Nanostructured Silicon-Based Powders and Composites

André P. Legrand and Christiane Sénémaud, Eds.
(Taylor & Francis, London, 2002)
320 pages, $96.00
ISBN 0-415-30113-0

Legrand and Sénémaud present a very detailed, comprehensive review of the synthesis, structural characterization, and mechanical properties of laser-synthesized silicon-based nanocomposites. Due to the variation inherent in materials synthesis, it is often difficult to perform a comparative analysis of the resultant material properties. A strong point of the text is that uniformity of the preparation and characterization techniques employed provide a means of independently studying the effects of preparation conditions, precursor selection, and the addition of sintering aids. Although each material prepared is not studied using all of the characterization techniques, the book still succeeds in providing a thorough discussion of the preparation–structure–property relationships.

The content of the text is very topic-specific, making it more suited for a reference text than a course textbook. For example, chapter 4 provides a brief discussion of the theory and operating conditions for transmission electron microscopy, but it appears at the end of the chapter. In some places, the authors assume that the audience will be well versed in the various experimental techniques discussed, so they focus more on the analysis of the specific data. In contrast, the sections in chapter 5 begin with basic theory of the characterization techniques followed by the results and discussion, better preparing the reader for the analysis to follow. In some chapters the information is presented as more of a review of the literature, while in other chapters the results are presented as new data. The inconsistent format for each chapter, and the heavy emphasis on data analysis, can at times give the impression of a compilation of research articles as opposed to a coherently themed book.

Strengths of the text include the expertise of the contributing authors, the high quality of the research, and the extensive reference lists provided with each chapter. In many places, the authors refer readers to additional references for more detail on a specific topic or technique. This is particularly helpful in chapter 9, where a complete explanation of the theory behind molecular dynamics and Monte Carlo simulations is beyond the scope of the text.

At times, some of the characterization analysis is difficult to follow, primarily due to the 2–3 page separation between the explanatory text and the figure. However, many of the figure captions contain a summary of the key conclusions drawn from the data. Such analysis in the figure captions could be very useful to instructors teaching a surface science or materials characterization course; the captions provide a source of examples for either graduate student self-study or discussion topics on how to analyze nuclear magnetic resonance and extended x-ray absorption fine structure data.

Reviewer: *Susan Stagg-Williams is an assistant professor in the Chemical and Petroleum Engineering Department at the University of Kansas. Her heterogeneous catalysis research is focused on the use of metal-loaded, nanostructured mixed-oxide-based powders and membranes for the production of alternative energy and renewable feedstocks.*

A User's Guide to Vacuum Technology, *3rd Ed.*

John F. O'Hanlon
(John Wiley & Sons, Hoboken, NJ, 2003)
516 pages, $99.95
ISBN 0-471-27052-0

The third edition of *A User's Guide to Vacuum Technology* by O'Hanlon is a volume that technologists, graduate students, engineers, and scientists involved with vacuum systems should have at their desk or workplace. This book details many correct procedures for vacuum equipment selection and operation while providing a look at the material processes which govern vacuum science. Many helpful hints are described in this book; these are often overlooked or ignored by vacuum users.

The text is clearly written with very few typographical errors, and the arrangement of topics is put forth in a logical manner. Many types of pumps, gauges, and flow meters are described in detail. Included in this text are several discussions of materials selection for vacuum systems. An entire chapter is devoted to "Materials in Vacuum," making it a useful reference for those working with ultrahigh-vacuum systems. The book includes useful summaries of 300 series austenitic stainless steels and their relevant properties, hard-to-find vapor pressure charts for commonly used pump fluids and lubricants, and a description of joints and seals used for vacuum systems. All of the figures are easy to read, with the exception of the vapor pressure charts of the elements listed in the appendix (these are much clearer in the second edition). O'Hanlon has updated the text from the second edition to include good reviews of new vacuum technology. These include discussions of increasingly popular scroll pumps, spinning rotor gauges, and magnetically levitated turbomolecular pumps. A new chapter describes ultraclean vacuum systems and appropriate practices for operating them. This book could be used as text for an advanced undergraduate course. There are problem sets at the end of each chapter and a list of references for further reading. Overall, this book is highly recommended.

