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BOOK REVIEWS

Microwaves in Organic Synthesis. Edited by André Loupy (Université Paris-Sud, France). Wiley-VCH: Weinheim. 2002. xxiv + 499 pp. $195.00. ISBN 3-527-30514-9.

The promise of significantly reduced reaction times, increased yields, and improved chemical selectivity has driven the rapid development of microwave heating techniques in synthetic chemistry during the last 15 years. Fast, efficient heating provides a number of advantages over traditional thermal methods. For example, shorter reaction times enable new, rapid approaches in exploratory synthesis and thus the use of combinatorial chemical methods. The combination of the use of solvent-free or solid-supported reactions with high chemical selectivity decreases the amount of organic solvent needed for reaction or purification, offering advantages for green chemistry. This book offers a collection of contributions from experts in this field that aims to describe the current status of microwave heating in organic synthesis.

The text provides generally well-written and well-organized descriptions of the fundamental and applied aspects of the use of microwaves in the synthesis of organic compounds. Although the focus of the book is on microwave heating in organic chemistry, its scope is broad, covering important fundamental topics such as wave−matter interactions (Chapter 1) and the discussion of microwave reactions in solution (Chapter 4), on solid supports (Chapters 6 and 7), and at high pressure (Chapter 2). A topic of particular importance is the discussion of nonthermal effects in microwave chemistry (Chapter 3). In addition to chapters covering these fundamental topics, subsequent chapters survey the use of microwaves for specific reaction types [cycloaddition reactions (Chapter 9), heterocycle synthesis (Chapter 8), and catalytic reactions (Chapters 10 and 11)] and for different reaction strategies [combinatorial, radio-, and photochemistry (Chapters 12−14, respectively)].

The book could be a valuable resource for researchers interested in gaining a solid background in the application of microwave chemistry in organic synthesis. Unfortunately, some of the key introductory chapters become too technical too fast. For example, in Chapter 1, the discussion of wave−material interactions could have been written to be more accessible to those who are unfamiliar with these interactions but are potentially interested in using microwaves in synthesis. Although each chapter is generally well-written, the book reads as a collection of review articles without significant integration of its chapters. For example, the controversy surrounding nonthermal effects is discussed in several of the chapters, even though there is a specific chapter dedicated to this topic. Each chapter has its own introductory material, most of which could have been more effectively consolidated in a single introductory chapter. A significant number of the references date from more than 5 years ago. Although the overall quality of the volume is high, the editing is a little uneven.

In summary, this compilation provides a comprehensive overview of microwave heating in organic chemistry. It is a useful collection of high-quality chapters that should serve as excellent reference materials for researchers at all levels. It is less accessible as a comprehensive source book on the subject for those seeking to enter this research area.

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JA0335061

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Advances in Chemical Physics, Volume 125. Edited by I. Prigogine (University of Texas at Austin and Université Libre de Bruxelles) and Stuart A. Rice (University of Chicago). John Wiley & Sons, Inc.: Hoboken. 2003. x + 596 pp. $175.00. ISBN 0-471-21452-3.

The latest volume of this venerable series continues its usual tradition of collecting a handful of unrelated articles in the field of chemical physics. Because there is no intentional thematic relation between these articles, it is best to address them individually.

In the first chapter, entitled "Finite-Size Scaling for Atomic and Molecular Systems", Kais and Serra review the emerging field of critical phenomena in quantum mechanical Hamiltonians. The questions being asked here are quite intriguing and in direct analogy to classical statistical mechanics of phase transitions. However, the control parameters that play the role analogous to macroscopic thermodynamic control variables are no longer easily tuned experimentally − for example, nuclear charge as opposed to temperature. Although this makes the work appear esoteric at first sight, the authors point out how these parameters may be tunable in the arena of "artificial atoms" and "artificial molecules" built from quantum dots. This article provides a thorough list of references to current and early work in the field, the latter being primarily concerned with one-dimensional potential energy functions. It also provides a clear introduction to quantum mechanical variants of finite-size scaling from classical statistical mechanics and convenient tables that emphasize the analogies between classical and quantum critical phenomena.

