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BOOK REVIEWS

Electroanalytical Methods: Guide to Experiments and Applications. Edited by Fritz Scholz (E.-M.-Arndt-Universität Greifswald). Springer-Verlag: Berlin, Heidelberg, New York. 2002. xxii + 332 pp. $69.95. ISBN 3-540-42229-3.

The recent emergence of electrochemistry at the forefront of many new areas has created an interest in books on the physicochemical fundamentals and applications of electrochemistry in such hot areas as nanomaterials, polymers, and molecular biology. Specialized books and updated editions of main references in the field have filled some voids, but there is definitely a place for an up-to-date book that focuses on new developments in electrochemical methods and provides examples of new applications.

Electroanalytical Methods: Guide to Experiments and Applications is a multiauthored book that, as stated in the Introduction, aims to address the needs of practitioners. The book has a definite European slant—there are no contributions from the U.S.—and the book is clearly distinguishable from mainstay texts in the area that were conceived in the U.S., such as *Electrochemical Methods: Fundamentals and Applications* by Bard and Faulkner and *Laboratory Techniques in Electroanalytical Chemistry* edited by Kissinger and Heineman.

Electroanalytical Methods is divided into four parts: (1) "Basic Electrochemistry", which is an overview of theory; (2) "Electroanalytical Techniques"; (3) "Electrodes and Electrolytes"; and (4) "Publications in Electrochemistry". Of the total 18 chapters, 8 are dedicated to methods. All chapters in Parts 1−3 cover some theory; however, examples of applications are sparse and are mostly from the authors' laboratories.

The most comprehensive chapters are "The Electrical Double Layer and Its Structure" by Stojek in Part 1 and "Cyclic Voltammetry" by Marken, Neudeck, and Bond in Part 2. The first chapter suffers some from brevity, whereas the second is guilty of the opposite—in an apparent attempt to be comprehensive and all-inclusive, some focus was lost, and the chapter is plagued with errors and symbols that are difficult to follow. Retter and Lohse's chapter, "Electrochemical Impedance Spectroscopy", in Part 2 is timely, and Stojek's "Pulse Voltammetry" is succinct and clear, although the emphasis on applications of less common techniques is a distraction.

The scope of coverage of methods in Part 2 varies significantly between chapters. Some chapters, such as "UV/Vis/NIR Spectroelectrochemistry" by Neudeck, Marken, and Compton are general reviews, whereas others, such as "Electrochemical Studies of Solid Compounds and Materials" by Fiedler and Scholz and "Potentiometry" by Kahlert do not aim to be comprehensive updates. The multiauthored Part 3, "Working Electrodes", "Reference Electrodes", "Electrolytes", and "Experimental Setup", features a series of short summaries. Part 4, "Publications in Electrochemistry", reviews many standards.

The main drawbacks of the book, which are significant, are the nonuniform, nonstandard uses of terms and symbols, which frequently are not those that are accepted and in use in major publications and books in the field, and the many errors in the text, which have not been addressed in the attached Errata. The list of abbreviations and terms uses multiple symbols for the same quantity and is not comprehensive. There are also major repetitions in the text. Two of the three chapters in Part 1 on thermodynamics and kinetics of electrochemical reactions cover the same territory covered in other chapters in Parts 2 and 3.

After a re-editing of errors and standardization of terms and symbols, the book may be of use to those who are interested in short monographs in the fields of research being pursued by the authors.

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JA025275O

10.1021/ja025275o

Scale-Up and Optimization in Preparative Chromatography: Principles and Biopharmaceutical Applications. Chromatographic Science Series, Volume 88. Edited by Anurag S. Rathore (Pharmacia Corporation, Chesterfield, MO) and Ajoy Velayudhan (Oregon State University). Marcel Dekker, Inc.: New York, Basel. 2002. xvi + 342 pp. $150.00. ISBN 0-8247-0826-1.

Preparative chromatography plays a key role in specialty chemical separations and continues to grow in importance in bioprocessing. This book addresses critical issues in the scale-up and optimization of chromatography as a unit operation emphasizing design tools and applications in bio/pharmaceutical manufacturing. The book has two main sections: "Methods and Approaches" and "Case Studies". The first six chapters provide a brief overview of scale-up issues, an analysis of the interplay of momentum and mass transfer in chromatography columns, a discussion of the optimization of productivity and recovery yield of different modes of operation based on numerical methods, a methodology for the scale-up of gradient elution chromatography, and a heuristics-based approach for the design and operation of simulated moving bed (SMB) systems. The remaining chapters provide accounts of industrial scale-up experiences and include timely examples of the separation of recombinant antibody fragments, plasmid DNA, monoclonal IgG, as well as small-molecule pharmaceutical intermediates.

