Book Reviews

Chemometrics in Environmental Analysis. By J. W. Einax, H. W. Zwanziger, and S. Geiss. VCH Publishing: Weinheim, Federal Republic of Germany. 1997. 384 pp. ISBN 3-527-28772-8.

The term chemometrics refers to the application of statistics and mathematical methods in the chemical and related sciences. This book describes the use of chemometrics in the study of environmental problems. It is divided into Parts A and B. Part A is an overview of statistical and chemometric methods (246 pages). Part B contains specific environmental applications (120 pages).

Part A reviews fundamental topics such as basic statistics, experimental design, sampling design, multivariate data analysis, time series analysis, etc. The description is comprehensive, and each chapter is followed by a list of up to date references, but the section reviewing chemometric software is rather brief. It should also be pointed out that there already exist several books on chemometrics, which are somewhat similar.

Part B provides some examples and case studies of environmental problems. This section has been divided into chapters on air, water, and soil contamination studies. A separate chapter covers miscellaneous problems. The treatment is not a comprehensive approach to the environmental problems, but sketchy applications of chemometrics. Few topics such as factor analysis, cluster analysis, etc. have been repeated again and again. Most of the analyses presented here are qualitative rather than quantitative. Many statistical techniques that are routinely used in environmental studies have not been covered. Concepts of source apportionment, quality control, and environmental models of different types, which also fall under the broad umbrella of chemometrics, have been left out. The majority of the examples are for metals; there are very few for volatile/semivolatile organic compounds or other pollutants.

On the whole, this book does not venture outside of the traditional chemometrics domain to offer a fresh approach to studying environmental problems. However, it provides a good review of select chemometric topics and can serve as a useful reference book.

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Organic Photochemistry. Series: Molecular and Supramolecular Photochemistry, Vol. 1. Edited by V. Ramamurthy (Tulane University) and Kirk S. Schanze (University of Florida). Marcel Dekker: New York. 1997. X + 593 pp. $195.00. ISBN 0-8247012-0

This book is the first volume in a new series that replaces the very successful 11 volume series from the same publishers entitled *Organic Photochemistry* and edited initially by Orville Chapman and later by Albert Padwa. V. Ramamurthy and Kirk Schanze are fine choices to edit the new series, capable of assessing all fields of photochemistry and inviting appropriate contributions to continue the success of the original series. Ramamurthy and Schanze have chosen to title the new series *Molecular and Supramolecular Photochemistry* to emphasize the multidisciplinary nature and expanded emphasis of photochemical research. This first volume is subtitled *Organic Photochemistry* to further categorize the coverage.

A word of caution: Anyone expecting a volume focused on summarizing the recent advances in the area of supramolecular photochemistry, as the title of the new series suggests, will be disappointed. Only five of the eleven chapters can loosely be labeled as supramolecular photochemistry. Except for one chapter, topics covering recent advances in the areas of organic photochemistry in organized assemblies, host−guest chemistry or in biological environments are not represented in this first volume. For the most part, the coverage of the book is similar to the original series. This is not necessarily a criticism. Volume 1 of the new series continues in the fine tradition of the original series, providing concise, well referenced, self-contained, in-depth critical surveys of areas of photochemistry by authors actively involved in the area. A key difference in this new series that adds to its value compared to the original series is that the editors have more than doubled the number of contributions in a single volume. Volume 1 contains twelve chapters that vary in length from 26 to 76 pages and total 593 pages; the style of each chapter is of high quality as are figures and schemes. For the most part the references in each chapter are up-to-date (to mid-1996) and include references to other recent reviews of similar topics when applicable.

The book contains a number of chapters devoted to what can be considered more "traditional" photochemistry—the spectroscopy and light initiated chemistry of interesting organic chromophores—of functional groups that have not been reviewed extensively in the past. These include chapters on the photochemistry of sulfoxides, ketosulfoxides, and sulfenic esters (W. S. Jenks, D. D. Gregory, Y. Guo, W. Lee, and T. Tetzlaff), sulfur containing unsaturated carbonyl heterocycles (P. Margaretha), pyrazoles and isothiazoles (J. W. Pavlik), and conjugated polyalkynes (S. C. Shim). In addition, a chapter on the photochemical generation, photophysics, and photochemistry of "reactive" carbocation intermediates (M. K. Boyd) studied largely using time-resolved methods and steady-state fluorescence techniques is included. It complements reviews in the original series on the photochemistry of more "stable" carbonium ions and other reactive intermediates.