The next chapter, "A Discussion of Some Problems Associated with the Quantum Mechanical Treatment of Open-Shell Molecules" by Stanton and Gauss, focuses primarily on coupled-cluster methods for doublet radicals while acknowledging the existence and possible strengths of other methods. The real core of this article concerns the phenomenon of "symmetry-breaking" in electronic structure theory. In principle, symmetry-breaking is not restricted to open-shell molecules, but in practice open-shell systems are much more likely to exhibit the problem. The authors provide clear explanations for some of the more "unusual" results that can be obtained from quantum chemical calculations in unfavorable cases − for example, vibrational

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frequencies in excess of 10 000 cm^{-1}. The authors stress that such results are usually artifacts of singularities associated with the reference wave function and cannot be expected to be easily rectified by straightforward escalation in the quantum chemical hierarchy. This article aims at a fundamental understanding of these problems and should be considered mandatory reading for any serious student of the theory of electronic structure.

Guérin and Jauslin contributed the next article entitled "Control of Quantum Dynamics by Laser Pulses: Adiabatic Floquet Theory". They discuss the application of the dressed picture of radiation−matter interactions to experiments involving sequences of ultrafast laser pulses, including the STIRAP scheme, which uses three or more molecular states to transfer population from one state to another with high efficiency. Using Floquet states in connection with the dressed picture leads to intuitive graphical depictions of this and other processes that can otherwise be difficult to describe. Interestingly, conical intersections play a prominent role in the theory. The authors stop short of making connections to the large amount of work concerning conical intersections in field-free molecules and their influence on dynamics. However, this article may inspire work along those lines.

Pesonen and Halonene discuss "Recent Advances in the Theory of Vibration−Rotation Hamiltonians" in the fourth chapter, emphasizing the influence of geometric algebra on the construction of quantum mechanical Hamiltonian operators in non-Cartesian coordinate systems. The appendix provides a concise and useful introduction to geometric algebra, which is a superset of the usual vector algebra and gives meaning to such operations as adding vectors to scalars.

In the final chapter, "Proton Transfer and Coherent Phenomena in Molecular Structures with Hydrogen Bonds", Krasnoholovets, Tomchuk, and Lukyanets provide a mathematically oriented review of the applications of theoretical approaches to proton transfer based on system-bath decompositions with a one- or low-dimensional proton transfer reaction coordinate. The review would have benefited from more references to and discussion of alternative, more chemical, approaches to the problem. Such approaches typically emphasize the molecular nature of the important coordinates, often eschewing system-bath decompositions entirely with obvious advantages and disadvantages.

Overall, this is a worthy addition to the *Advances in Chemical Physics* series, which will be useful to researchers interested in recent developments in the topics covered.

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The Chemical Physics of Solid Surfaces. Volume 10. Surface Alloys and Alloy Surfaces. Edited by D. P. Woodruff (University of Warwick). Elsevier: Amsterdam and NewYork. 2002. xvi + 536 pp. $275. ISBN 0-444-51152-0.

This book is an excellent reference on the topic of surface alloys and alloy surfaces for scientists and engineers involved in the study of metallic surfaces and interfaces. Not only does it provide an overview of the field by referencing 1346 publications, it also describes recent results as represented by the fact that 16% of the references are from the past 4 years. The volume is edited by a professor who has previously authored or edited more than 10 other works in the area of surface science; he is also a coauthor of one of the chapters. In addition to selecting an appropriately focused topic for a single volume, he has collected contributions from experts from 12 countries. On an aesthetic note, the gray scale images of atomically resolved images have been well reproduced.

The majority of the text focuses on bimetallic systems with an emphasis on structural and electronic properties. Most research in the field of surface alloys has been performed on single-crystal elemental substrates with anywhere from a partial monolayer to several monolayers of another element. Of particular interest is the formation of ordered phases that do not occur as bulk alloys. The commercial importance of noble metal alloy surfaces is discussed, including some material on catalytic activity and a chapter on the interaction of sulfur. Brief summaries of experimental techniques for the characterization of surfaces are provided, and synthetic conditions for the preparation of the surfaces are also reviewed. Theoretical descriptions include density functional theory, total energy calculations, molecular dynamics calculations, and an extensive discussion on atomistic modeling using the Bazzolo−Ferrante−Smith method.

In conclusion, this volume is an essential reference for scientists and engineers pursuing metallic systems especially concerned with interfacial reactivity. There is no doubt that metallic interfaces and alloying will become a dominant concern for devices on the nanometer scale.

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JA0253540

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Encyclopedia of Electrochemistry. Volume 4. Corrosion and Oxide Films. Edited by Martin Stratmann (Max-Planck Institut für Eisenforschung, Dusseldorf) and Gerald S. Frankel (The Ohio State University). Series Edited by Allen J. Bard and Martin Stratmann. Wiley-VCH: Weinheim. 2003. x + 746 pp. $430.00. ISBN 3-527-30396-0.