Rather than providing a handbook-style treatment, this book seems designed to make the reader *think* about scale-up issues. This is achieved quite well in Chapter 2, which deals with the interaction of mass transfer and fluid mechanics, and in Chapter 5, which provides a useful intuitive understanding of SMB design and operation. Useful simplified scale-up criteria (valid when intraparticle diffusion is controlling) are presented in Chapter 1, and applications of some of these criteria are illustrated in several of the "case-study" chapters. Unfortunately, these chapters do not provide examples of the application of the more sophisticated approaches introduced in the first section

10.1021/ja025275o CCC: $25.00

of the book. Perhaps this demonstrates the difficulties in implementing these tools within the constraints of cGMP manufacturing and the very fast-paced development needs of the pharmaceutical industry.

Overall, this book provides useful coverage of a selection of topics in preparative chromatography, emphasizing the understanding of the underlying phenomena and designs guided by an appropriate combination of simplified theories and experience. It is likely to be most useful to industrial practitioners who are familiar with chromatography as an analytical and process development tool and who want to develop an appreciation for scale-up issues. In addition to providing a starting point for several important separation problems, the case-study chapters also address many of the practical issues encountered in the implementation of chromatography in a manufacturing setting. Readers seeking more in-depth analyses can consult the extensive reference lists accompanying each chapter.

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JA025322C

10.1021/ja025322c

Group 13 Chemistry I: Fundamental New Developments. Structure & Bonding, Volume 103. Edited by Herbert W. Roesky (University of Gőttingen, Germany) and David A. Atwood (University of Kentucky, Lexington). Springer-Verlag: Berlin, Heidelberg, New York. 2002. x + 172 pp. $129.00. ISBN 3-540-43615-4.

This volume is the first of a three-part series focusing on fundamental, biological, and applied aspects of the group 13 elements. Although it contains only four chapters, this book nicely illustrates recent developments in this area.

The first chapter, written by Hopfl, covers the synthesis of boron compounds with macrocycles and cagelike structures. Applications of boron-containing hosts in ionic and molecular recognition are also discussed. The author is especially successful in describing the similarities of the boron compounds with organic, coordination, and organometallic analogues, making this chapter of interest to a broad range of chemists.

The second chapter, which focuses on multiple bonding between heavier group 13 elements, was written by Power, the leading expert of this field. Considering that the first authentic reports on compounds featuring a group 13−group 13 multiple bond were not published until 1993, this chapter has a description of some very recent developments, some of which are currently the subject of controversy. It ends with a section entitled "Future Work", which in fact summarizes results that appeared in the last few months!

Chapter three by Mahalakshmi and Stalke is entitled "The R_2M^+ Group 13 Organometallic Fragment Chelated by P-Centered Ligands". Here the authors argue that group 13 organometallics, which are currently considered only as cocatalysts, might become outstanding catalysts on their own if the right ligands can be designed. This is one of the very rare reviews available concerning cationic group 13 derivatives.

The last chapter by Schulz outlines the unique nature of the combination of group 13 and 15 heavier main group element chemistry. In view of the importance of group 13−15 element compounds in semiconducting materials, this chapter might be of interest not only to inorganic chemists but also to material scientists as well.

Overall, the book is well written, and the editors have done an excellent job in selecting the topics and authors. It gives a good account of the current and future importance of main group chemistry, which appears to be at the intersection of many subdisciplines in chemistry.

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JA025331L

10.1021/ja025331l

Handbook of Radical Polymerization. Edited by Krzysztof Matyjaszewski (Carnegie Mellon University) and Thomas P. Davis (University of New South Wales). John Wiley & Sons, Inc.: Hoboken. 2002. xvi + 920 pp. $200.00. ISBN 0-471-39274-X.

The field of free radical polymerization has undergone a renaissance in the past 12 years, making this compendium on the topic timely and extremely valuable. The editors have solicited chapters from experts in the field, covering a wide range of important topics in a scholarly fashion. This book is appropriate for an audience ranging from advanced beginners to experts in the field. It does an excellent job of referencing the primary literature and should serve as a valuable resource in the form of a readable compilation as well as a source of important references through 2001.

Chapter 1 focuses on the theory of radical reactions, including transition-state theory and computational quantum chemistry. The next chapter is a masterfully written overview of small-molecule free-radical chemistry including basic reactivity, fundamental principles, common synthetic methods, and kinetics. This is followed by a chapter in which the general aspects of radical polymerization, including initiation, propagation, chain transfer, inhibition, and termination, are discussed. This is the one chapter that is difficult to follow in parts because the authors tend to discuss specifics without using enough accompanying figures. Chapter 4 is a clearly written treatment of the kinetics of free-radical polymerization, including the rates of initiation, propagation, and termination, and covers experimental methods for determining these values. The kinetics of copolymerization are the subject of the next chapter. Chapter 6 on heterogeneous systems starts with a clear descriptive introduction on suspension, emulsion, dispersion, and precipitation polymerization, which is followed by a more technical treatment, and ends with a discussion of living radical polymerization in dispersed media. The discussion in Chapter 7 on industrial applications and processes focuses on issues of process scale-up.

