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BOOK REVIEWS

Phosphorus Heterocycles I. Edited by Raj Kumar Bansal (University of Rajasthan, Jaipur, India). From the series, Topics in Heterocyclic Chemistry, 20. Edited by R. R. Gupta (Jaipur, India). Springer-Verlag: Berlin, Heidelberg. 2009. x + 314 pp. $339.00. ISBN 978-3-642-00337-0.

Phosphorus heterocycles have become significant players in the areas of catalysis, development of medicinal agents, and as synthetic intermediates in multistep syntheses. This book consists of eight timely reviews that encompass a broad range of topics involving these heterocycles, including the synthesis of novel molecular systems, mechanisms of action, metal-cation binding, and molecular recognition properties of the compounds. The chapters cover anellated azaphospholes; biological activity of aminophosphonic acids and their short peptides; phosphinine derivatives; spiro and tricyclic phosphoranes; the chemistry of phosphinines; 1,2-heteraphosphacyclanes; and phosphorus-containing calixarenes, macrocycles, and dendrimers. Discussion of synthetic methodologies for the target compounds is a major component of all the chapters, and generally speaking, the syntheses are well described, with many of the citations being to results obtained from the laboratories of the authors. It is also noteworthy that there are many examples of materials in each chapter in which basic structures were confirmed by X-ray diffraction analysis, thereby not only establishing the compound but also providing support for the mechanisms leading to the products. This is particularly true for chapters in which azaphospholes and phosphinines are discussed. The descriptions of fused five- and six-membered rings and six-membered phosphorus-containing rings in these chapters are important because these systems are precursors for coordination with a variety of metals. Whether the phosphorus atom behaves as a weak σ-donor or π-acceptor, the evidence is clear that stable coordination materials are often formed under mild conditions. These observations should be exciting for both inorganic and organic chemists in areas of specific catalysis who may wish to exploit the strategies described in these reviews.

The diversity of bonding characteristics of the phosphorus atom is prominent in the many complex phosphorus-containing heterocycles discussed in nearly all the chapters. The bonding includes two-coordinate tervalent [σ^2,λ^3] phosphorus, P(III), P(IV), and P(V) systems that allow entry to a wide variety of structural manifestations in strained cyclic frameworks. References in each chapter bring the reader to the cutting edge of research utilizing the versatility of phosphorus in compound design. Such details will be encouraging to those in the field as well as to those anticipating entering the area.

Homogeneous catalysis in conjunction with generating chirality in systems is also an active part of heterocyclic phosphorus chemistry. Chiral phosphorus-containing catalysts play an important role, particularly in enantioselective reductions, and are well-known. Some examples are briefly discussed in the chapter on phosphinines. Although this subject is not addressed directly in the section on calixarenes, their complexes with metals such as Pd, Pt, and others are cited and could well lead to discoveries of stereoselective and enantioselective reductions with such species.

Macrocycles and dendrimers containing a phosphorus atom have come into prominence in recent years. The ability to graft a large number of different functional groups to an appropriate phosphorus reagent makes for a convenient method to obtain large molecules with phosphorus at the core. The long P−O and P−N bonds allow for considerable flexibility in the resulting macrocycle or dendrimer. Work in this field is in its infancy since phosphorus can assume so many different bonding states and thus result in a wide conglomeration of very large molecular structures. Thus, the chapter on this topic here is timely.

There are references to publications within the past 10−11 years as well as to those within the past 2−4 years enabling the reader to assess the current status of the fields discussed. It is also noteworthy that the index is useful, something not commonly found in many reference books. Consequently, the volume should be a valuable resource for students and advanced researchers in the areas described.

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Bioinorganic Photochemistry. By Grazyna Stochel, Malgorzata Brindell, Wojciech Macyk, Zofia Stasicka , and Konrad Szacilowski (Jagiellonian University, Poland). John Wiley & Sons, Ltd.: Chichester.2009. xvi + 382 pp. $199.99. ISBN 978-1-4051-6172-5.