This volume of the *Encyclopedia of Electrochemistry* focuses on metallic corrosion, one of the more important areas of electrochemistry considering the high costs associated with corrosion and its control (estimated to be ca. 4% of a developed country's gross national product). It is organized into seven major sections, each consisting of two to five chapters written by various authors. For a work of this magnitude involving a number of authors, the editors have done a fine job of blending the various contributions into a coherent volume with few redundancies. However, a few of the weaknesses of a multi-author volume are apparent, such as inconsistent use of symbols and some variation in the clarity of presentation. Most chapters contain references that are extensive and current, with many citing references as recent as 2002.

For the most part, this volume emphasizes the electrolytic corrosion of metals capable of forming oxide films. It begins

with a section containing four chapters on the fundamentals of corrosion, including thermodynamic, kinetic, and transport issues. The second section addresses homogeneous corrosion of metals in electrolytes, with three chapters on uniform corrosion, hydrogen ingress, and corrosion of alloys. Section 3 consists of two chapters focusing on atmospheric corrosion and passivity of metals, alloys, and semiconductors, and Section 4 concentrates on localized corrosion, with three chapters on crevice, pitting, and intergranular corrosion, respectively. The five chapters in Section 5 cover corrosion protection by anodic and cathodic protection, inhibition, conversion coatings, organic coatings, and metallic coatings. Corrosion in special environments is described in Section 6, which consists of three chapters on molten salts, high-temperature gases, and microbiologically influenced corrosion. The volume concludes with a section containing a chapter on (mostly) electrochemical techniques for determining corrosion rates, including a discussion of experimental design considerations. A 21-page index facilitates location of particular topics throughout the volume.

This volume of the *Encyclopedia of Electrochemistry* will be a valuable resource for anyone working in the area of corrosion science and engineering. Its strength is its comprehensive coverage of the topic and good balance between fundamental and practical issues. Most of the chapters are clearly presented and well referenced. It would make a great resource book for a course in corrosion, and certain chapters of this volume will be must reading for members of my own research group. Although a bit pricey, corrosion scientists and engineers will find this book a most useful addition to their personal collection, and certainly no library should be without it.

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Advances in Polymer Science, 159. Statistical, Gradient, Block and Graft Copolymers by Controlled/Living Radical Polymerizations. By Kelly A. Davis (University of Colorado-Boulder) and Krzysztof Matyjaszewski (Carnegie Mellon University). Springer-Verlag: Berlin, Heidelberg, New York. 2002. xii + 192 pp. $139.00. ISBN 3-540-43244-2.

This volume reviews the methodologies developed over the past decade to provide "living"-type radical polymerizations that can be exploited to produce well-defined macromolecular architectures. The interest in developing controlled radical polymerization stems from the tolerance for functional groups that radical polymerizations exhibit when compared with other methods of living polymerization, particularly those based on the propagation of ionic species. As a consequence, such radical-based methods are ideal for the preparation of a wide variety of functional macromolecules for the increasing number of applications that require a high level of morphological control.

Publications in this area have increased significantly in the past few years, and, in compiling this review, the authors set out to present and organize the diversity of literature into a simple-to-follow format that provides the user an easy point of access to primary works. The book begins by comparing and contrasting the advantages and limitations of various methodologies of controlled polymerization, such as stable free-radical polymerization, nitroxide-mediated polymerization, atom-transfer polymerization, and degenerative chain transfer. Subsequent chapters are arranged by the targeted macromolecular morphology, namely, statistical copolymers, linear block copolymers, and other chain architectures. The concluding chapter deals largely with the application of controlled and living radical polymerization to grafting, with smaller sections covering star polymers and polymers derived from multifunctional initiators in which two or more polymerizations can be initiated through different mechanisms. These chapters serve to categorize the literature surrounding the application of each type of polymerization to that structural class, with subsections that further subdivide the literature on the basis of specific monomers or classes of monomers.

The layout of the book represents a very logical way of presenting a literature survey. However, because of this method of organizing the information, I would not recommend the work for those who are looking for a technical introduction to this subject; in that case, organization around the methodology of the polymerizations would provide a more coherent, satisfying, and ultimately, I suspect, more valuable result. The strength of this book is its character as a detailed review of the subject area. In this context, there are 372 references, overwhelmingly to primary sources. The book is an excellent reference work for those working in the field or needing to use these techniques of polymerization in their research.