The next five chapters are directed toward controlled or living free-radical polymerization (LFRP). The first of these covers the general principles and evaluates the advantages and limitations of living versus conventional radical polymerization. A historical perspective is provided, as well as suggested areas for future developments. The next chapter is a description of the kinetics of various types of living polymerization processes, particularly with regard to the reversible activation of the transient polymer radical. Chapter 10 offers a discussion of nitroxide-mediated living radical polymerization, including the preparation of block copolymers, and applications in the control

of macromolecular architecture. This is followed by a chapter on atom transfer radical polymerization with regard to the catalyst, ligands, initiators, and mechanism and demonstrates the versatility of the method in preparing designed materials. Chapter 12 covers chain-transfer methods and includes a discussion of traditional chain-transfer agents, catalytic chain transfer, and degenerative chain processes, such as reversible addition-fragmentation transfer and iodide and aryltelluride chain-transfer methods.

The last few chapters deal with issues common to all of the previously discussed methodologies. Control of stereochemistry, starting with a review of stereocontrol in small molecule radical reactions, and then turning to the control of both tacticity (relative diastereoselectivity) and absolute stereochemistry in polymerizations are the focus of Chapter 13. Included in this discussion is the effect on structure for polymerizations carried out in heterogeneous preorganized environments and in the solid state. Chapter 14 is a description of the state-of-the-art in macromolecular engineering using LFRP, including end-functionalization, and the preparation of block copolymers, graft, star, hyperbranched, and dendritic polymers. The following chapter is unusual, in that it provides "this is how you do it" details on a variety of selected radical polymerization procedures including bulk, solution, emulsion, and suspension polymerization, as well as representative examples of the major LFRP processes. It offers simple basic pointers, such as how one removes inhibitors from commercially available monomers—information that is common knowledge to experienced practitioners, but not obvious to the inexperienced. Finally, Chapter 16 on future outlook and perspectives gives a thoughtful summary of the state-of-the-art and predicts where the important improvements and advances in the field are likely to occur.

In total, this is a very diverse, yet cohesive, collection of chapters on a rapidly developing field that has both practical and academic importance, from commercial applications in the preparation of advanced materials to biotechnology and nanotechnology. Each chapter is very specialized, and although individual chapters are authored by different people, overlap is minimal, and the chapters are of consistently high quality. The only disappointment is the absence of a compendium of raw data, such as abbreviations and physical properties (e.g., propagation rate coefficients) for commonly used monomers, which could have been included in tabular form as an appendix. This would have truly made this a "handbook" of radical polymerization. Nonetheless, this is an excellent resource for understanding the advances made in the scope and control of radical polymerization in recent years.

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JA0253078

10.1021/ja0253078

Surfactants and Polymers in Drug Delivery. Drugs and the Pharmaceutical Sciences. Volume 122. By Martin Malmsten (Royal Institute of Technology, Stockholm, Sweden). Marcel Dekker, Inc.: New York, Basel. 2002. x + 348 pp. $165.00. ISBN 0-8247-0804-0.

This volume provides both an excellent introduction to the field of structured delivery systems and a comprehensive review of current research in a variety of specific areas. Overall, the text is well organized and quite readable, with lucid explanations that presume no prior knowledge of surfactant or polymer physical chemistry, drug delivery, or biochemistry. Thus, this work is accessible to a broad audience and represents a much-needed bridge between scientists in the fields of complex fluids and polymeric materials and those in biochemistry and the pharmaceutical sciences.

A range of relevant topics is covered in the book, including block-copolymer gels, microemulsions, vesicular phases, hydrogels, and nanoparticles. Of particular note is the section on production and processing of delivery systems, an important engineering challenge that is often overlooked in reviews of research in drug delivery. One significant omission is a discussion of adverse health effects (e.g., anaphylatic shock) noted in some clinical trials of emulsions and particles stabilized by PEO−PPO copolymers following parenteral administration and the subsequent withdrawal of certain formulations from the market due to these concerns. Nevertheless, the author has done a commendable job of covering the vast literature on drug delivery and giving context to new results. The text is well referenced, with citations that include works published in 2000 and 2001. In summary, this volume is highly recommended to those who wish to increase their knowledge of drug delivery systems. The work is clearly written and fulfills an important need in the scientific community.

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JA025301I

10.1021/ja025301i