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BOOK REVIEWS

Heterocyclic Supramolecules I. Edited by Kiyoshi Matsumoto (Elm Institute of Science, Otsu, Japan). From the series Topics in Heterocyclic Chemistry, 17. Edited by R. R. Gupta. Springer-Verlag: Berlin, Heidelberg. 2008. xiv + 202 pp. $229. ISBN 978-3-540-68189-2.

Contributing to this book of six chapters were 14 scientists working in the field of supramolecular chemistry, with a special focus on molecular recognition, functional materials, and nanocarbon science. The chapters are well written, addressing mainly heteroatom-containing macrocycles, such as crownophanes, azacalixarenes, calixfurans, and porphyrins. Although this book covers only a small section of these areas of research, it does a good job of providing an in-depth analysis within each area.

The first chapter, "Molecular Recognition with Designed Heterocycles and Their Lanthanide Complexes", is a description of cation and anion recognition by heterocycles and serves as an introduction to molecular recognition and to supramolecular assemblies based on metal−heteroatom interactions. Classes of molecules that can serve as cation or anion receptors are described as well as driving forces, such as size matching, electrostatic interactions, and hydrogen bonding—concepts that the next chapters build upon.

In the second chapter, "Synthesis and Properties of Crownophanes", the authors describe a wide variety of crownophanes possessing benzene and condensed polyaromatic and heteroaromatic nuclei. Crownophanes have received much attention recently in the scientific community as a result of their desirable binding properties, similar to their parent crown ethers, but with more sites for functionalization. Here, the authors discuss multiple approaches to access these functionalized crownophanes using simple synthetic strategies as well as recent examples of their binding properties. The chapter concludes with a brief section on the examples of catenanes and rotaxenes, which strengthens the argument about the utility of crownophanes.

The third and fourth chapters, "Azacalixarene: A New Class in the Calixarene Family" and "Chemistry of Calixfurans", respectively, cover recent developments in the field of calixarenes. Nitrogen used as a bridging element and heterocycles as the aromatic component are recent and potentially useful extensions of the calixarene family. These chapters give comprehensive synthetic summaries on the construction of these calixarenes and on the ability to modify such macrocycles synthetically. Although these systems have low intrinsic binding abilities, the authors comprehensively discuss the most recent accomplishments in terms of structure−property relationships.

The next chapter, "Supramolecules Based on Porphyrins", is about the potential of porphyrins as optical or electronic functional materials in supramolecular systems. The authors provide a general introduction on the governing interactions that are utilized in building supramolecular structures from porphyrinic building blocks. They also present a few good examples from the past decade of such architectures, as well as specific examples on how the two-photon absorption properties of porphyrins can be tuned by extending the conjugation of the porphyrin system. The concept of using porphyrins in artificial photosynthesis and molecular electronics is discussed using examples from the literature. Of all the chapters covered by this book, this one is the closest to providing actual practical applications.

The last chapter, "Heterocyclic Supramolecular Chemistry of Fullerenes and Carbon Nanotubes", summarizes the most recent developments in both exohedral and endohedral functionalizations of fullerenes and carbon nanotubes through noncovalent chemistry. It is well organized, descriptive, and somewhat of an extension of the previous chapter because it further highlights the potential of porphyrin chemistry.

Overall, this book is an informative summary on the progress that researchers have made over the past decade toward generating useful functional materials from heterocyclic supramolecules. This is an advanced text that should be most useful to those with an established background in supramolecular sciences and engineering.

Gabor Borzsonyi and Hicham Fenniri, *University of Alberta*

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Nanostructured and Photoelectrochemical Systems for Solar Photon Conversion. Edited by Mary D. Archer (Imperial College, UK) and Arthur J. Nozik (National Renewable Energy Laboratory, USA). Imperial College Press: London. 2008. xx + 760 pp. $185. ISBN 978-1-86094-255-6.

With the intensifying interest in renewable energy, the publication of a new book on the science and engineering of solar energy conversion is certain to be met with demand. This book makes an excellent addition to the solar energy library and joins two previous publications in the series "Photoconversion of Solar Energy". This third volume focuses on some of the newer directions in solar energy, including nanostructured devices and photoelectrochemical systems. It provides a scholarly treatment of the devices as well as the fundamental science upon which they rest.

