Book Review

Crystallography of Modular Materials. IUCr Monographs on Crystallography, 15 By Giovanni Ferraris (University of Turin), Emil Makovicky (University of Copenhagen), and Stefano Merlino (University of Pisa). Oxford University Press: Oxford. 2004. x + 370 pp. $144.50. ISBN 0-19-852664-4.

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J. Am. Chem. Soc., **2005**, 127 (5), 1589-1590• DOI: 10.1021/ja040958k • Publication Date (Web): 10 December 2004

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BOOK REVIEWS

Transition Metal Arene π-Complexes in Organic Synthesis and Catalysis. Topics in Organometallic Chemistry, 7. Edited by E. Peter Kündig (University of Geneva). Springer-Verlag: Berlin, Heidelberg, New York. 2004. viii + 232 pp. $269.00. ISBN 3-540-01604-X.

Because of the possibility of transition metals to enhance the reactivity of complexed arenes, transition metal arene complexes have always evoked excitement for the chemist interested in reactivity. This book, written by leaders in the field, is an excellent compilation of what is known about the reactivity of these materials. A "holy grail" in this area has been to utilize metals in a catalytic manner for conversions involving arenes. Although efficient catalysis still remains a challenge, this book brings the reader up-to-date on the latest uses of transition metal arene complexes in synthesis and reactivity, covering such areas as nucleophilic substitution, lithiation, dearomatization, cycloaddition, and the use of transition metal arene complexes as catalysts and ligands.

The information contained in this book should be of immense value to readers who are peripherally familiar with the field and are interested in its current state of development. Not only will the contents fulfill a desire simply to learn more about the utility of transition metal arene complexes in organic synthesis or their reactivity in general, but they can also serve as a guidepost for those considering initiating a research program in this field. The chapter on the use of metal arene complexes in natural product synthesis, for example, illustrates for the organic chemist the broad range of utility of these complexes.

The book is well-written and organized with minimal redundancy among the nine chapters. The writing is concise, and there are many schemes that enhance understanding of the range of chemistry covered. The chapters are well-referenced and cover the literature of the last 10−15 years. The only shortcoming of this text, in my opinion, is the absence of a chapter on the challenges and issues of using metals to convert arenes catalytically via reversible complexation of arenes. Given the lure of such a possibility, this topic would seem appropriate for a more complete picture of the evolving saga of the chemistry of transition metal arene complexes.

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JA040984I

10.1021/ja040984i

Crystallography of Modular Materials. IUCr Monographs on Crystallography, 15. By Giovanni Ferraris (University of Turin), Emil Makovicky (University of Copenhagen), and Stefano Merlino (University of Pisa). Oxford University Press: Oxford. 2004. x + 370 pp. $144.50. ISBN 0-19-852664-4.

In the 1970s, students were sometimes told that if they wished to discover a new mineral, all they needed to do was examine a sample of zinc sulfide. They were then introduced to its stacking faults, identical defects that alter the sequence of layers regularly every few hundred layers. Even at that time, the topic of "crystallography of modular materials" was a rapidly expanding subject. This book brings together early work in this area with later developments in a most timely fashion.

The book opens with a lengthy introductory chapter (approximately one-third of the book) on the principles and types of modular structures. It is very thorough and comprehensive, presenting a lucid and concise introduction to the classification and categories of the structures, followed by clear descriptions of the various series of structures. It is also copiously illustrated with excellent diagrams. Those already familiar with the subject should have little difficulty extracting the details of the structures to their own satisfaction from these diagrams; the less knowledgeable reader may puzzle somewhat over the intricacies. This reviewer would have preferred to see more space devoted to a few of the diagrams; some quite narrow illustrations would have been much clearer if they were rotated to run the length of the page. In these cases, the details showed up best under $\times 3$ magnification! After the descriptions of the various series, the chapter ends with a short examination of how modular structures may be derived (predicted). The predictions arise from combinations of homologue unit cells, examination of the weighted reciprocal lattice, TEM measurements, and a consideration of the chemical composition. Here the authors emphasize the principles of the predictions using a small number of examples to illustrate their point.

