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BOOK REVIEWS

Molten Salts: From Fundamentals to Applications. Edited by Marcelle Gaune-Escard (Institut Universitaire des Systèmes Thermiques Industriels, Marseille). Kluwer Academic Publishers: Dordrecht, Boston, London. 2002. x + 404 pp. $147.00. ISBN: 1-4020-0458-3

This book was developed from the NATO Advanced Study Institute meeting of the same title held in Kas, Turkey, in May 2001. Its 16 chapters cover a variety of topics related to molten salts, with subjects ranging from such fundamental concepts as the interfacial and thermodynamic properties of molten salts to the application of molten salts in room-temperature glass formation. A sampling of the chapters includes "Metal−Molten Salt Interfaces: Wetting Transitions and Electrocrystallization", "Data Mining and Multivariate Analysis in Materials Science: Informatics Strategies for Materials Databases", and "Synthesis and Catalysis in Room-Temperature Ionic Liquids". A subject index completes the book. References are current to 2001.

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Concise Dictionary of Biomedicine and Molecular Biology. Second Edition. By Pei-Show Juo (State University of New York, Potsdam). CRC Press LLC: Boca Raton. 2002. viii + 1154 pp. $129.95. ISBN: 0-8493-0940-9

This reference book contains over 30 000 entries, including over 23 000 definitions of commonly used terms in biotechnology, molecular biology, and biomedicine; ∼4000 chemical structures and their functions; 1200 equations of enzymatic reactions; and 600 restriction endonucleases and their modes of action. Brand names and generic names of common drugs and antibiotics are also provided and cross-referenced with their chemical structures, and medical and molecular abbreviations are given of terms often used by the scientific community.

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The HPLC Solvent Guide. Second Edition. By Paul C. Sadek (Access Business Group, Ada, Michigan and Analytical Consulting Laboratories, Kentwood, Michigan). Wiley-Interscience: New York. 2002. xx + 644 pp. $99.95. ISBN: 0-471-41138-8

This 10-chapter guidebook offers practical and operational information about solvents for use in high-pressure liquid chromatography. Chapters 1−3 cover the operational aspects of solvents under the following titles: Physical and Chemical Solvent Properties; Method Optimization; and Method Validation and Ongoing Performance Evaluation. The remaining chapters focus on "real-world chromatographic uses for each solvent class" covering alcohols; alkanes and alkyl aromatics; chlorinated alkanes and chlorinated benzenes; ethers; ketones and esters; nitriles and nitrogeneous solvents; and water, dimethyl sulfoxide, and common acidic modifiers. This new edition features the addition of chemical structures and an expansion of the references from some1100 to over 1600. The book also contains a list of abbreviations, acronyms, and symbols as well as a comprehensive subject index and an index of analytes.

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Magnetism: Molecules to Materials III. Nanosized Magnetic Materials. Edited by Joel S. Miller (University of Utah) and Marc Drillon (Institute de Physique et Chemie des Materiaux de Strasbourg). Wiley-VCH: Weinheim. 2002. xvi + 388 pp. $125.00. ISBN 3-527-30302-2

This book is very broad in scope, beginning with a chapter that should interest the chemistry community and then progressing toward subjects more relevant for physicists, material scientists, and engineers. Although its publication date is 2002, references are only through the year 2000.

The first two chapters are reviews of synthetic methods for nanoscale magnetic particles, their unique properties, and a host of applications. Examples include metals, metal oxides, and transition metal zintl isotypes, such as $Ba_{14}MnP_{11}$ and $SrMnSb_{11}$. Structures, paramagnetic susceptibilities, magnetic coupling, anisotropy, heat capacities, and magnetic resistance are also discussed. The next two chapters are discussions about the magnetic properties of large coordination compound clusters, for example, $Mn_{12}O_{12}(CH_3COO)_{16}(H_2O)_4$ and the "ferric wheel" $Fe_{10}(OMe)_{20}(CH_2ClCOO)_{10}$. In-depth theoretical treatments and detailed physical measurements are discussed, such as AC susceptibility, cantilever magnetrometry, and various high-field EPR measurements. A case history of an Fe_8 complex is given, and quantum tunneling of magnetization in such cluster complexes is discussed, including a search for quantum effects on the "macroscale." Thermal effects are described in detail. It is pointed out that molecular clusters of tens of atoms are ideal systems for the study of quantum tunneling and quantum coherence at the mesoscopic level. Time-dependent measurements of specific heat are emphasized in the discussion, as is phonon-assisted quantum tunneling.