Each chapter is written by a different set of authors and highlights a different topic. Many of the popular designs currently under consideration for so-called second and third generation solar cells are examined, including quantum-confined structures and multiple exciton generation (Nozik), inorganic extended-junction devices (Könenkamp), dye-sensitized solar cells (Grätzel and Durrant), organic donor−acceptor heterojunction cells (Benson-Smith and Nelson), semiconductor/liquid junction photoelectrochemical solar cells (Maldonado, Fitch, and Lewis), and photoelectrochemical storage cells (Licht and Hodes). Interspersed throughout these device-themed chapters are additional chapters that focus on the fundamental science underlying the devices, such as photoelectrochemistry, electron transfer reactions, heterogeneous photocatalysis, and experimental techniques for measuring photoinduced electron-transfer dynamics.

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The editors have assembled some of the top authorities in the field of solar photon conversion to write about their areas of expertise. Most of the authors delve deeply into their topics, and the extensive referencing in each chapter provides useful guidance for further reading. Moreover, there is a good coherence to the book's structure despite the contributions from multiple authors. The coherence is assisted by an excellent introductory chapter by Archer, as well as consistency in formatting and figure style throughout the book. There is, of course, variation in the style of the writing in the different chapters. Some chapters, e.g., Chapter 10 on photoelectrochemical storage cells, emphasize a compilation of systems that have been investigated, while other chapters delve much more deeply into the theory. For example, Chapter 2 on fundamentals in photoelectrochemistry extends over nearly 100 pages in fulfilling its promise to cover "essentially all the fundamental processes governing the conversion of solar energy into other forms of energy based on exploiting semiconductor photochemistry." Some of the best chapters in the book provide depth together with balanced explanations of both the promise and challenges of the specific approach through excellent prose. Chapter 3 on quantum-confined structures and Chapter 6 on inorganic extended-junction devices are especially fine in this regard.

One important caveat is that the book is not geared to a broad audience. In particular, as a stand alone volume it would not serve well as an introduction for beginners, nor is it likely to be suitable for a university textbook, except perhaps in an advanced-level course. The content is highly technical, and in many cases the authors forego elementary explanations in favor of technical details suitable for those already familiar with the field. For example, band diagrams, p-i-n devices, diffusion length, and ballistic electron motion are among the concepts used without introduction.

The cross-section of topics included in this book is quite broad. A reader seeking to learn more about how nanostructured photovoltaics work will also encounter chapters on metal-oxide heterogeneous photocatalysis and experimental techniques in photoelectrochemistry. Given the somewhat unwieldy size of this volume, it may have made more sense to separate the topics into two volumes: one dedicated to solar-to-electrical conversion, i.e., photovoltaics, and the other dedicated to solar-to-chemical conversion, e.g., photoelectrocatalysis and photoelectrochemical storage cells. On the other hand, this book will serve an excellent resource for practitioners who want to find out more information about any of the included topics.

In summary, the book is a must-read for scientists wanting to familiarize themselves with the field of solar energy conversion beyond silicon-based solar cells. This is a scholarly treatise written by the experts that is sure to become an important resource.

Stacey F. Bent, *Stanford University*

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Dictionary of Nanotechnology, Colloid and Interface Science. By Laurier L. Schramm (Saskatchewan Research Council, Canada). Wiley-VCH Verlag GmbH & Co. KGaA: Weinheim. 2008. viii + 290 pp. $145. ISBN 978-3-527-32203-9.

This compact dictionary "provides brief explanations for the most important terms that may be encountered in a study of the fundamental principles, experimental investigations, and industrial applications of nanotechnology and colloid and interface science", to quote from the Introduction. It includes both new and older terms—many of which now have multiple meanings—synonyms, abbreviations, names of famous scientists and engineers associated with important discoveries in the field, and cross-references. The dictionary begins with an introduction to and historical overview of nanotechnology, colloid, and interface science and concludes with two appendices: (1) a list of 22 helpful tables, which includes, for example, a glossary of viscosities and an index of famous names, and (2) a list of references for further reading.

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Multivariate Methods in Chromatography: A Practical Guide. By Tibor Cserháti (Hungarian Academy of Sciences, Budapest). John Wiley & Sons, Ltd.: Chichester. 2008. xvi + 336 pp. $180. ISBN 978-0-470-05820-6.

This book was not what I expected it to be based on its title. I expected a text that would guide the reader in how to apply chemometric techniques to chromatographic data sets, one that covered chemometric tools that are popular for chromatographers, with examples of how to prepare chemometric data sets from chromatographic data and a guide to interpreting the results. This is not to say that the book is without value, merely that potential readers would be well advised to scan its contents before purchasing it to make certain that their needs will be served.