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Colloid Chemistry I. Topics in Current Chemistry, 226. Edited by Markus Antonietti (Max Planck Institute of Colloids and Interfaces, Potsdam, Germany). Springer-Verlag: Berlin, Heidelberg, New York. 2003. x + 258 pp. $189.00. ISBN 3-540-00415-7.

This is a very interesting and useful multi-author book that gives the general reader an overview of the most recent developments in colloid chemistry with a special focus on nanostructures. To its advantage, the book includes such diverse topics as synthesis, characterization, and potential applications of nanosize materials.

It begins with an excellent introduction to the preparation of nanoparticles and nanostructures. By using liquid crystalline templates, it is possible to synthesize nanoparticles as well as inverted "hard copies" of the primary liquid crystalline structure. The principles of self-organization of liquid crystals can also be applied to inorganic colloids to obtain new mineral liquid crystalline mesophases. An extensive discussion of the synthesis and characterization of inorganic nanoparticles is presented as well as a detailed review of current literature. Through the use of the concepts of consecutive and hierarchical templating, one can prepare complex nanostructures for applications in catalysis, electrooptics, and particle separation. The extension of nanocasting to nanocoating allows the synthesis of membrane-like materials for potential solar cells, catalytic support, or nanotechnology-relevant materials.

The book also deals with matrix-assisted structuring of micrometer-size droplets via controlled demixing in liquid

crystals. High concentration surfactant phases can be used in a similar way as templates for polymerization reactions to produce a variety of morphologies such as spherical polymer shells. The construction of complex colloid structures based on gold core−shell nanocrystals is discussed, and the authors illustrate how geometry and optical properties are linked.

In general, the book is an excellent source of information on selected, but not all, aspects of colloid chemistry. Because of the book's emphasis on nanostructures, I would have expected the title to contain the word "nano" in some way. Nevertheless, this is an excellent source of information, and I highly recommend it. It is an important and timely addition to any collection of books in the very rapidly developing area of colloid chemistry and nanotechnology-related materials science.

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Polymers for Photonics Applications II: Nonlinear Optical, Photorefractive and Two-Photon Absorption Polymers. Edited by Kwang-Sup Lee (Hannam University, Korea). From the series: Advances in Polymer Science, 161. Springer-Verlag: Berlin, Heidelberg, New York. 2003. $149.00. ISBN 3-540-43157-8.

This volume has three chapters—Polymeric Materials and Their Orientation Techniques for Second-Order Nonlinear Optics; Photorefractive Polymers and Their Applications; and Organics and Polymers with High Two-Photon Activities—that offer a broad view of the field of nonlinear optics from theory to practice. The first chapter covers dendritic materials thoroughly, the second deals with background theory as well as theory as it relates to practical application, and the third chapter has a nice section on the "Strategy for Molecular Design" of materials for practical applications. Each covers the background theory, the first two extensively. Although thorough, the discussion of the theoretical background is at a level that may be beyond the newcomer to this field. There are many older volumes that are more appropriate for the neophyte, however.

This is a valuable book that is recommended to those currently involved in photonic materials as well as to those who already have an understanding of the background physics but are looking to expand their knowledge of some recent research activities in the area. It should be noted, however, that very few of the references are newer than 1999.

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Molecular Imprinting: From Fundamentals to Applications. By Makoto Komiyama (University of Tokyo), Toshifumi Takeuchi (Kobe University), Takashi Mukawa (Kobe University), and Hiroyuki Asanuma (University of Tokyo). Wiley-VCH Verlag GmbH & Co. KGaA: Weinheim. 2003. xii + 147 pp. $155.00. ISBN 3-527-30569-6.

Molecular imprinting involves the formation of a substance, most often a polymer, around a molecular template. When the template is removed by extraction, a binding site remains. That site can have a variety of properties engineered into it, ranging from selective binding of specific molecules (molecular recognition) to enzyme-like catalysis. Molecular imprinting has a long history, dating back to 1931. Modern methods using polymer chemistry were developed in the 1970s, with continued significant progress to the present. Recently, new and improved techniques for molecular imprinting have enhanced the quality of molecularly imprinted substances. In addition to traditional applications in chromatography, new applications in sensors and catalysis are emerging.

