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Book Reviews

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Book Reviews

"**Review of Near-field Optics**" by Michael A. Paesler and Patrick J. Moyer (Wiley, New York). 1996, ISBN 0-471-04311-7; xii + p. 355; $69.95.

This monograph presents an excellent general account of the state of the art in near-field scanning optical microscopy (**NSOM**), after a decade of practice. The content is well-organized and readable, with the emphasis upon breadth rather than depth. The scanning-probe microscopist will find it to be an accessible introduction to the literature and special challenges of NSOM.

The first section, "Theory and Instrumentation", presents a series of definitions and semi-quantitative treatments of such subjects as resolution, diffraction limit, optical waveguides, heat dissipation, and vibration isolation, among others. This section resembled a series of excerpted introduction and conclusion sections from published papers; it is singularly lacking in quantitative detail, from which it would have benefited greatly. However, it does serve adequately to introduce the conceptual and technological foundations for the following sections. An additional chapter contributes an interesting survey of the photon tunneling microscope.

The following sections explore more fully-detailed highlights of actual experimentation and results. Section II, "Practice", surveys some important NSOM instrumental configurations and ground-breaking results, as organized into six contrast mechanisms: intensity, polarization, wavelength, amplitude/phase, time dependence, and plasmon resonance. The examples are presented in excellent detail, and include diagrams of instrumentation and a few well-chosen color figures.

The last sections, "Applications" and "Related Techniques and Conclusion", discuss achievements in various applied or analytical directions in the field, broadly organized by sample type: surface chemistry, microbiology, materials science, and information storage, as well as excursions into other spectral regions and instrumental designs. Although the applied branch of

NSOM is still in its infancy, its discussion here continues to excel in quantitative detail. The monograph concludes with a glimpse of opportunities and expectations for future progress in NSOM, including improvements in optical probe efficiency and shear-force feedback.

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"Handbook of Conducting Polymers" edited by T. A. Skotheim, R. L. Elsenbaumer, J. R. Reynolds; Marcel Dekker, Inc., New York, 1998, 2nd edition, revised and expanded, ISBN 0-8247-0050-3; xvi + 1097 pages; $ 195.00.

This book is truly a worthy successor to Skotheim's 1986 work which appeared in two volumes totalling 1417 pages. With contributions from eighty distinguished authors from academic, industrial, and government laboratories and research institutes from around the world, the book highlights the major developments of numerous topics since the publication of the first edition. The book is divided into five sections with a total of thirty-eight chapters. The sections are titled: "Theory and Transport in Conducting Polymers"; "Synthesis of Conducting Polymers"; "Processing of Conductive Polymers"; "Properties of Conducting Polymers"; and "Applications of Conducting Polymers".

The second edition differs from the first in the emphasis of topics. While the first edition was approximately equally divided between chemical issues and experimental and theoretical physics, the second edition has markedly less physical theory and far more along the lines of processing and specific technological applications of the materials. This would be consistent with the fact that electrooptic polymers and doped forms of polypyrrole and polyaniline have been introduced to the commercial marketplace and the existence of several large technology programs seeking to move electroluminescent polymers toward commercialization.

A remark about nomenclature appears appropriate. If the term "conducting polymer" implies to you a conjugated polymeric material with a significant magnitude of its dc conductivity, then many of the chapters

deal with polymers that are not conductive in that sense. Hence, the electroluminescent polymers, such as PPV, that emit light through electron-hole recombination in an insulating form of PPV are conjugated, but not conducting, and many of the polymers under discussion for nonlinear optical properties are not conjugated.

Collectively, the ten chapters concerned with synthesis appear as the strongest, most comprehensive section of the book. Most of the chapters are fairly complete summaries of their topic, although there is significant overlap between the chapters by McCullough and Ewbank and that by Roncali. The latter fails to grasp the significance of regioregularity in poly-3-alkylthiophenes.

While a certain unevenness is perhaps not surprising in a multiauthored work of this type, several chapters could have done better. "Conformation-induced chromism" is a topic that is well-known at the conceptual level but lacking along experimental lines. It does not follow that temperature dependent processes in solution and thin films have a similar structural origin. In the chapter on structural studies, the section on polydiacetylenes would have been markedly improved by simply citing the definitive article by V. Enkelmann in 1984.

