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BOOK REVIEWS

Magnetism: Molecules to Materials II. Molecule-Based Materials. Edited by Joel S. Miller (University of Utah) and Marc Drillon (CNRS, Institut de Physique et Chimie des Materiaux de Strasbourg). Wiley-VCH: Weinheim. 2001. xiv + 490 pp. $125.00. ISBN: 3-527-30301-4.

This is the second volume of a three-part review series, fitting logically in subject matter between Volume I (*Models and Experiments*) and Volume III (*Nanosized Magnetic Materials*). The topic of molecule-based magnetic materials has been actively researched for some time, both because of the potential for the development of new applications of such materials and because much fundamental information remains to be learned about the interactions between individual magnetic centers in condensed media.

The present volume consists of 14 chapters by an international group of authors. The chapters can be divided roughly into two categories based on their length and scope: The longer ones tend to cover broader and more highly developed areas, but many of the shorter chapters are more specialized, often emphasizing results from the authors' own laboratories. Of the former group, the first two chapters on nitroxide (or aminoxyl) radicals and their metal coordination complexes do a particularly good job of summarizing the current state of understanding of these compounds and of emphasizing the formidable challenges that must be met if they are to serve as the basis for useful devices. The final four chapters provide a good overview of work on a number of types of layered materials and thin films. An excellent variety of other topics is also covered—anyone who pays attention to the general area of molecule-based magnetic materials is likely to find something new and interesting. About one-half of the chapters have references extending into 2000, and the remainder terminate their literature coverage in 1999. There is a brief index. Overall, this volume presents a good and reasonably current overview of an active and diverse research area.

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Electron Transfer in Chemistry. Volume II: Organic, Organometallic, and Inorganic Molecules. Edited by Vincenzo Balzani (Universita di Bologna). Wiley-VCH: Weinheim. 2001. Volume 2 of a 5-volume set. 4200 pp (for set). $1425.00 (for set). ISBN: 3-527-29912-2 (for set).

This book is part of the five-volume set entitled *Electron Transfer in Chemistry*, which emphasizes the multidisciplinary nature and increasing importance of electron transfer research and is a timely and necessary contribution. Volume II is divided into two parts: Part 1, "Organic Molecules", edited by Mattay; and Part 2, "Organometallic and Inorganic Molecules", edited by Astruc. I had hoped (perhaps naively) that this volume would provide comprehensive coverage of the general topics, as suggested in the title, and would serve as a useful reference textbook for both those entering the field as well as those working in the area. It did not meet this expectation. What it does provide, however, is individual chapters of excellent quality written by highly regarded experts. Each chapter stands alone and is authoritative and up-to-date for the selected topic. Because of this, the variation in the format of diagrams and figures for each chapter is more forgiveable. Most astonishing for a volume (and series of volumes) of this size and complexity is that the references in each chapter are up-to-date, at least to the year 2000. The editors should be applauded for their ability to coordinate this compilation in a timely fashion.

Volume II contains a variety of chapter styles that add to the general feeling that the volume is a collection of review articles. There are a couple of excellent general and broadly relevant chapters, including "The Thermodynamics of Organometallic Systems Involving Electron-Transfer Paths" and "Reactivity Patterns of Radical Ions—A Unifying Picture of Radical-Anion and Radical-Cation Transformations". The majority of the volume contains, as expected, chapters that deal with electron-transfer processes of a particular class of compound or specific functional group. For example, chapters dealing with electron transfer to aliphatic and acyclic, aromatic, and heteraromatic compounds, C—C multiple bonds, amines, carbonyl compounds, fullerenes, and radicals appear in Part 1. In Part 2, chapters describing electron transfer reactions of organometallic complexes, transition metal complexes, mononuclear polypyridine metal complexes, and dinitrogen species are provided. The authors of these chapters are well-known to the field of electron transfer, and their respective chapters will serve as excellent resource material. They were, indeed, a pleasure to read, and I learned a lot. Many topics were covered in more than one chapter, so there was sufficient overlap of references. There were a few chapters, however, that seem to have been misplaced. For example, the interesting and well-written chapters entitled "Reflections on the Two-State Electron Transfer Model" by Brunschwig and Sutin and "ESR Spectroscopy of Inorganic and Organometallic Radicals" by Kaim would have been more appropriately placed in Volume I of the set entitled *Principles, Theories, Methods and Techniques*. Additionally, the chapters by Forde and Morris entitled "Transition-Metal Complexes as Models of the Active Sites of Hydrogenases" and by Fukuzumi and Imahori entitled "Biomimetic Electron-Transfer Chemistry of Porphyrins and Metalloporphyrins" seem better suited to Volume III, *Biological and Artificial Supramolecular Systems*. The table of contents for Volume II was not conveniently located, but rather was buried in the front along with those for all five volumes. In addition, there was no index provided for this particular volume. However, such criticisms are minimized, because the only way to own Volume II is by buying the complete five-volume set; the publisher does not sell the individual volumes.

