Book Reviews

Optical Properties of Polymers. Edited by G. H. Meeten (City of London Polytechnic). Elsevier Science Publishers: New York. 1986. x + 398 pp. $89.25. ISBN 0-85334-434-5.

The light-weight, low cost, durability, and easy fabrication of polymers have led to their increased use in optical applications. Additionally, much about polymer structure can be inferred from their optical properties, yet scientists whose job it is to design or characterize polymeric materials frequently have little knowledge of optical properties and methods. Even for the physically inclined scientist familiar with optical properties in general, the special situations posed by polymers—crystallites, natural and induced birefringence and how they may couple to structure and rheology, scattering and turbidity in solution, and qualitative appearance—are often unfamiliar. This book will serve as a valuable resource and guide, both to polymer chemists and physicists who use optical properties to analyze polymers in solutions, melts, or solids, and to engineers who may wish to design polymeric preparations for certain optical characteristics.

The lead-off chapter, "Refraction and Extinction of Polymers", by G. H. Meeten, discusses the origins and measurement of optical refractive and absorbance properties of polymeric solids: glasses, crystalline materials, and rubbery solids. It recalls a number of basic optical theorems and measurement techniques and describes how they are applied to polymers. Covered are interferometric, beam deviation, critical angle, reflectometric, ellipsometric, index matching, and transmission methods. One might wish that the straightforward text were punctuated more frequently with helpful diagrams and practical examples; in 62 pages, there are but 8 figures. However, the 136 references should prove helpful. Chapter two, "Double Refraction in Polymers: Measurement and Interpretation", by G. F. Harding, contains useful information on the birefringence of polymers, excluding solutions. The basic experiment of placing the doubly refractive polymer between crossed polars is described, followed by the author's expert observations on various instrumental details, which will probably be more appreciated by scientists already involved in birefringence methods than by beginners, who doubtless could still make good use of the 20 references and 13 figures in this 32-page chapter. Chapter 3, "Rheo-optical Properties of Polymer Solutions", by D. Dupuis, Y. Layec, and C. Wolff, discusses such subjects as flow-induced birefringence, including principles and theory, concluding with illustrative results from the literature. Also included are interesting sections on static and dynamic light scattering as rheo-optical tools for solutions. More than Chapters 1 and 2, Chapter 3 can stand alone on the strength of its presentation and the good use of its 25 figures, but 195 references are cited for the ambitious. J. M. Haudin's Chapter 4, "Optical Studies of Polymer Morphology", summarizes in 98 pages with 137 references what may be learned by interpreting crossed polars images (of spherulites, for example) and by applying small angle light scattering (SALS) methods. Explained are such important procedures as determining the sign of a spherulite, and how to characterize morphology via SALS patterns. Over the years, SALS patterns have been worked out for spherulites, rods, discs, and various suprastructural assemblies of these basic shapes. This chapter compiles the results, making excellent use of 50 figures, including many SALS patterns. This reviewer is not aware of any similarly comprehensive single source for the SALS technique. "Transluscency, Transparency and Gloss" is the title of the practical fifth chapter by F. M. Wilmouth, which explains the origins of haziness and clarity in polymeric fabrications and defines optical parameters used to quantify appearance phenomena. A continuous monitoring technique is given, followed by a description of a model relating appearance to morphology. Also included is a section on using optical transfer methods, so powerful in analyzing conventional optical elements such as lenses, for characterizing polymer film transparency. This penultimate chapter cites 125 references and uses 27 figures in its 69 pages. The final installment is a 58-page chapter entitled "Polymer Latex Optics" by G. H. Meeten, which concerns static and dynamic light scattering by latex suspensions, both dilute and concentrated. Thirteen figures and 108 references guide the reader through issues germane to latex sphere problems, such as multiple scattering and Mie theory. Much of the information is applicable to other colloids, not just latex spheres.

In summary, this book is a convenient compilation of the classical optical behavior of diverse polymeric systems. It would probably not make a good text, except possibly as a point of reference in a graduate-level special topics course. Most chapters are not suitable for beginners, but even the raw neophyte should come away with some useful information for each chapter and, in most of the chapters, there is an extensive bibliography. Certain important subjects are ignored, such as nonlinear optical properties or the behavior of liquid crystals, but these are treated well elsewhere. This book fills a need for a convenient description and compilation of classical optical methods applied to macromolecules. It is recommended to all who characterize or design polymers, especially as the sort of book one pulls off the shelf frequently to check some forgotten (or never-learned) detail, or as a checkpoint prior to initiating a new optical research endeavor.

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Sample Pretreatment and Separation. By Richard Anderson (Wolverhampton Polytechnic). John Wiley & Sons: New York. 1987. xxxv + 632 pp. $37.95. ISBN 0471-91361-8.