When I was preparing to teach a graduate class on the photochemistry of inorganic compounds and materials last year, it was evident that there were no modern textbooks or monographs that were appropriate for use at this level. Indeed, the same situation appeared to be true for all flavors of photochemistry, which is a subtopic relevant to nearly all areas of chemical and materials science. In 2009, this changed somewhat with the publication of the excellent introductory text *Principles of Molecular Photochemistry* by Turro et al. (University Science Books). However, despite the general title, this is a text on organic photochemistry and does not cover many of the issues that I would have chosen to introduce in such a course. In this context, I was pleased to see the publication of *Bioinorganic Photochemistry*, since it would potentially address an important need: the opportunity to introduce students or more senior scientists to the subtleties of the photochemistry of inorganic and bioinorganic compounds and materials.

Bioinorganic Photochemistry is much broader in scope than implied by the title−or perhaps more accurately stated, the authors' definition of bioinorganic chemistry is much broader than this reviewer's. After the short introductory Part I, which consists of one chapter, "Philosophy of bioinorganic photochemistry", the book has four key sections: II, "Fundamentals" (6 chapters); III, "Natural photoprocesses involving inorganic compounds" (4 chapters); IV, "Photochemistry and photophysics in bioinspired systems: studies and modelling" (3 chapters); and

Unsigned book reviews are by the Book Review Editor.

V, "Towards applications" (7 chapters including such topics as "Fluorescent and chromogenic sensing and labeling" and "Therapeutic strategies"). The various chapters are surveys of a number of subjects related to the photochemistry and photobiology of various inorganic compounds and materials, and most chapters are generously referenced. Although most of the topics covered within each section are appropriate to the book's title, it does seem rather restrictive, given such titles as "From interstellar space to planetary atmospheres" (Chapter 8) and "Solar radiation and terrestrial environment" (Chapter 9). The breadth of topics certainly makes for some interesting reading; however, this reviewer found the style of the text too qualitative for his personal taste, especially from a teaching perspective.

The qualitative character of the book is especially apparent in the chapters in Part II, "Fundamentals", with the notable exception of Chapter 7, "Photochemistry and photophysics of supramolecular systems and nanoassemblies", which includes an excellent and more quantitative discussion of excited states of semiconductors. An example is the treatment of the mechanisms of energy transfer, a topic of considerable interest to photochemists and photobiologists today. Two such mechanisms are commonly discussed: the electron exchange mechanism, frequently called Dexter excitation transfer, and the dipolar exchange mechanism, often called Förster resonance energy transfer (FRET). Both are briefly discussed in Chapter 4, "Photophysical deactivation of electronic excited states", and FRET is mentioned in some of the later chapters. However, the mathematics of these models, especially those that describe the predicted distance dependences of the rates of energy transfer, is not discussed. Furthermore, as the basis for a graduate course, this text would have been strengthened by more quantitative attention to other fundamental issues, such as theories relevant to radiationless (nonradiative) deactivation and excited state electron-transfer mechanisms, among others. The tone of the book is consistently qualitative, and this is unfortunate given that the chemistry and dynamics of excited states is a subject that has received considerable quantitative attention both experimentally and theoretically.

Overall *Bioinorganic Photochemistry* presents a broad, qualitative overview of photochemical topics largely focused on the interface of inorganic chemistry with biological, medical, and environmental issues. The book will be of interest to those working in the field who are interested in surveying how photochemistry is applied in a variety of biologically relevant areas. However, a more quantitative and theoretical approach would have come much closer to meeting this reviewer's needs for a text to use in a graduate photochemistry course.

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Annual Review of Materials Research, Volume 39, 2009. Co-edited by David R. Clarke (Harvard University) and Manfred Rühle (Max-Planck Institute of Metals Research, Stuttgart) and Guest edited by Roger H. French (DuPont Co. Central Research) and Thomas M. Shaw (IBM, T. J. Watson Research Center). Annual Reviews: Palo Alto, CA. 2009. xii + 494 pp. $89.00. ISBN 978-0-8243-1739-3.

This book consists of 19 reviews on current research in materials science. As with previous volumes, the first section is devoted to a specific topic, which in this case is "Materials Advances for Next-Generation Microelectronics", whereas the second section features reviews of current interest in materials research. A sampling of some of the chapters includes "Immersion Lithography: Photomask and Wafer-Level Materials", "Size-Dependent Resistivity in Nanoscale Interconnects", and "Shape Memory Polymer Research". The book concludes with a cumulative index of contributing authors for Volumes 35−39.

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