10.1021/ja015363t CCC: $22.00

Because the volume is not comprehensive, I do not recommend it as essential for the bookshelves of anyone involved in research in the area. With individual volumes not available for purchase, the cost of the set is a disincentive for private collections. However, as a five-volume set, the price is extremely attractive for institutional libraries, and it should be ordered as part of the necessary acquisitions of any library collection. I am confident that the volumes in this set will become the most cited in the area of electron transfer.

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Essays in Contemporary Chemistry: from Molecular Structure toward Biology. Edited by Gerhard Quinkert (Johann Wolfgang Goethe-Universität, Frankfurt am Main, Germany) and M. Volkan Kisakürek (Verlag Helvetica Chimica Acta, Zurich, Switzerland). Verlag Helvetica Chimica Acta: Zurich and Wiley-VCH: Weinheim. 2001. xvi + 456 pp. $115.00. ISBN 3-906390-28-4.

This volume is designed as a tribute to the contributions of Albert Eschenmoser in the field of organic synthesis. The interesting stories of the synthesis of vitamin B-12 and the cooperation of the Woodward and Eschenmoser groups are only briefly summarized in the preface, which also touches on Eschenmoser's interest in the evolution of biological molecules. The book itself outlines a number of research areas in chemistry that can be solved "with the aid of chemical synthesis", and the editors acknowledge that "the choice of the problems and the style of their solutions ... are individual matters ... to be accredited to particular protagonists." Consequently, the 11 essays are essentially unconnected and of varying style and purpose.

A number of the essays describe spectroscopic and structural techniques that are essential for chemical synthesis. These include crystallography, NMR, and EPR techniques. In Dunitz's autobiographical tale of progress in crystallography over the 20th century, one is reminded of the incredible advances that have occurred during this time. It also suggests that we should not be surprised if the rate of progress continues unabated. In an article on NMR spectroscopy, a detailed review of the capabilities of NMR and its applications to biomolecules is presented. Clearly, the field is moving so fast that some of the information with respect to detection limits (as a result of the use of cryoprobes) and size of complexes that can be examined (using TROSY) is already outdated; however, the article does survey many relevant experimental strategies using a number of descriptive figures and schemes. Femtochemistry is also represented in an article coauthored by Zewail, although this contribution does not travel anywhere near biology or synthesis. This highlights one of the overall problems of the book: it is not tied together by the coherent themes that might be suggested by the title or by the life of Eschenmoser.

Other articles, particularly those coauthored by Dervan and by Schultz, seem to take on the challenge more directly of exploring the role of synthesis in service to the understanding of biology. In his contribution, Dervan also tries to connect to Eschenmoser's interest in the origins of life with a short paper on the targeting of the DNA minor groove by polyimides. In this essay, the author declines to "review that 25 year expedition" that was originated by the solution to the double-helix. However, this reader was left unsatisfied, and a recount of Dervan's view of the journey would have been welcome. Schultz's paper would be, in a large part, familiar to anyone who has heard him give a seminar over the past few years; the paper is, in fact, based on a previously delivered lecture. The author's prodigious range of interests is illustrated with examples of research in proteins, nucleic acids, and materials science.

The volume ends with a solid but not particularly innovative survey of the implications of the advances in molecular biology for medicine. Perhaps this article is appropriate as the tag line for the book, since Eschenmoser was interested in the origins of life; this contribution presupposes an interest in where it is going. The author tries to draw boundaries beyond which it would not be ethical to go, but the boundaries appear to be defended as much by issues of feasibility as by the consequences of permanent alterations of the germline. Specifically, cloning is presented as such a low probability process (e.g., it took 277 trial embryos to produce Dolly), that "it becomes obvious that such a procedure cannot, by any means, be extended to people". With such spectacular advances in molecular biology as are adequately documented in the book, issues of feasibility might become moot with but a small passage of time. The consequences, therefore, need to be closely examined.

Overall, the book is of moderate interest. It is not a thorough enough history to be compelling from that standpoint, and it is also not particularly comprehensive as a reference work.

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Polymer Crystallization: The Development of Crystalline Order in Thermoplastic Polymers. By Jerold M. Schultz (University of Delaware). Oxford University Press: New York. 2001. x + 288 pp. $195.00. ISBN 08412-3669-0

The importance of polymer crystallization has increased in modern polymer industry, despite the recent decline in research activities. More than 80% of the commodity polymers made today are crystalline, and the subject of crystallization is still the number one issue concerning the performance of semicrystalline polymers. Although many believe the field of polymer crystallization has "matured", new problems and new knowledge continue to emerge, making research and education of this topic ever more challenging.