This excellent book is one of the *Analytical Chemistry by Open Learning* (ACOL) series of texts, which are the result of an initiative by the Committee of Heads of Polytechnic Chemistry Departments in the United Kingdom. The 29 texts in the series (which range from *Samples and Standards* to *Microprocessor Applications*) are "for those interested in the basics of analytical chemistry and instrumental techniques who wish to study in a more flexible way than traditional institute attendance or to augment such attendance. It is emphasized however that whilst the theoretical aspects of analytical chemistry can be studied in this way, there is no substitute for the laboratory to learn the associated practical skills".

This text deals with the ways raw samples received for analysis are converted into a form for making useful measurements. Its basic structure is as follows. Part 1 reviews the major stages of analysis and the position of pretreatment and separation in the overall analysis. Part 2 is concerned with a general survey of a number of preliminary sample pretreatments which might precede other processes. Parts 3 and 4 deal with methods for dissolution and opening-out of samples. Parts 5 and 6 study ways in which the analyte can be converted into a different chemical form, either to make determination possible or more efficient or to aid its separation, preconcentration, or further pretreatment. Part 7 introduces the topics of separation and preconcentration and then briefly reviews a wide selection of separation and preconcentration techniques. Parts 8 to 10 consider in more detail a number of the more important separation techniques. The most widely used group of separation processes, namely chromatography and electrophoresis, although touched upon from time to time, is not formally covered; this subject is so broad that five individual ACOL texts are devoted entirely to it.

In any book on open learning it is important to develop a rapport with the reader, and this is certainly achieved in *Sample Pretreatment and Separation*. Self-assessment questions are introduced at appropriate places with the author's response to each given at the end of the text; at intervals there is a list of objectives based on material just read to provide a checklist of tasks the reader should then be able to achieve. Chapter headings are as follows: (1) Introduction (pp 1–8); (2) Preliminary Sample Pretreatment (pp 9–28); (3) Decomposition and Dissolution of Inorganic Solids (pp 29–80); (4) Decomposition of Organic and Biological Matrices for Elemental Analyses (pp 81–124); (5) Organic Derivatives in Analysis (pp 125–145); (6) Metal Complex Formation in Analysis (pp 146–174); (7) Introduction to Separation and Preconcentration Techniques (pp 175–214); (8) Solvent Extraction (pp 215–311); (9) Ion Exchange (pp 312–387); (10) Other Separation Techniques (pp 388–433). Conclusions (pp 434–435), Questions and Responses (pp 436–627), and Units of Measurement (pp 628–632) complete the text.

If other texts in the ACOL series are as good as this one, then library copies, at least, should be available to *all* students and practitioners of analytical chemistry.

D. E. Ryan, *Dalhousie University*

A Handbook of Nuclear Magnetic Resonance. By Ray Freeman (Oxford University). Longmans; Harlow, UK. John Wiley & Sons: New York. 1987. xiii + 312 pp. $49.95. ISBN 0470-20812-0.

For the nonspecialist, a readily accessible state-of-the-art spectrometer, bristling with capabilities and user-friendly, can be both exciting in its promise and daunting in its complexity. Instruction manuals and even monographs oftentimes seem written largely for engineers, physicists, and the incorrigibly mathematical. As a result, many NMR users (as opposed to practitioners) do their thinking about FT NMR with a CW

mindset, picking their way through the alphabet jungle of acronyms with little appreciation of what the physical processes are and how they work—rather like a tourist who does not speak the language, who finds his way around by matching the markings on street signs and pointing to an address he has been given at the train station.

Ray Freeman's book is a practical and deceptively simple attempt to provide the other-than-casual user with an accurate understanding of the physical basis of modern NMR. He is, on the whole, successful. The arrangement of the book is unusual—59 concise (typically, 5 pages), single-topic entries, alphabetically arranged, liberally illustrated, and extensively cross-indexed, on a diverse range of topics divided about evenly among basic theory (e.g., Chemical Exchange, Free Induction Decay, Rotating Frame, Spin-lattice Relaxation), electronics (Field/frequency Regulation, Modulation and Lock-in Detection, Quadrature Detection), experimental techniques (Composite pulses, J-spectroscopy, Multiplicity Determination, Solvent Suppression), and data treatment (Digitization, Fourier Transformation, Resolution Enhancement, Zero-Filling). Consistent with his stated goal of avoiding equations whenever possible, Freeman often introduces a topic with some well-chosen verbal analogy, which those of us not routinely accustomed to visualizing the intricacies of spin gymnastics can appreciate. Freeman uses a minimum of equations in conjunction with a maximum of well-constructed diagrams to explain his topics without trivializing them. A reflective reading of this book will convey far more than mere vocabulary. Asterisks in the text denote topics treated in separate entries, while a list of related entries appears at the end of each topic. Literature references are plentiful and very up-to-date, many as recent as 1985 and 1986. The book contains numerous practical observations and hints for the person sitting at the console (which is, appropriately enough, where Freeman suggests the book be kept). As a bonus, there are a number of cartoons which are both humorous and illuminating.