Three chapters on areas of photochemistry of synthetic potential to organic chemists are also included. The use of the [2+2] photocycloaddition reaction in regiochemical and stereochemical controlled synthesis (S. A. Fleming, C. L. Bradford, and J. J. Gao) is outlined in a very thorough chapter covering one of the most synthetically important photochemical reactions. Advantages of the use of semiconductor particles, especially TiO_2, for photoinduced electron transfer (PET) initiated organic functional group redox transformations are covered in a chapter by Y. Li. G. Pandey authors an extensive chapter illustrating selective examples on the growing use of photoinduced (PET) redox reactions in organic synthesis that is largely an account.

As mentioned above, the coverage of areas pertaining to supramolecular photochemistry is limited. The exception is a chapter entitled Use of Photophysical Probes to Study Dynamic Process in Supramolecular Structures (M. H. Kleinman and C. Bohne) that covers the use of singlet and triplet excited state probes to study the dynamics in supramolecular structures, including micelles, bile salt aggregates and cyclodextrins, and a shorter section on proteins and DNA. Other reactive intermediates as probes are only mentioned briefly. A chapter on the physics and chemistry of the fullurene photoexcited state (Ya-Ping Sun) provides a reasonable, but necessarily limited overview of the vast amount of work being done on the photochemistry and photophysics of these fascinating materials. Finally there is a pair of chapters (one by S. Das, K. G. Thomas, and M. V. George and the other by Kock-Yee Law) that summarize the state of knowledge of the photophysics, photochemistry and spectroscopy of squaraine dyes in both homogeneous and heterogeneous media.

The usefulness of this volume in a private collection is limited, but I recommend it as a useful resource in any institutional library collection. I cannot count the number of times I have used our library's collection of *Organic Photochemistry* as a lead source to an area of photochemistry; I predict my group and I will use this new series as often. Photochemistry remains an exciting and relevant multidisciplinary field of research; topical reviews in this new series will continue to highlight its importance. I look forward to future volumes.

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High-Pressure Techniques in Chemistry and Physics: A Practical Approach.. Edited by Wilfried B. Holzapfel (University of Paderborn) and Neil S. Isaacs (University of Reading). Oxford University Press: New York. 1997. vii + 388 pp. ISBN 0-19-855811-2.

High-pressure techniques have been applied with increasing frequency in chemical and biochemical/biophysical studies in recent years,

for example, to probe the validity of proposed reaction mechanisms and to elucidate the factors which stabilize conformations of macromolecules. The experimental approaches required for such studies are unfamiliar to most workers not directly involved in this field, and it is the objective of this volume to attempt to provide a practical introduction.

The book begins with a fairly extensive description of methods of pressure generation, including a substantial section on diamond anvil cells, the most widely used type of cell for pressures above 1 GPa (10 kbar). A short chapter then outlines methods of pressure determination; a useful feature of this chapter is the inclusion of several luminescence pressure sensors which complement the well-known ruby fluorescence scale. A survey chapter then describes briefly, in turn, the procedures for various types of physical measurements, e.g., electrical properties, X-ray diffraction, neutron scattering, and optical measurements.

The remaining five chapters of the book, which constitute the bulk of the volume, cover topics which should be of interest and importance to chemists; despite its title, the overall focus of this book is on chemical or molecular problems, rather than topics of physical or geophysical interest. For example, a section by Buback and Hinton nicely describes approaches for kinetic studies of reactions at high pressure and high temperature, using vibrational spectroscopy to monitor concentrations. Equipment for high-pressure NMR is described in a section by Helm, Merbach, and Powell, and in a chapter by Price and Ludemann, which focuses on measurements of self-diffusion and relaxation times in liquids. A chapter by Magde and van Eldik presents in cogent terms the general considerations for pressure studies of reaction thermodynamics and kinetics, showing designs for pressure generating equipment and sample cells, and discussing the implementation of several spectroscopic, electrochemical, and other techniques to measure species concentrations, along with guidelines for the interpretation of data. A section by Isaacs very nicely describes the application of high pressure to organic synthesis, giving useful schematics for equipment and presenting many examples of reactions and reaction types whose rates are affected by pressure, along with typical values for the volumes of activation. A final chapter by Masson describes application of high pressure to electrophoresis of proteins and the interpretation of effects on, for example, protein conformation and oligomeric equilibria.

A helpful feature of the book is that these applications chapters are largely independent of each other, so that one may pick and choose. Some additional detail on pressure generation or measurement from the introductory chapters is helpful in some cases.