As Chapter 6 unfolds, the subject matter moves to more physical methods, such as island growth by surface-deposited metal atoms. Growth kinetics, island densities, shapes, self-organization, and nucleation on ordered dislocations are considered. Magnetism in low-dimensional systems is discussed, including the Co/Au(111), Fe/Au(111), Fe/W(110), and Co/

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Cu(100) combinations. Next, a broad overview of spin electronics is given, encompassing spin injection across interfaces, giant magnetoresistance (GMR), giant thermal magnetoresistance, and more. An interesting analogy with polarized light is given, and the important application of ferromagnetic single-electron transistors is discussed. The latter chapters continue to deal with ultrathin films and NMR as a useful tool to investigate magnetic phase separation, magnetic stiffness, and soft and hard phases. Interlayer exchange interactions in magnetic multilayers is another important topic that is treated both theoretically and experimentally, and emphasis is given to the Co/Cu(001)Co and Fe/Au(001)Fe multilayer systems. The last chapter deals with magnetization dynamics on the femtosecond time scale. Time-resolved magnetic-optical response and spin-resolved photoemission are covered. Nickel and $CoPt_3$ films are discussed, and experiments showing that ultrafast demagnetization of ferromagnetic thin films can be induced with femtosecond optical pulses are described.

This is an interdisciplinary text that transitions from a focus on chemistry toward one on physics/engineering. The topics range from wet chemistry to structures and thin films and have substantial components of theory and applications. The scope of the book may indeed be too broad for the chemistry community. On the other hand, the book does deal with essentially all types of magnetic nanostructures and should appeal to many scientists in the ever growing nanotechnology field.

Kenneth J. Klabunde, *Kansas State University*

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Phosphorus−Carbon Heterocyclic Chemistry: the Rise of a New Domain. Edited by Francois Mathey (Ecole Polytechnique, Palaiseu, France). Pergamon (An Imprint of Elsevier Science): Amsterdam. 2001. x + 846 pp. $315.00. ISBN 0.08-043952-7

This treatise on phosphorus−carbon heterocyclic chemistry is one of the most inclusive that I have ever seen on the topics discussed. Except for the reviews by Dimroth [*Comp. Heterocycl. Chem.* **1982**, *1*, 493] and by Maerkl [in *Multiple Bonds and Low Coordination in Phosphorus Chemistry*; M. Regitz and O. J. Scherer, Eds.; Georg Thieme, Verlag: Stuttgart, 1990], the present work is the most updated and comprehensive. The individual authors have done a remarkable job discussing their particular areas of expertise, and Professor Mathey is to be congratulated for his selection of the authors and editing of the various sections. Evaluations of the chemistry and properties in each chapter have been done with rigor and with discernment.

The scope of the book is reasonably broad, covering ring sizes of three- to seven-membered systems, with a few larger heterocycles being discussed in parts 1 and 2 of Chapter 6. The work outlined in Chapter 7 on the applications of phosphorus heterocycles in homogeneous catalysis is quite timely in view of the extreme interest in developing catalysts that induce the formation of products with high stereospecificity. This reviewer found the descriptions in each chapter of the spectral properties of typical compounds to be particularly valuable to those working in the field. Only the reviews of NMR spectra of cyclic phosphorus compounds by Fluck and Heckmann [Heckmann, H.; Fluck, E. *Rev. Heteroat. Chem*. **1994**, *11*, 65; **1995**, *12*, 6121] are as extensive in NMR spectral analysis. Nearly all of the chapters have references up to 2000 and, in some instances, 2001, which enhances the merit of the book. Literature citations are numerous in every chapter, and using the year, letter code for a journal, and page numbers makes for ready access to check a specific reference.