There have been many recent review articles and books published over the past few years on molecular imprinting, for example: *Molecular and Ionic Recognition with Imprinted Polymers* edited by Maeda and Bartsch, American Chemical Society, 1998; *Molecularly Imprinted Polymers: Man-Made Mimics of Antibodies and their Application in Analytical Chemistry* edited by Sellergren, Elsevier, 2001; and *Molecularly Imprinted Materials-Sensors and Other Devices*: *Symposia Held April 2−5, 2002, San Francisco, California, U.S.A.* edited by Shea and Cremer, Materials Research Society, 2002. These books are highly technical, aimed at specialists in the field. In contrast, the book under review here is a shorter, more general introduction to the topic, although it should also be of some value to the specialist as a source of leading references.

The book focuses heavily on molecularly imprinted polymers. It begins with a brief, basic introduction to natural and artificial receptors, followed by a review of the basic principles of molecular imprinting in Chapter 2. The next two chapters cover experimental methods both to make imprinted polymers, including several representative procedures, and to evaluate the quality of molecular imprinting, typically evaluated as selectivity for binding of specific compounds. In Chapter 5, the authors discuss quantitative spectroscopic analysis of binding interactions that will eventually produce the molecularly imprinted site, and in Chapter 6, they provide a step-by-step guide to making a molecularly imprinted polymer, processing it, and measuring the imprinting efficiency.

The following chapter covers many topics, including applications to sensors, signaling polymers, molecularly imprinted sorbent assays and membranes, affinity-based solid-phase extraction, in situ preparation of imprinted polymers, and molecularly imprinted catalysts. It also contains several, information-packed, multipage tables titled "Books and Reviews", "New Functional Monomers", "Imprinted Polymer-Based Solid-Phase Extraction", and "Molecularly Imprinted Catalysts". Each of these tables is well referenced and contains much useful information.

The final two chapters are "Recent Challenges and Progress" and "Conclusions and Prospects". The first includes such topics as "Molecular Imprinting in Water" and "Artificial Enzyme (Molecular Catalyst) by Molecular Imprinting", and the second considers possible future applications of molecularly imprinted substances.

This is a relatively short book that provides a brief, clear introduction to molecular imprinting. The text focuses on representative examples of each topic and does not attempt to give a comprehensive or encyclopedic in-depth treatment of the subject. Often the approach works well, but occasionally it seemed that the treatment was too light and a little more breadth and depth would have strengthened the presentation. There are

numerous references − especially in the tables in Chapter 7 − many of which are recent, up to 2001. The few typos contained in the text and schemes did not detract from the content or clarity of the presentation.

According to the Preface, this book was "written primarily as a textbook for graduate courses." Although it could fulfill that objective for a short course or mini-course or as a supplement to a full-term course, I do not think it could serve as the sole source of information for a full-term course. I would recommend the book as one of the first things to read if you are unfamiliar with molecular imprinting. Because of its many, good, up-to-date references, it could also be used as a resource to guide further study.

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Paramagnetic Resonance of Metallobiomolecules. Edited by Joshua Telser (Roosevelt University). American Chemical Society (Distributed by Oxford University Press): Washington, DC. 2003. xiv + 432 pp. $122.50. ISBN 0-8412-3832-4.

This book is based on a symposium sponsored by the American Chemical Society (ACS) Division of Inorganic Chemistry at the ACS National Meeting in Orlando, FL in April 2002. A variety of techniques, including electron paramagnetic resonance, nuclear paramagnetic resonance, and magnetic circular dichroism, are discussed in relation to their ability to increase our understanding of complex bioinorganic systems. An author and a subject index complete the book.

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Handbook of Bond Dissociation Energies in Organic Compounds. By Yu-Ran Luo (University of South Florida, St. Petersburg). CRC Press LLC: Boca Raton. 2003. xii + 380 pp. $159.95. ISBN 0-8493-1589-1.

This book offers a comprehensive collection in tabular form of experimental bond dissociation energies (BDE) for 2400 organic compounds. Up to five BDE values are given for each compound, with the recommended value highlighted and references provided for each. The data are ordered according to class of the bond, functional group, bond order, bond degree, saturated or unsaturated compounds, and molecular size and structure. The book also includes a chapter on heats of formation of atoms and organic and inorganic radicals and one on the BDEs of some inorganic compounds. A list of notations and abbreviations opens this handbook, and a list of references plus indices of compound classes and compound names conclude it.

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