Book Review

Handbook of Layered Materials Edited by Scott M. Auerbach (University of Massachusetts, Amherst), Kathleen A. Carrado (Argonne National Laboratory), and Prabir K. Dutta (The Ohio State University). Marcel Dekker, Inc.: New York, Basel. 2004. xii + 646 pp. $195.00. ISBN 0-8247-5349-6.

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BOOK REVIEWS

NMR, 3D Analysis, Photopolymerization. Advances in Polymer Science, 170. With contributions by Rainer Kimmich (Universität Ulm), Nail Fatkullin (Kazan State University), Hiroshi Jinnai, Yukihiro Nishikawa (Kyoto Institute of Technology), Takayuki Ikehara (Kanagawa University), Toshio Nishi (Tokyo Institute of Technology), Hong-Bo Sun, and Satoshi Kawata (Osaka University). Springer-Verlag: Berlin, Heidelberg. 2004. x + 294 pp. $199.00. ISBN 3-540-20510-1.

This book consists of three review articles whose only, rather distant, relationship to one other is that each involves discussions of polymers. The first summarizes NMR studies of polymer chain dynamics in the solid or melt state by various NMR techniques. The author wisely avoids lengthy descriptions of the theory of the NMR experiments because of its availability in many other places and instead concentrates on what can be learned about the dynamics of polymer chains from NMR data. The presentation and discussion of the experimental data in terms of various models of polymer motion are the most readable and potentially the most useful to those working in the field. Because of the nature of the subject, those with little or no exposure to the mathematics, nomenclature, and concepts of the theory of the dynamics of polymer chains will find this a very difficult article to read. However, for those with a suitable background in both polymer physics and NMR relaxation theory, this is likely to be a useful summary and discussion.

The second article, the most easily readable of the three, is a description of the various technologies available for three-dimensional microscopic imaging of polymer structures. Brief descriptions of technologies, such as laser scanning confocal microscopy and transmission electron microtomography, may be easily understood even by a nonexpert. After descriptions of the technologies, the remainder of the article is devoted to methods of characterizing the images of three-dimensional objects quantitatively and the application of these methods to the characterization of phase separation in polymer mixtures.

The final article covers the current state of photopolymerization technology as it is applied to the microfabrication of three-dimensional objects. There are descriptions, readable by the nonexpert, of stereolithography by one- and two-photon photopolymerization. Nearly 100 pages are devoted to the discussion of 3D stereolithography, and remarkable photos of micromachine components and microwaveguides created by these techniques are included. The emphasis is on the application of two-photon photopolymerization to the production of photonic crystals and other devices having a volume less than the diffraction limit.

The individual articles in this volume are well-written and quite readable, if the reader has the proper background. My greatest objection to this volume is that the three subjects chosen have so little in common. In particular, the NMR chapter does not really relate to the other two. It would have been better to have included the NMR article with articles on polymer dynamics as studied by other methods, or perhaps with articles on solid-state NMR. Similarly, the second article would have been better placed if it were among articles related to imaging. The title, *NMR, 3D Analysis, Photopolymerization*, may be misinterpreted by some as relating to 3D NMR, which is certainly not the case. The NMR chapter will be most useful to those who already have a background in polymer physics and NMR, although the remaining two chapters can be read by those having less substantial backgrounds in the technology discussed.

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Handbook of Layered Materials. Edited by Scott M. Auerbach (University of Massachusetts, Amherst), Kathleen A. Carrado (Argonne National Laboratory), and Prabir K. Dutta (The Ohio State University). Marcel Dekker, Inc.: New York, Basel. 2004. xii + 646 pp. $195.00. ISBN 0-8247-5349-6.

Materials with layered structures exhibit a wide variety of interesting chemistry and are used in many important applications ranging from cat litter to nanocomposites and from crockery to catalysts. The goal of this book is to provide a comprehensive and dedicated source of information on clays and related layered materials. Eleven chapters by separate authors cover the synthesis and/or natural occurrence, characterization, host−guest chemistry, and catalytic applications of some of the more important families of layered materials.

The first six chapters are devoted to clays, the most versatile and widely used layered materials. An introduction to the basics of clay structure and chemistry is followed by chapters on clay−organic interactions, including absorption, catalysis, and photochemistry, modeling the structure and surface chemistry of clays, and the microporous/mesoporous pillared clays and porous clay heterostructures. These chapters provide clearly written introductions to the basic themes in clay chemistry and include numerous examples from the recent literature. There are more complete references available describing the subject matter of each of the individual chapters of this section, but the convenience of having them gathered together and the consistency of style make this book a valuable reference for an introduction to or a re-examination of the field of clay chemistry.

The last five chapters of the book cover selected non-clay layered materials that show interesting intralayer chemistry. Included are zirconium phosphates and phosphonates, layered double hydroxides (hydrotalcites), layered manganese oxides, layered metal chalcogenides, and crystalline silicic acids and alkali silicates. Again, the presentation is uniformly good, but the level of coverage varies among the contributors. The chapters on layered double hydroxides and on silicic acids and alkali silicates are extensive, providing a comprehensive review of recent work in the area, while those on zirconium phosphates

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and phosphonates and layered chalcogenides are more selective, reflecting the large amount of work in those areas.

