$$\int_0^1 \mathbf{a}(\mathrm{x})\mathbf{b}(\mathrm{x})\,\mathbf{d}\,\mathrm{x} = \lim_{\mathrm{n}\to\infty} \sup\ \psi_{\mathrm{n}}(\mathbf{a},\mathbf{b})$$

$$\sigma_x^2 = \frac{1}{n}\left\{\sum_{i=1}^{n} X_i^2 - n\bar{X}^2\right\}$$

$$A = \begin{bmatrix} \frac{abc}{b+c} & ab & ac \\ ba & \frac{abc}{c+a} & bc \\ ca & cb & \frac{abc}{a+b} \end{bmatrix}$$

$$\sin^{-1}(x) = \int_0^x \frac{dt}{\sqrt{1-t^2}}$$

Figure 1. Examples of MathType equations, reproduced from LaserWriter output from a Microsoft Word document.

of virtually any desired mathematical expression of almost any complexity. Figure 1 contains four such examples, directly reproduced from MathType output, pasted into a Word document and printed using a LaserWriter. Equations may be optimized for either LaserWriter or ImageWriter output.

Other currently available commerical equation editors that are roughly equivalent in function to MathType are Expressionist (List price $79.95) and MacEqn (List price $44.95). Although both are somewhat less expensive than MathType, the latter is significantly more user-friendly and appears to be a superior value, when ease of use and overall versatility is considered.

Features: A minimum of 512 Kb of RAM is required. Although, as with most Macintosh software, it can be run with use of only a floppy disk drive, a hard disk is recommended. This is visually oriented program that can easily be mastered in an hour or two by anyone familiar with operation of a Macintosh computer. The user interface is comprised of a set of symbols (the Symbol Drawer) and a set of templates (the Template Drawer). The first contains approximately 80 special mathematical symbols, including all the commonly used Greek Symbols, which can be placed in equations by clicking on them. Equations are constructed by first selecting from among 60 or so templates, most of which include some symbols (e.g., integrals, fractions, product signs, summations, etc.) and various empty slots, and then filling in the slots with appropriate numbers, variables, and symbols. As the equations are constructed, they are continuously displayed and updated, as they will appear when printed out. A useful "Zoom" function allows display at double size to facilitate work with complex expressions. The program allows automatic assignment of any font installed in the Macintosh system to each of the various functions within equations (i.e., functions, variables, vectors, Greek functions, Greek variables, symbols) in any of five different styles (bold, italic, underline, outline, and shadow). Default choices are easily defined to suit individual user's needs and preferences and equally easily redefined temporarily. Similar flexibility is available in selection of typesizes and equation spacing. Documentation supplied with the program is adequate and well-written and is supplemented with an on-line tutorial, which is included on the disk with the program.

In short, MathType is an easily learned versatile tool that should be invaluable to anyone routinely using a Macintosh for preparation of scientific manuscripts. It is a well-designed high-quality software package and offers sufficient flexibility and ease of use that it should have wide appeal to chemists.

Charles L. Wilkins, *University of California, Riverside*

*Book Reviews**

Chemistry of the Natural Atmosphere. By Peter Warneck (Max-Planck-Institut fur Chemie). Academic Press: San Diego, CA. 1988. xiii + 757 pp. $85.00. ISBN 0-12-735630-4.

The *International Geophysics Series*, of which this is Volume 41, was started nearly 30 years ago and has maintained a high standard ever since. This volume is a comprehensive review of tropospheric and stratospheric atmospheric chemistry up to about 1985. The general tone of this volume is descriptive, with great emphasis placed on presenting observational data. The description of concepts is relatively abbreviated, but useful; enough detail is presented for a student to follow an argument, but the details of derivations are omitted.

The range of subjects covered in this review is extraordinary, but few subjects are covered with great depth, probably due to space limitations. Nonetheless, references to the literature are very extensive and thorough: the bibliography requires more than 80 pages and there appear to be nearly 2000 references.

The book opens with a discussion of the physical properties of the atmosphere and a qualitative discussion of atmospheric circulation. Photochemistry and kinetics are covered in a cursory fashion, but in sufficient detail for a rudimentary understanding of atmospheric reactions. The chemistry of the stratosphere is described in an excellent chapter that includes an historical survey and a very complete review of observational data on ozone and other trace species.