Cserháti's goal in writing this book was to provide "a concise description and evaluation of the various multivariate mathematical-statistical methods applied for the assessment of retention data sets", which he does in the following four chapters: "Fundamentals"; "Gas Chromatography"; "Liquid Chromatography" (including TLC); and "Electrically Driven Separations". The author approaches these problems from a practical standpoint without presenting the underlying mathematics of the various chemometric techniques. The reason this approach was chosen is obvious. As the author states, chemists and chromatographers are for the most part very much turned off by the mathematics involved in chemometrics. At the same time, new commercially available chemometric software is rendering a detailed understanding of the underlying mathematics less important than it once was. However, a slightly less-minimalistic approach to the mathematics would have gone a long way to improving the accessibility and utility of this text.

The chapter on fundamentals covers topics ranging from multilinear and nonlinear regression through principal component analysis, cluster analysis, and several other chemometric techniques in a mere six full pages of text. Consequently, any reader who is not already reasonably familiar with these techniques—how they work, what they can do—and the basics of chemometric data interpretation would be advised to have another book close by. I would suggest either Otto's *Chemometrics: Statistics and Computer Application in Analytical Chemistry* or, for those who wish to avoid mathematics as much as they can, Brereton's *Applied Chemometrics for Scientists*. As with the chemometric fundamentals, the sections on theory that introduce each of the separation techniques are very brief. Here, the lack of depth is not a problem, as the book has been

written with chromatographers in mind. Consequently, readers should have a strong enough background to follow the instrumental side of the experiments being described.

The strength of this book and the reason that it deserves its spot on my shelf is its very thorough collection and concise description of where and how multivariate techniques have been applied to a variety of chromatographic data sets to achieve various goals. The book reads like a series of very quick review articles covering the spectrum of multivariate interpretations of chromatographic data, ranging from techniques that have been used to characterize stationary phases in LC to manners in which samples of honey and honeybees can be classified according to origin. Overall, it meets the stated goals quite well and is well referenced: Cserháti cites hundreds of mostly current articles in the primary literature. This makes it quite simple for readers to find greater detail on a topic should they wish.

In conclusion, I would recommend this book for those who are curious about the diverse ways in which multivariate techniques have been applied to a variety of chromatographic problems and are looking for a broad survey of the field that they can use to direct more detailed study.

James Harynuk, *University of Alberta, Edmonton*

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Photoresponsive Polymers I. Edited by Seth R. Marder (Georgia Institute of Technology, Atlanta, USA) and Kwang-Sup Lee (Hannam University, Daejeon, South Korea). From the series Advances in Polymer Science, 213. Springer-Verlag: Berlin, Heidelberg. 2008. xii + 210 pp. $229. ISBN 978-3-540-69448-9.

Although two-photon absorption was developed by Goeppert-Mayer in 1931, wide interest began only when high-intensity pulsed lasers became commercial. The concepts of two-photon absorption, emission, and absorption cross sections are well-known to photoscientists today. Applications of two-photon chemistry in photon imaging, photon dynamic therapy, photon-initiated deprotection, 3D data storage, and microfabrication have attracted much attention. What kind of material shows large two-photon absorption? What is the relationship between this property and molecular structure? What are the factors that affect two-photon applications? This book, written by leading scientists, provides basic answers to these common questions, with a special focus on the two-photon chemistry of polymers.

The book might be appropriate for a graduate-level course since no previous knowledge is required, but that is not its primary purpose. Background information and basic concepts of two-photon chemistry are provided in the first chapter "Two-Photon Absorbing Materials and Two-Photon-Induced Chemistry". Descriptions of the process of two-photon absorption, molecular structure property relationships, and two-photon-induced reactions provide the reader with an overview of what constitutes two-photon chemistry. Subsequent chapters build upon this basic information.

In the next chapter "Two-Photon Absorbing Photonic Materials: From Fundamentals to Applications", materials design, synthesis, and the two-photon properties of fluorene derivatives are described. Specific examples of such derivatives used in two-photon fluorescence imaging, 3D data storage and microfabrication, and photodynamic therapy are given. Fundamental methods are discussed in each case.

Optical techniques and methods are introduced in the final chapter, "Three-Dimensional Structuring of Resists and Resins by Direct Laser Writing and Holographic Recording". Laser-beam focusing, the use of ultrashort pulses, and plasmonic and near-field effects are reviewed.