This book provides a good exposition and specific examples of the basic themes that underlay all of the chemistry of layered materials. It is current, with most of the chapters containing references up to the 2000−2002 period. It is regrettable that more space was not dedicated to the actual uses of layered materials today. Tens of millions of tons of clays are used annually in a wide variety of products, and more information on these uses would help to make the chemistry discussed more immediate to the reader. Nevertheless, this book will occupy a valued space on this reviewer's shelf, next to *Handbook of Molecular Sieves* by Szostak.

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Synthetic Organic Photochemistry. Molecular and Supramolecular Photochemistry, Volume 12. Edited by Axel G. Griesbeck (Universität zu Köln, Germany) and Jochen Mattay (Universität Bielefeld, Germany). Series edited by V. Ramamurthy and K. S. Schanze. Marcel Dekker: New York. 2005. x + 630 pp. $199.95. ISBN 0-8247-5736-X.

This book conveniently gathers in one place a wealth of information aimed at making chemists who are involved in organic synthesis more aware of the many photochemical methods that can be synthetically useful in the construction of molecules, including those of structural complexity. The editors and the authors have succeeded admirably in fulfilling this objective. There are 18 chapters, written by a total of 26 authors from eight countries (Germany, USA, Italy, Japan, Spain, Argentina, France, and India). The documentation is extraordinarily thorough and up-to-date, with a total of 2113 references. The topics covered include: intramolecular abstraction of hydrogen by excited carbonyl groups; cycloadditions of alkenes with excited carbonyls, other excited alkenes, and excited arenes; di-π-methane rearrangements and oxa-di-π-methane rearrangements; electron transfer cyclizations via radical ions and photooxygenations involving both cycloadditions and ene reactions; addition of nitrenes to π bonds; *E*/*Z* isomerizations of alkenes; CX bond cleavage of benzylic substrates; photochemically induced $S_{RN}1$ nucleophilic aromatic substitution reactions; and the effects of organized and confined media on various photoreactions. Each chapter consistently follows the same systematic pattern of organization with the following sequence of headings: historical background, state-of-the-art mechanistic models, scope and limitations, synthetic potential, and representative experimental procedures. Furthermore, nearly all of the chapters conclude with a section designed to stimulate the chemical imagination of the reader by showing the structures of specific examples of important target molecules, both natural and nonnatural products, whose syntheses have been achieved using photochemical reactions as key steps. This book should prove to be a valuable resource to the community of chemists involved in organic synthesis.

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Transition Metal and Rare Earth Compounds III: Excited States, Transitions, Interactions. Topics in Current Chemistry 241. Edited by Hartmut Yersin (Universität Regensberg). Springer-Verlag: Berlin, Heidelberg. 2004. xii + 294 pp. $299.00. ISBN 3-540-20948-4.

The excited states and photophysical properties of transition metal complexes have fascinated chemists and physicists from an intellectual point of view for several decades, but this field has now taken on added importance because of several recent, significant applications. Such materials are now being used in new photovoltaic devices, luminescence sensors and probes, IR-to-visible upconversion materials, new optical and/or laser components, and most especially, as organic/organometallic light-emitting diodes (OLEDs) in the latest generations of display screens and other optical components.

This volume comprises six reviews, each of which stands independent of the others and is equally relevant to the topic. All deal with photophysical behavior in considerable detail, and several also elucidate on the potential applications. Taken together with the earlier editions (Volumes 213 and 214), these reviews represent a timely summary on the nature of excited states and the photophysics of transition metal and rare earth complexes.

The first chapter, by Yersin, deals with the application of triplet-emitting materials for OLEDs. Practical photophysical aspects are discussed, including the reasoning for multilayer structures and how the singlet and triplet excited states of the doped emitter complexes are populated. Attention is paid to the efficiency of the photophysical processes and spin−orbit coupling effects. A number of well-known compounds are also evaluated in terms of their OLED possibilities. The second chapter, by Lai and Che, shows how the photophysics of cyclometalated diimine Pt(II) complexes are affected by their molecular structure and microenvironment. By modification of the ancillary or cyclometalated ligands, complexes have been prepared that have tunable emission energies and emission lifetimes that give them potential as luminescence sensors and electrophosphorescent materials in OLEDs.

In the next chapter, Hauser et al. cover energy-transfer processes that take place in three-dimensional transition metal tris-oxalate network structures. A model system that is based on the excited states of Cr(III) and facilitates a differentiation of the various feasible photophysical mechanisms is presented. In the fourth chapter, Luneau, Reber, and co-workers focus on the excited states, optical spectroscopy, and magnetic behavior of nitronyl nitroxide radicals and their lanthanide and transition metal compounds. The absorption and luminescence spectra of these complexes are at very long wavelengths, and their spectroscopic properties are reported in detail.

In Chapter 5, Daniel reviews recent theoretical developments in quantum chemistry and wave packet dynamics that enable

investigations of the electronic spectroscopy and photoreactivity of transition metal complexes. Recent examples are presented that reveal a need for interpretation involving accompanying experimental measurements. The final chapter, by Tanner, is an examination of the spectroscopy and energy levels of high-symmetry lanthanide complexes. Detailed analyses of optical and vibrational spectra are provided to facilitate understanding of the crystal field and energy-transfer mechanisms between lanthanide ions.

This book would certainly make a valuable addition to the chemistry collection in academic and industrial libraries. Unfortunately, its very high price (almost three times the cost of each of the two previous ones, which appeared only four years ago) precludes its purchase by most individuals.

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