Three chapters are devoted to the complexities of tropospheric chemistry. The first of these chapters describes the fundamental chemical mechanisms and the second concentrates on ozone distribution, budgets, and general behavior. The third chapter is devoted to hydrocarbon oxidation mechanisms, which are very complex and are central to understanding photochemical smog. The chapters on the stratosphere and troposphere are augmented by appendixes that tabulate critically reviewed homogeneous rate constants that were current in 1985 (and are still nearly up to date).

The second half of the book describes several diverse topics, including nitrogen and sulfur chemistry. Other chapters include a detailed discussion of atmospheric aerosols (size distributions, production rates, mechanisms for formation, etc.) and clouds (cloud formation, scavenging of gases, chemical reactions in cloud droplets, etc.). The book concludes with two chapters on carbon dioxide geochemistry and atmospheric evolution. Each of these subjects is covered in some detail, with copious references to current literature.

In summary, the author achieves the two goals he has set for himself: "...to assemble and review observational data...and present concepts for interpretation ... in a manner suitable for classroom use." This collection of observational data is exceptional in extent and it will be an excellent source for atmospheric scientists. Concepts are presented in a manner most suitable for those who are already somewhat familiar with the field, but this volume could also serve as a text if it is supplemented in the classroom with more elementary material.

John R. Barker, *The University of Michigan*

Advances in Catalysis. Volume 35. Edited by D. D. Erley (The University Nottingham), Herman Pines (Northwestern University), and Paul B. Weisz (University of Pennsylvania). Academic Press, Inc.: London and Orlando. 1987. vii + 433 pp. $90.00. ISBN 0-12-007835-X.

This 35th volume of *Advances in Catalysis* continues in its tradition of providing comprehensive and informative reviews on topics of current interest in catalysis. The richness and diversity of research in the field is amply demonstrated by the variety of topics covered in the six chapters, spanning studies of single crystal catalysts, high surface-area supported catalysts, and phase-transfer catalysis.

The importance of structural studies has long been recognized as providing a foundation for understanding mechanistic aspects of catalysis. It seems appropriate then, that the extensive review (536 references) by Jan C. J. Bart and Gilberto Vlaic on extended X-ray absorption fine structure studies in catalysis be chosen as the first chapter of the book. The article is well organized; the introductory portions, which describe the experimental requirements and discuss the theoretical basis for X-ray absorption spectroscopy, are all written so as to be comprehensible to even a novice at EXAFS. The majority of the article deals with, as is advertised by the title, applications of EXAFS to catalysis with emphasis on supported metal and multimetal systems. Attention is focused on studies that characterize the identity and distance of nearest neighbors to the metal in the first few coordination spheres, and how these change with catalyst preparation, activation, and chemisorption on the surface. These structural properties are at times nicely compared with chemical properties such as reactivity and valence. A section on sulphided catalysts, currently of interest due to their relation to hydrodesulfurization reactions, concludes this important article.

The second chapter, by Daniel J. Driscoll, Kenneth D. Campbell, and Jack H. Lunsford, deals with the formation, detection, and role in catalysis of surface-generated gas-phase radicals. Both the method of detection and the reactions that generate the radicals are described in the review. Samplings are taken from studies utilizing mass spectrometry, matrix-isolation infrared spectroscopy, laser-induced fluorescence, matrix-isolation EPR, photoelectron spectroscopy, and resonance-enhanced

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* Unsigned book reviews are by the Book Review Editor.

multiphoton ionization spectroscopy for detection of the radicals formed. Relationships of experimentally observed radicals to proposed reaction mechanisms are emphasized, which should make this article attractive to a wide audience.

A great number of the studies on catalysts have been derived from a need to understand at a mechanistic level, those catalysts that were discovered by empirical observation. The article by Yasuhiro Iwasawa serves notice that the direction of the future will be specific chemical design of the surface to optimize catalysis of the reaction of interest. Various aspects of chemical surface design are treated in the review, including nature and control of support surfaces, use of organometallic complexes and metal carbonyls for creating heterogenized homogeneous metal complexes, and surface structural and valency transformations of the metal complexes by oxidation and/or reduction. Detailed examples are presented for Mo, Cr, Co, and Ru based catalysts, with specific attention paid to surface identity and structure of the chemically designed supported catalyst.