Reviewer: *David P. Adams is a Distinguished Member of the Technical Staff at Sandia National Laboratories in Albuquerque, New Mexico. His work involves a number of different vacuum processes, including thin-film deposition, focused ion-beam milling, and various surface analysis techniques.*

Introduction to Phonons and Electrons

Liang-fu Lou
(World Scientific, Singapore, 2003)
236 pages, $56.00
ISBN 981-238-439-1

This book is basically an introduction to solid-state physics, and it is distinguished in its attempt to incorporate the proper fundamental building blocks of quantum and statistical mechanics, which are generally left out or presented as axioms in most other books of similar scope. In the preface, the author states that it was his intent to do just that, and to a very great extent, he has succeeded.

This book is a little over 200 pages long and covers the fundamentals of solid-state physics in six chapters. These are "Crystal Structure," "Reciprocal Lattice and X-Ray Diffraction," "Lattice Vibrations and Phonons," "Thermal Properties of Insulators," "Free Electron Fermi Gas," and "Electron Energy Bands." The presentation is done well and the author has an easy-to-read style that is almost chatty. The editing could have been a little better, as there are a few typos and occasional words that have been misused; but, by and large, the errors are minor and can be overlooked, as the material can be easily understood without any major issues. Overall, I think that the author has succeeded in providing a book for a niche where the beginning student of solid-state physics wants a self-contained book without having to go to another textbook.

My only disappointment with this book stems from the title, *Introduction to Phonons and Electrons*. I was expecting to see some material on electron–phonon scattering, and there is only marginal mention of phonon–phonon and electron–electron scattering. The author states in the preface—which I read *after* I read the book—that this text has arisen from his lecture notes, which had two parts. One part of his lecture notes covered the basic under-

standing of phonons and electrons in crystalline solids, which is included in the book. The second part, which he has left out, includes a set of classical and contemporary topics. I hope the author will write the second part in the future, as I enjoyed this first part very much.

Reviewer: *Mitra Dutta is Distinguished Professor and Head of the Electrical and Computer Engineering Department of the University of Illinois at Chicago. She previously spent 15 years in various positions as a researcher and in the management of research at the Army Research Laboratory and the Army Research Office, where her last position was as a senior executive service directorate head. Her research interests include optoelectronic devices, quantum and nanoscale devices, and electron–phonon interactions in these structures for electronic, optoelectronic, and medical applications.*

Synthetic Methods in Step-Growth Polymers

Martin E. Rogers and Timothy E. Long, Eds.
(Wiley-Interscience, Hoboken, NJ, 2003)
605 pages, $145.00
ISBN 0-471-38769-X

This book reviews step-group polymerization reactions. It devotes one chapter to each of the major classes of polymers, including polyesters, polyamides, polyurethanes, polyimides, poly(arylene ether)s, and phenolic resins. There are two chapters on nontraditional step-growth polymerizations: one on acyclic diene metathesis (ADMET) and one on transition metal catalyzed cross-coupling reactions. The book concludes with a chapter on depolymerization of step-growth polymers. The material is presented at a level appropriate for graduate students familiar with organic and polymer chemistry. The book will be valuable to researchers who routinely practice step-growth polymer syntheses. On the whole, the material is assembled with clarity and care. Informative discussions on reaction mechanisms are included in most chapters. The chemical structures are adequately represented throughout the book.

The chapters on polyesters, polyamides, and polyurethanes are thorough and provide a useful collection of references (many of which are more than 30 years old) along with an extensive compilation of experimental procedures. A common organization theme runs through these three chapters, and it is disappointing that this style did not continue in all of the remaining chapters. In the chapter on polyurethanes, the author provides insightful comments for many of the experimental procedures—practical information that will be helpful for anyone seeking to perform a particular type of procedure. This feature made the chapter on polyurethanes more than just a literature review, and similar comments would have been a valuable asset to the other chapters. It was disappointing that the chapters on polyimides, poly(arylene ether)s, and phenolic resins did not include an extensive set of experimental procedures. The chapters on nontraditional step-growth methods are fairly comprehensive and up to date. The chapter on transition metal catalyzed cross-coupling includes a useful compilation of experimental procedures and it is organized similarly to the chapter on polyesters. The most valuable feature of the book will probably be its collection of experimental procedures.

Reviewer: *Jeffrey S. Moore is the William H. and Janet Lycan Professor of Chemistry and Materials Science and Engineering at the University of Illinois at Urbana-Champaign. He uses the tools of synthetic and physical organic chemistry to address problems at the interface of chemistry and materials science.*