Three-membered rings were thoroughly reviewed in sections 1 and 2 of Chapter 2 with adequate background provided and references included as late as 2000. The discussion of diphosphiranes was an especially appealing part in view of the chemical versatility of the ring system in its ability to be preserved and, in some cases, to experience ring-opening with the formation of novel products.

The four-membered rings are the subjects of Chapters 3, sections 1−3. Section 3 on the various isomers of diphosphetes was drafted in a particularly attractive manner to illustrate, for example, σ-complexation with transition metals and to point out that the field is in its infancy. Chapter 4, sections 1−3 on phospholanes, phospholenes, phospholes, and heterophospholes, make the coverage of this ring system the most extensive within the past two decades.

Chapter 5, section 1, on phosphinanes and dihydro- and tetrahydrophospinines and section 2 on phosphinines, are very well written and well documented. The polydentate phosphorus ligands are an important part of phosphorus heterocycles and are covered well in section 2 and amplified in Chapter 6, section 1, with emphasis on macrocycles. Chapter 5, section 3, covers six-membered phosphorus-possessing molecules with two or more heteroatoms in a ring and at least one phosphorus atom. This is an emerging field, in my opinion, since phosphorus can replace heteroatoms, with that of nitrogen being especially noteworthy.

Chapter 6, section 1 on "Macro- and Spiro-heterocycles" is unique and exemplifies the diversity by which phosphorus can assume so many different configurations and, thereby, so many cylic structures of varying sizes from seven- to nine-membered units and, in some instances, even larger rings. The ligand-binding capability of phosphorus atoms with metals in a cyclic system is readily apparent from the examples given. A few spiro, multicyclic systems were also included, but section 3 focuses primarily on spiro heterocycles with phosphorus at the spiro position. Bicyclic and polycyclic rings with a ring-junction phosphorus atom is the subject of section 2. The huge variety of phosphorus heterocycles in such structural units is not only aesthetically pleasing but represents compounds from which chiral examples might be useful in enantiomeric syntheses.

The applications of phosphorus heterocycles in homogeneous catalysis in Chapter 7 may be one of the most actively investigated areas of organophosphorus heterocycles. Chiral, cyclic phosphametallocenes are certainly one class of compounds that begs for additional work. The promise of enantiomeric catalysis in synthesis is a potentially useful result from the directive influence of such heterocyclic catalysts.

This book is published at a time in phosphorus heterocyclic chemistry when new catalysts, new medicinal agents, and new synthons are capable of being generated. With advanced theoretical calculations to compute optimized geometries as well as total energies for the pyramidal, planar, and other geometric

states of phosphorus in cyclic systems, one could almost predict that new structures will emerge with specific properties. This book should be in every research library and on the shelf of everyone who works with phosphorus heterocycles or who thinks he or she might delve into the area. The pioneers who wrote the chapters have laid the groundwork for advances that are sure to come.

K. Darrell Berlin, *Oklahoma State University*

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Surfactant Science Series, Volume 106. Interfacial Electrokinetics and Electrophoresis. Edited by Angel V. Delgado (University of Granada). Dekker: New York and Basel. 2002. xiii + 991pp. $250.00. ISBN 0-8247-0603-X.

The spectacular 50 000-fold increase in the surface-to-volume ratio that accompanies the decrease of the diameter of a particle from 1 cm to 100 nm is a fundamental and important consequence of size quantization. Such large surface-to-volume ratios manifest themselves in substantial electrostatic forces between dispersed charged nanoparticles in solution. Indeed, these electrostatic repulsions are responsible for the stability of colloidal dispersions. Interfacial electrokinetics provide the theoretical framework for the treatment of charged particle interactions, and electrophoresis and related techniques permit the necessary experimental determinations. Attempts have been made in this book to provide an up-to-date summary of the physics and chemistry that govern the electrical interactions between solid−liquid, liquid−liquid, and gas−liquid interfaces.

The book is organized into five main parts. Some of the chapters appear to overlap the somewhat arbitrary classification, and there are quite a number of repetitions in the introductory parts of the chapters. All the chapters are authored by scientists who are practicing researchers.