The next chapter covers order/disorder (OD) structures. These may be recognized by their sharp spots and diffuse streaks so familiar to those from the era of photographic crystallography, but less familiar to those raised with point-detector four-circle diffractometers, where the phenomenon can be overlooked unless the data are examined rather carefully. The subject is introduced using the classic structure of wollastonite ($CaSiO_3$), which illustrates well many of the features of OD structures and the theory that is used to untangle their construction.

Once the principles of partial operations, OD-groupoid families, and maximum degree of order are established, the authors then discuss OD families, first covering those built with equivalent layers, then those with two different kinds of layers. Again, all these families are excellently illustrated. The first appendix at the end of the chapter contains a table of monoclinic and orthorhombic OD-groupoid families, which would have been more useful if presented at the beginning of the chapter when the families were first considered. Alternatively, since it is referred to elsewhere in the book, it might have been more conventionally sited at the end of the book. Also, a small quibble, the table would have been much better presented if it were rotated on the page so that a larger font could have been used.

In the next chapter, the authors introduce polytypes and polytype categories. This can be a confusing field with regard to its terminology because common usage is often at variance

with the strict definitions. This chapter reflects this tension to some extent, with the authors treading warily in their descriptions. Of all the chapters in the book, this, the shortest, was also the most difficult in terms of grasping the overall picture.

The next chapter covers the application of modularity to the description of structures. Naturally, it starts with the perovskites and high-temperature superconductors and then moves on to minerals familiar to the general structural audience. The topics are presented in the same rational and thorough manner used in the prior chapters.

The final chapter concerns twinning. Until the recent introduction of crystallographic software to detect, unscramble, and "solve" crystal twins, the crystallographer often regarded twins as either an intriguing but time-consuming challenge, or nothing but a nuisance. New software has opened the field for the routine examination of crystallographic twins; thus, this chapter is particularly timely. There are some excellent descriptions of twinning available in the literature, but there is no better introduction and summary of the subject than that presented in this chapter. From the classification and definition of the various twins, to the consequences and the warning signs of twinning, to a brief survey, with examples, of the de-twinning processes, it is all there. Advanced graduate classes in crystallography should be required to study this chapter, and for the crystallographer faced with a twinned structure, it will be an excellence reference.

The book ends with more than 50 pages of references, ranging from a citation dated 1851 to several from 2004, making this book a valuable resource. Navigating the index is straightforward once you have grasped its system for ordering keywords. For example, to find perovskite *modules* and perovskite *structures*, you would look under the headings "modules" and "structures", respectively.

Overall, this book presents a wealth of well-ordered information. It should be in every serious science library and is doubtless heading for a future characterized by well-used, dog-eared pages.

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JA040958K

10.1021/ja040958k

Reflexive Polymers and Hydrogels: Understanding and Designing Fast Responsive Polymeric Systems. Edited by Nobuhiko Yui (Japan Advanced Institute of Science and Technology, Ishikawa), Randall J. Mrsny (Welsh School of Pharmacy, Cardiff), and Kinam Park (Purdue University). CRC Press LLC: Boca Raton, FL. 2004. xvi + 452 pp. $179.95. ISBN 0-8493-1487-9.

This book, edited by experts in biochemistry, pharmaceutics, and materials science, brings a unique perspective to the parallels between biological materials that react to or "reflect" stimuli and synthetic materials that have been designed to respond to external stimuli, such as pH, light, or temperature. Although important advances have been made in the area of synthetic systems, especially in fields such as separations and drug delivery, biological systems remain far more complex and robust.

The book is divided into three main sections: the first focuses on natural systems and gives several examples of rapid responses; the second considers some of the theory behind response kinetics, with emphasis on synthetic systems; and the third details specific synthetic responsive materials and how they respond to external stimuli. The editors blend the main points of this book in the final chapter in which the future of research in this area is discussed in general terms.

By presenting two perspectives on responsive systems (biological and materials science), the editors have crafted a resource to help researchers in these areas understand the state of the science and further develop synthetic materials that more closely match biological behavior. The book provides good coverage of related subjects, including both simple and complex models to describe the shrinking/swelling/self-assembly of materials and giving numerous examples of synthetic materials designed to perform in cyclic patterns. A reader who is well-versed in materials science will be impressed by the biological "smart" materials, whereas the life scientist will gain insight into the capabilities of synthetically derived materials. This is a strong compilation that will be beneficial for researchers at the interface of biology and materials.

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JA040974H

10.1021/ja040974h