Among the book's few shortcomings are that, while the Bloch equations are mentioned several times in the text and actually appear in the discussion of CW Spectroscopy, the index contains no explicit reference to them. I also found the section on broadband decoupling rather difficult to follow. Finally, the figure on p 68 (Difference Spectroscopy) looks more like the ^{13}C satellites of the aldehyde proton of acetaldehyde than those of the methyl proton.

By and large, I found the book well-written and informative; reading it was rather like having an NMR expert answering questions over a cup of coffee. The arrangement of the book makes it possible to jump in at virtually any point, depending on your interest and/or need, follow the cross-references, and iterate to self-consistency. While the book, with its strong physical orientation, is not easy reading, anyone who wants to rise above the black-box level of NMR use should own a copy.

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Advances in Organometallic Chemistry. Volume 28. Edited by F. G. A. Stone (The University of Bristol) and R. West (The University of Wisconsin). Academic Press, Inc.: San Diego. 1988. vi + 471 pp. $95.00. ISBN 0-12-031128-3.

This volume contains a total of seven contributions covering a very broad spectrum of topics of interest for both inorganic and organic chemists. G. L. Geoffroy and S. L. Bassner report the interaction of organometallics with ketenes. Four separate but related aspects are described: (a) the reaction of ketenes with organometallic complexes; (b) the preparation, structures and reactions of stable ketene complexes; (c) the chemistry of ketenyl complexes that have a metal as one of the ketene substituents; (d) the chemistry of ketenylidene complexes in which the ketene carbon has only metals as substituents (83 pages, 179 references). The synthesis, structures and reactivity toward organic molecules of graphite–metal intercalation compounds are presented by R. Csuk, B. I. Glänzer, and A. Fürstner in a 54-page review (280 references). They describe extensively the synthetic applications of graphite intercalation compounds of alkali metals, zinc, zinc–silver, tin, palladium, nickel, magnesium, iron, and titanium and demonstrate that they are promising reagents or catalysts for both inorganic and organic reactions. The role played by certain nucleophile adducts of metal-coordinated carbon monoxide in the stoichiometric and catalytic chemistry is discussed by P. C. Ford and A. Rokicki in a review of 78 pages (313 references). The article focuses on relatively recent developments for systems where oxygen or nitrogen bases have been used as the nucleophiles. R. Uson and J. Fornies describe the preparation and a survey of the reactivity of organopalladium and platinum compounds with pentahalophenyl ligands (78 pages, 140 references). The properties of dihydrogen complexes and complexes containing σ-bonded C–H ligands are reviewed by R. H. Crabtree and D. G. Hamilton (39 pages, 105 references). These complexes are of special interest in connection with the problem of C–H activation. Physical methods for the recognition of agostic interactions are presented. The chemistry of organometallic compounds containing oxygen atoms is described by F. Bottomley and L. Sutin (57 pages, 266 references). The review is restricted to compounds of the transition elements which have a metal–carbon and a metal–oxygen bond, with the same metal being involved in both bonds. Finally, recent developments in NMR spectroscopy of organometallic compounds are presented by B. E. Maun in a 61-page review (73 references). Recent progress in one-dimensional-, two-dimensional-, multinuclear-NMR spectroscopy as well as in magnetization transfer and relaxation measurements and solid-state NMR spectroscopy are described.

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Chemical Bonds Outside Metal Surfaces. By Norman H. March (University of Oxford). Plenum Press: New York and London. 1986. v + 284 pp. $52.50. ISBN 0-306-42059-7.

This book provides the reader with a comfortable way to learn about chemical bonding to metal surfaces, as viewed by a theorist who writes about theory in a lucid and readable manner. The book nicely covers classical areas such as the kinetics of adsorption and desorption and the thermodynamics of adsorption. The bonding of diatomic molecules to metal surfaces is then treated, followed by a treatment of slightly larger molecules. A rather long section on molecular dynamics, featuring neutron inelastic scattering methods, precedes a discussion of desorption induced by thermal and by electronic excitation of adsorbed molecules. The book concludes with a selective look at the kinetic factors in the generally complex area of heterogeneous catalysis. An appendix containing specific details of many kinds of theoretical calculations is included. Finally, a uniquely useful section is included in which "notes added in proof" have been inserted for each chapter.

The book is especially effective in making contact with the experimental literature, and wherever possible it illustrates the comparison between theory and experiment. This is done effectively in several cases by illustration of the experimental data being considered. A total of over 400 key references makes the book a handy tool for workers in many fields involving surface chemistry at metal surfaces.

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