechanical components will be essential constituents of such future composites.

In general, the volume does an excellent job of presenting both basic and applied information for an amazing range of composites in a very accessible and useful manner and is a valuable addition to the literature in the field.

Reviewer: L. Eric Cross is an Evan Pugh Professor of Electrical Engineering at Pennsylvania State University. His research interests are in dielectric, ferroelectric, and electrooptic materials, and in the practical applications of piezoelectric ceramics and composites.

Combustion and Plasma Synthesis of High-Temperature Materials

Edited by Z.A. Munir and J.B. Holt
(VCH, 1990, 501 pages).
ISBN: 0-89573-756-6

This book is intended to cover the preparation of well-characterized materials, including intermetallic compounds, ceramic, and composite materials, via combustion and plasma processing which represent emerging technologies. The proceedings of the International Symposium on Combustion and Plasma Synthesis of High-Temperature Materials held in San Francisco, California, October 23-26, 1988, the book contains 50 papers, starting with a keynote address by A.G. Merzhanov. The first two papers provide excellent reviews of research and development in self-propagating high-temperature synthesis (SHS) in the U.S.S.R. and Japan.

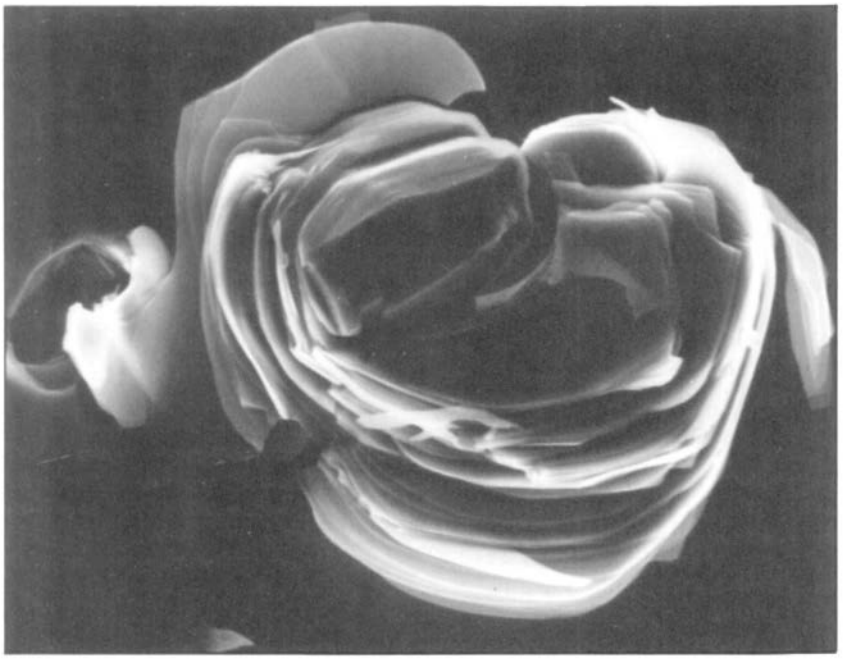
Thirty-four papers included in the first part of the book particularly cover solid-state combustion synthesis, which has never been the subject of an international symposium such as this one. Sixteen papers in the second part cover plasma and gas-phase synthesis. The papers in the first part provide the theory or modeling for the SHS process and the great research and development achievements in preparing and processing intermetallic compounds, e.g., TiAl, NiAl, ZrNi, NiTi, etc.; ceramics, e.g., TiB_2, SiC, TiC, B_4C, AlN, Si_3N_4, etc.; and composite materials, e.g., Fe_2O_3-Al, Al_2O_3-B_4C, TiC-Ni-Al, etc. The papers in the second part explain the processing of and theoretical models for plasma and gas-phase synthesis. Many ceramic powders, e.g., Si_3N_4, SiC, AlN, TiN, TiC, MgO, Y_2O_3, etc., and coatings, e.g., Al_2O_3, ZrO_2, SnO_2, superconducting Y-Ba-Cu-O, etc., have been made via this process.

The book presents the work of numerous investigators in combustion and plasma synthesis of high-temperature materials. It contains a large number of references in which investigators in the area may be interested. The book would be helpful for learning ideas and findings, and for focusing on the important problems and their potential solutions in the area as well. It would also be an ideal reference for students in materials science and engineering.

Reviewer: Cui Guowen is associate professor in ceramics at Tsinghua University, Beijing. He has researched sintering of alumina, silicon nitride, and silicon carbide ceramics and their applications since 1970. □

EDITOR'S CHOICE

Figures appearing in the EDITOR'S CHOICE are those arising from materials research which strike the editor's fancy as being aesthetically appealing and eye-catching. No further criteria are applied and none should be assumed. When taken out of context, such figures often evoke images beyond and unrelated to the original meaning. Submissions of candidate figures are welcome and should include a complete source citation, a photocopy of the report in which it appears (or will appear), and a reproduction-quality original drawing or photograph of the figure in question.



The 1990 International Metallographic Contest, under the auspices of the International Metallographic Society, awarded first prize to this scanning electron micrograph. Pictured, at 3,000X magnification in the original 10 cm x 12.5 cm negative, is a crystallite of one of the new family of copper-based superconducting oxides. This one is from the bismuth, strontium, calcium, copper branch of the family (the BSCCOs) with stoichiometry 2:2:4:5. EDITOR'S CHOICE first saw the tattered end of a parchment scroll when this image arrived. Only later did we learn that when microscopist Rich Lee of the Argonne National Laboratory entered his micrograph in the contest, he titled it "The Rose." Well, a parchment scroll by any other name....