Chapter 1, written by the Editors, is an excellent review of the theory of electrokinetics and related phenomena and a useful survey of the available experimental techniques. The other chapters in Part I, which is simply titled "General", cover a range of topics from "Nonequilibrium Electric Surface Phenomena and Extended Electrokinetic Characterization of Particles" (Chapter 2) to "Electroacoustic Phenomena in Concentrated Dispersions: Theory, Experiment, Applications" (Chapter 17).

In the three chapters in Part II, the authors survey the electrokinetic effects in membranes and the use of electrokinetics for the characterization of microfiltration and ultrafiltration membranes.

Part III is devoted to polymers and particles of biological interest. In the five chapters in this section, the authors summarize the current state of understanding of polystyrene, latex particles, and polymer-coated particles, and the modeling and fingerprinting of the electrophoresis and biological cells.

Surface properties and electrokinetics of mineral particles and clay mineral particles are the subjects of Part IV, and electrokinetic effects of gas bubbles, liquid−liquid interfaces, surfactant-stabilized emulsions, oil-in-water emulsions, and liposomes make up the topics of Part V.

This book is an extremely valuable resource. The current interest in anything nano and the pervasive presence of interfacial electrokinetics in such diverse fields as molecular electronics and electrooptics; ceramics, paper, paint and coating technologies; and food, agricultural and pharmaceutical processing amply justify the purchase of this book.

Janos H. Fendler, *Clarkson University*

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Nanoscale Materials in Chemistry. Edited by Kenneth J. Klabunde (Kansas State University). Wiley-Interscience: New York. 2001. xi + 292 pp. $99.95. ISBN: 0-471-38395-3.

The science of nanoscale objects, though still in its infancy, has already become a sprawling field in need of survey volumes that can tie together important themes. Klabunde's edited book serves this goal by providing an overview of the science of nanometer-scale particles. The book includes well-chosen reviews from experts in the synthesis and properties of inorganic nanoparticles. Despite its general title, the book omits a number of important types of nanostructures, including carbon nanotubes and other anisotropic nanorods, organic nanoparticles, and environmental aerosol nanoparticles; as a result, readers of this compilation should not expect an overview of all nanoscale materials. It is also important to note that the book does not address nanostructured bulk materials, such as block copolymer or layered materials, which are important topics in nanoscience but are clearly beyond the editor's focus. Nevertheless, the book contains essential reviews on metal, semiconductor, ceramic, magnetic, and inorganic catalyst nanoparticles and their properties. Klabunde's choice of topics within the field of nanoparticle chemistry makes this book useful for specialists in nanomaterials as well as those interested in an overview of research in nanoparticles through the 1990s.

The volume is well-organized. It includes not only reviews, but also an interesting "Introduction to Nanotechnology" by the Editor and a refreshing conclusion on potential commercial applications of nanoparticles. Most of the chapters begin with a discussion of the physical consequences of reducing a particular type of bulk material to the nanometer scale and then review the synthesis and novel properties of nanoparticles made from that material. The chapters vary considerably in their emphasis on materials theory and past experimental work. For example, Schmid and Mulvaney provide an excellent balance between a general discussion of the electrical and optical properties of metal nanoparticles and a survey of the literature on these subjects. Pileni's chapter on semiconductor "quantum dots", on the other hand, focuses mostly on synthetic work and Sorensen's chapter on magnetic nanoparticles spends too much text developing general theories of magnetism. As a result, I am not sure the work fulfills the editor's stated goal of creating a textbook for a course in "nanochemistry"; the varying voices do not provide enough of a coherent framework for classroom learning. However, practicing scientists who read this book will get a very good sense of important themes in nanoparticle science and learn a great deal about current research in this exciting field.

Overall, Klabunde's book offers a balanced survey of different topics in basic nanoparticle science. I do feel that the book could have been improved by additional chapters on the technological applications of nanoparticles. The Editor's focus on fundamental properties means that some of the most exciting recent research on nanoparticles, such as using chemically tailored nanostructures in biology, chemical sensing, information storage, and photonics, is not stressed. But the book does provide a thorough discussion of different classes of nanoparticle materials, and readers will learn a great deal about past and current research in this exciting subfield of nanoscience.

T. Andrew Taton, *University of Minnesota*

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