The chapters are generally well written, and give enough background and basic theory so that the general reader will know why high-pressure studies are useful in a particular area, and what can be learned. It is to be realized that these chapters are not reviews of results of pressure studies; nevertheless, most chapters present some typical and recent results of interest, and citations to several review articles are included. The most recent references in the volume are from 1995, with just a few from 1996. In some cases, unpublished recent designs from the authors' laboratories are presented. The major emphasis of the volume is the "practical approach", so there are extensive drawings or schematics of equipment, with accompanying specifications. A unique feature is the "protocols", which give, in some cases, fairly detailed, step-by-step procedures for, e.g., preparation of gaskets for diamond anvil cells, loading a high-pressure cell with a sample, and carrying out particular types of measurements under pressure. A list of commercial suppliers (most of them European, reflecting the authorship of the chapters) is given at the end of the book, along with an appendix focusing on safety aspects.

Does the book accomplish its objective? It can certainly be said that this volume does introduce the reader to a wide range of equipment and procedures for high-pressure work, along with examples of the types of information which can be gleaned from these studies. If one desires a more extensive discussion of results in particular area, one can consult the several reviews cited in the chapters. Despite the fact that the book is intended to highlight the practical aspects, I think it is unlikely that a novice would be able to design, construct and use most of the equipment presented here without first receiving some advice and help from a group working in the relevant area. The book is not a stand-alone manual for the conduct of high-pressure experiments; it is, however, a useful and up-to-date introduction to the practice of high-pressure research.

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Ionomers: Synthesis, Structure, Properties and Applications. Edited by M. R. Tant (Eastman Chemical Company), K. A. Mauritz (University of Southern Mississippi), and G. L. Wilkes (Virginia Polytechnic Institute & State University). Chapman & Hall: New York. 1997. xiv + 514 pp. $144.95. ISBN 0-7514-0392-X.

Ionomers are a subclass of ion-containing polymers that typically contain less than 15−20 mol % of ionically functionalized units and possess physical and/or morphological properties that are dominated by specific electrostatic interactions. Over the last 30 years, the emerging field of ionomer science has generated a wealth of experimental and theoretical information on a wide range of ionomeric systems with varied composition, molecular architecture, and morphology. Moreover, due to the current advancements in synthetic and analytical capabilities, the international interest in these complex materials has grown steadily in academic and industrial arenas since the last comprehensive treatment of the field of ionomers by Eisenberg and King (*Ion-Containing Polymers*), published in 1977. As such, the extensive overview provided by this text serves as a timely update in truly defining the current state-of-the-art in the field of ionomers.

In contrast to other field specific surveys containing a collection of edited chapters covering only the specific research efforts of a limited number of contributors, the editors of this book have taken a refreshing and exceptionally valuable approach of organizing a group of expert scientists with the charge of compiling comprehensive overview chapters encompassing all major areas of interest in the field. The text is logically organized in a fashion that follows a typical systematic research protocol of synthesis and structural characterization (Part One), followed by structure and property analysis (Part Two), which leads to applications (Part Three). Chapter 1 covers the synthesis methods and molecular structure characterization of many anionomers, cationomers, and zwitterionomers. The development of classical random ionomers is compared to the tailored ionomers having controlled molecular architecture for model studies. Chapter 2 focuses on probing morphology by a wide array of spectroscopic techniques, X-ray and neutron scattering, and TEM methods. The state-of-the-art information in this chapter provides a fundamental basis for the morphological theories in Part Two of the text.

Chapter 3 is a detailed survey of the numerous morphological models and theories that have been developed in the field. Particular attention has been paid to important comparisons and contrasts between the various treatments with respect to current experimental and theoretical information in the literature. Chapters 4 and 5 provide an in-depth review of the solution and melt rheology properties of ionomers. These chapters detail the influence of complex electrostatic interactions, as they impact rheology, morphology, and ultimate processing of ion-containing polymers. A valuable comparison of the structure and properties of the general classes of hydrocarbon-based and perfluorinated ionomers is offered in Chapters 6 and 7.

Part three involves the wide range of ionomer applications stemming from the unique chemical and morphological structures outlined in the preceding chapters. The carefully described applications include membranes, packaging, blend compatibilization, urethane-based dispersions and coatings, and elastomers.

In summary, this text offers an excellent survey of the technologically important research and applications of ionomers. With the detailed descriptions of past and present research and development, coupled with the extensive referencing at the ends of each chapter, this text will certainly serve as a principal resource to students, faculty, industrialists, and other scientists and engineers with interests in the realm of ionomers.

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