Even though there are several excellent books available on the subject of polymer crystallization,[1−5] the last one was published about two decades ago, and there has been a dire need for a more updated text. This book certainly provides an

(1) Geil, P. H. *Polymer Single Crystals*; *Polymer Reviews*, Vol. 8; Wiley-Interscience: New York, 1963.
(2) Mandelkern, L. *Crystallization of Polymers*; McGraw-Hill: New York, 1964.
(3) Wunderlich, B. *Macromolecular Physics*; Academic Press: New York, 1973, Vols. I−III.
(4) Tadokoro, H. *Structure of Crystalline Polymers*; Wiley-Interscience: New York, 1979.
(5) Bassett, D. C. *Principles of Polymer Morphology*; Cambridge University Press: Cambridge, U.K., 1981.

excellent overview of past and current developments in the field and is written in a very clear and succinct manner, which makes it easy to understand by readers who have no prior training in the field. It is also a useful resource for more experienced scientists, because it contains a good summary of references.

The book is focused on three major subtopics: (1) structure and development (from solution, melt, multicomponent, and flow states), (2) kinetics, and (3) dynamics (external fields, internal fields, injection molding, and fiber spinning). Particularly noteworthy chapters are those on crystallization from multicomponent systems (Chapter 5), the effects of molecular extension (Chapter 6), and the effects of self-generated fields (Chapter 10). All three topics are contemporary and have recently attracted significant research interest in the community. In these chapters, the author has outlined the principles of physics that underlie the topics, much of which is based on his own distinguished research experiences. No similar articles dealing with these subjects can be found all in one source.

With the author's engineering background, much of the information provided in the text is quantitative. Extensive mathematical equations have been given to describe the kinetics of crystallization, which should be useful for simulation of structure and properties during processing. The subject of self-generated fields (Chapter 10) is well-known in the field of metallurgy, but it is not frequently encountered in polymer science. However, with the advent of thin films and nanofabrication, this subject should gain more ground, because it is well-suited to tackling problems related to the surface and the nanotechnology. The introduction of the effects of molecular extension (Chapter 6) should enable the readers to understand the last two chapters with ease: crystallization during injection molding (Chapter 11) and crystallization during fiber spinning (Chapter 12). These two topics involve orientation of large molecules, leading to extraordinarily fast crystallization rates and unique structure and morphology development, which have been fascinating areas in the community.

The book also contains descriptions of modern experimental techniques for the characterization of polymer crystallization. These techniques were not contained in independent chapters; rather, they were listed in the chapters where the particular techniques were useful. These techniques included electron microscopy (TEM and SEM), scanning probe microscopy (STM and AFM), synchrotron X-ray scattering and diffraction (SAXS and WAXD), optical microscopy, and thermal analysis methods.

The aspects of the science that are missing in the text are related to the most recent developments during the initial stages of polymer crystallization. These developments include the alternative pathway for nucleation due to spinodal decomposition in polymer melt,[6,7] the formation of a mesomorphic precursor prior to crystallization,[8] the formation of a supramolecular network in the initial stages of crystallization,[9] and the effect of molecular weight and relaxation time on orientation-induced crystallization.[10] The author has wisely avoided these subjects, because some of them are controversial and challenge the conventional concept of nucleation and growth mechanisms. These topics will require more experimental and theoretical data to rebut. They are still in their early stages and deserve more time to evolve.

In summary, a good summary of the current state of understanding in the field of polymer crystallization is presented in this book. Two unique strengths are noted: (1) the introduction of crystallization behavior in multicomponent systems, crystallization under external fields, and crystallization-induced internal fields; and (2) the incorporation of detailed mathematical expressions that would be useful for simulation and engineering applications. The book is particularly useful for scientists with little or no prior training in polymer crystallization.

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(6) Imai, M.; Mori, K.; Mizukami, T.; Kaji, K.; Kanya, T. *Polymer* **1992**, *33*, 4451.
(7) Olmsted, P. D.; Poon, W. C. K.; McLeish, T. C. B.; Terrill, N. J.; Ryan, A. J. *Phys. Rev. Lett.* **1998**, *81*, 373.
(8) Strobl, G. *Eur. Phys. J. E* **2000**, *3* (2), 165.
(9) Pogodina, N. V.; Winter, H. H. *Macromolecules* **1998**, *31*, 938.
(10) Somani, R. H.; Hsiao, B. S.; Nogales, A.; Srinivas, S.; Tsou, A. H.; Sics, I.; Balta-Calleja, F. J.; Ezquerra, T. A. *Macromolecules* **2000**, *33* (25), 9385.