To summarize, both experienced researchers and beginning students will find this book a useful source of most of the highlights of the last ten years of research and development in conjugated and conducting polymers. It will be of interest to see what developments the next ten years bring to a possible third edition of this work.

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"**Poled Polymers and Their Applications to SHG and EO Devices**", by S. Miyata and H. Sasabe; Gordon and Breach Science Publishers, 1997, ISBN 90-5699-025-X; x + 279 pages; $150, £ 98.

This book contains papers presented at the Satellite Symposium of the 2nd International Conference on Organic Nonlinear Optics which was held at Hotel Village, Kusatsu, Gumma, Japan, July 23–26, 1995. Poled polymer

films containing chromophores with second order nonlinear optical activity for application in second harmonic generation and electrooptics have been introduced to the marketplace and there are numerous science and technology programs devoted to various aspects of this technology. The book consists of 18 chapters and a subject index. There are 7 contributions from Japan, 3 from Korea, 2 from the U.S. and Switzerland, and one each from Belgium, France, Germany and Taiwan. The first chapter is a 46 page overview of the subject by F. Kajzar and P.-A. Chollet with emphasis on physical issues. The remaining chapters deal with materials synthesis and processing, methods of poling and measurement, and device issues. The book will be of interest to researchers and students in nonlinear optics, device engineers, and those interested in an overview of this field.

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"Chemistry of Advanced Materials" edited by L. V. Interrante and M. J. Hampden-Smith, Wiley-VCH, 1998; ISBN 0-471-18590-6; xii + 580 pages; $ 89.95.

In the preface, the editors state that the purpose of this book is to introduce the concept of "materials chemistry" to the broader chemistry and materials since communities. Toward this end they are both well qualified and indeed successful. Interrante is well known to the chemistry, physics, and materials science communities for his original contributions to the study of charge-transfer salts and novel precuror approaches to ceramic materials. He is also the founding editor of the successful American Chemical Society journal "Chemistry of Materials" and has devoted substantial effort to promoting materials chemistry as a discipline to both the chemistry and materials science communities. Several of his written works to this end are cited at the end of the preface and the introductory Chapter 1. Hampden-Smith is well-known for both his original contributions in the area of chemical vapor deposition and the organization of broadly based materials chemistry workshops.

In the preface, the editors note that "materials chemistry", defined as "chemistry related to the preparation, processing, and analysis of materials" has always been an activity that occupied a significant percentage of the population of chemical professionals, yet there is a trend in recent years to recognize common grounds and language among people engaged in various aspects of interdisciplinary projects that might be called "materials chemistry". Toward this end, they have assembled works by a group of authors who have made timely contributions to the aspects of materials chemistry under discussion.

The book consists of eleven chapters and an eighteen page index. In addition to the "Introductory Terms and Concepts" chapter, the readership of this journal will find chapters dealing with charge-transfer salts, electroactive polymers, polymers in electronics, nonlinear optics of organics, and biomaterials of interest. The chapters "Chemical Vapor Deposition" and "Molecular Precursor Routes to Inorganic Solids" should also attract some attention. Curiously, lack of a chapter on modern liquid crystal research is a glaring omission; the term "liquid crystal" is not found in the index. On the whole, each chapter contains sufficient introductory material to allow the general reader to gain a familiarity with the subject and references to review articles and original papers to allow those with specific interests to get to relevant material. The editors and authors are to be congratulated for this accomplishment.

The importance of purification and the consequences that even traces of impurities can have on the properties of electronic materials is clearly appreciated by the editors in the introductory chapter. Nevertheless, this perspective is lacking in the chapter on charge-transfer salts. The subject of organic metals from charge-transfer salts has credibility in chemistry, physics, and materials science communities because major efforts were devoted to the purification of these materials twenty-five years ago. In particular for a material such as TTF-TCNQ, it is established that no covalent bond making processes occur after initial electron transfer that might lead to impurities in the resultant crystalline solid. The same statements cannot be made for the charge-transfer salts found to be ferromagnetic materials. In particular, a serious assessment is required for the chemistry of decamethylmetallocenes.

To summarize, the editors are to be congratulated for assembling in one volume a meaningful survey of much current research in materials chemistry. While it is clearly not exhaustive, their efforts are useful. In particular, their discussions in the introductory chapter of educational and

political issues and their willingness to glance into the future of several topics will be greatly appreciated by most readers. Experienced scientists and students will both benefit from this book.

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