Overall, this is a valuable book that offers a broad view of the field of two-photon polymer chemistry. Because this is a rapidly developing field, it would be impossible to include all current achievements. The basic concepts addressed in this book should be useful to readers with an interest in this chemistry, as well as to students wishing to learn more about this area of research.

Xichen Cai and D. C. Neckers,
Bowling Green State University

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Cheminformatics Approaches to Virtual Screening. Edited by Alexandre Varnek (Louis Pasteur University of Strasbourg) and Alexander Tropsha (University of North Carolina at Chapel Hill). Royal Society of Chemistry: Cambridge. 2008. xvi + 338 pp. $189.00. ISBN 978-0-85404-144-2.

This book is an up-to-date comprehensive overview of the field of cheminformatics related specifically to the application of virtual screening in drug discovery. The title emphasizes the fact that not all computational approaches are discussed but only those that use the unique paradigm and the mathematical apparatus of cheminformatics—the representation of chemical structures in the form of chemical descriptors and the computational methods connecting these descriptors with the physical, chemical, or biological properties of the molecules. This book would be of practical help as a teaching guide and as a reference for students, faculty, and researchers with all levels of experience in the field. Although the major audience of this book is the professionals conducting research in cheminformatics and allied fields, it would be of interest for the chemical community at large.

Cheminformatics Approaches to Virtual Screening is a great overview of the current status of the cheminformatics methods available to accelerate each major stage of the modern drug design process, such as hit identification, lead generation, and lead optimization. The main topics covered by the book are QSAR/QSPR, pharmacophores, molecular similarity and diversity, molecular field topology, probabilistic approaches in activity prediction, *de novo* and compound library design, early ADMET predictions, and integration of chemo- and bioinformatics approaches in the virtual screening. The book is written and edited by experts in the area from academia and industry. The theoretical concepts and their practical applications are blended in a rigorous yet concise and well-balanced manner, providing all the necessary up-to-date literature citations. The authors do not merely review the current status of the field but provide their own view of the recent progress, the limitations and the challenges, and the outlook and needs for further development of the approaches, which make the book quite entertaining to read. The flow of the sections is logical and reads

almost as a whole. The book is well-organized and clearly written and has high quality color illustrations and a useful subject index.

Pavel A. Petukhov, *University of Illinois at Chicago*

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Polymer Microscopy, 3rd ed. By Linda C. Sawyer (Celanese Americas, ret., Palmyra, VA), David T. Grubb (Cornell University, Ithaca, NY), and Gregory F. Meyers (Dow Chemical company, Midland, MI). Springer: New York. 2008. xiv + 540 pp. $149. ISBN 978-0-387-72627-4.

Polymer scientists and engineers strive to understand the interplay between the synthesis, processing, morphology, and properties of polymers. Each of these four aspects of polymer science is critical to providing reliable insights about how to manipulate polymers to improve existing products and discover new applications. Polymer morphology is a broad field of study that includes the orientation of crystallites relative to the processing direction, the self-assembled structures in block copolymers, and the surface texture on a fiber. This book focuses on polymer morphology and, specifically, the variety of microscopy methods available to characterize polymers.

The third edition of this book adds Meyers to the team of Sawyer and Grubb. Other additions include more information about scanning probe microscopy methods as applied to polymers, digital imaging methods in all types of microscopy, and the application of various analytical methods for compositional mapping. Along with the new content, the authors have maintained the aspects of the book that have been most appealing to its broad audience: a chapter about polymer morphology for the novice, a description of methods of specimen preparation that is unparalleled in scope and detail, and more than 150 pages detailing the application of microscopy methods to specific polymer applications. The chapter on applications serves to transform the theory of the various microscopy methods into a demonstration of their importance. Clearly, the intent of the authors is not simply to improve the polymer microscopy skills of their readers, but to empower them with the wisdom to select the best microscopy method to solve the problem at hand.

Using various microscopy methods to study polymer morphology is both an established and an emerging area, and *Polymer Microscopy* captures the best of both. This latest edition will continue to be a valued reference book for polymer scientists and analytical scientists alike. Its exhaustive content and complete index make *Polymer Microscopy* the first resource to use when questions arise. Readers with modest prior knowledge of microscopy methods or polymers will easily gain important insights. I strongly recommend this book to every polymer scientist and engineer who is looking for a new imaging method that will answer an outstanding question or who is struggling to interpret the contrast in an image. Similarly, I highly recommend this book to microscopists working with polymeric materials.

Karen I. Winey, *University of Pennsylvania*

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