The article by R. A. van Santen and H. P. C. E. Kuippers on the mechanism of ethylene epoxidation provides a beautiful example of how the multitechnique approach of modern surface science can yield a detailed understanding of an industrial catalytic process. The most important issue in the ethylene epoxidation reaction is how to control the degree of oxidation so that the epoxide is selectively produced and the formation of the fully oxidized product, CO_2, is minimized. The article very ably reviews the multitudinous studies on single-crystal silver that have sought to isolate those factors which have a bearing on this selectivity. The relationship of chlorine moderators and currently used alkali promoters to the selectivity of the reaction is discussed. This article should be of interest to researchers in single crystal and supported metal catalysts alike.

The last two articles in the book deal with applications of catalysis in organic chemistry. Herman Pines provides numerous examples of the catalytic versatility of nickel as a function of its preparation and modification. The effects of sulfidation, reduction, and oxidation on the ability of various types of supported nickel to catalyze select organic reactions are discussed. In the final article of the book, Mieczyslaw Makosza and Michal Fedorynski review phase-transfer catalysis. In these types of catalysts, lipophilic cations such as tetraalkylammonium salts, crown ethers, cryptands, etc., are used to form ion pairs with a lipophilic reactant anion, to facilitate transfer of the reactant anion to the organic phase containing the reaction partner. Numerous examples are presented of the chemistry possible with both inorganic and organic anions. Proposed mechanisms for catalysis in two-phase systems are discussed.

Acquisition of this latest volume of *Advances in Catalysis* should provide researchers in catalysis a convenient means of obtaining a broader perspective on the diverse field of catalysis.

Charles S. Feigerle, *University of Tennessee*

Rotations, Quaternions, and Double Groups. By Simon L. Altmann (Oxford). Oxford University Press: Oxford and New York. 1986. xiv + 317 pp. $49.00. ISBN 0-19-855372-2.

The concept of quaternions and application to the physical sciences is relatively unrecognized by the scientific community. This is unfortunate, for as the author shows, there are many advantages to be gained in their use, as opposed to the Eulerian angles. Quaternions, as the Euler–Rodrigues parameters, do not have the inherent asymmetry of the latter.

The first several chapters develop the necessary concepts for the discussion of quaternion algebra and its application to rotations. Here are sections on group theory, matrix algebra, spinor, vector, and tensor representations of the full rotation group, SO(3). Aside from these sections, intended as review, the book is directed to a graduate level audience. The spinor representation in SU(2) together with the homomorphism of the latter to SO(3) allows spinors to form an irreducible basis for the rotation group. The bilinear transformation is central here. Concepts from Topology are used to show that the double group $\hat{D}_2$ (as opposed to D_2 alone) allows an unambiguous description of all possible rotations from 0 to 4π. Connection is made with Quantum Mechanics. (Recall that a 2π rotation inverts the electron spin.) Note that the Eulerian angles cannot distinguish between a rotation of ϕ and one of $\phi + 2\pi$. Quaternions are shown to be a special case of Clifford algebra, as the even group C_{3+}.

The introduction to the subject is made quite interesting by a historical account of early work, by such men as Rodrigues and Hamilton. The final chapter contains applications from molecular and atomic physics, as examples from solid state and relativistic theory would presume too much of the reader. I recommend this book to anyone interested in angular momentum theory.

Adam Helman, *University of Michigan*

A Primer of Diffusion Problems. By Richard Ghez (IBM). John Wiley & Sons: New York and Chichester. 1988. xiii + 243 pp. $22.95. ISBN 0-471-84692-9.

This is a well-written book dealing with that part of mathematical analysis which is useful in solving the diffusion equation in practical cases. By design, it is not a simple catalogue of solutions for various boundary conditions. Nor does it deal with methodology. The author limits consideration of examples to important applications he has encountered in metallurgy and in semiconductor research. Those examples are examined carefully and critically. Thermal oxidation of silicon, crystal growth, impurity diffusion, precipitate growth, and thermally stimulated diffusion are some of the topics reviewed.

The text begins with a thorough exploration of the diffusion equation and its properties. There follows a consideration of a number of steady state properties which can be described by that equation. A detailed discussion of the error function and iterated error functions precedes a general discussion of similarity solutions. A remarkably clear introduction to the Laplace transform and its use in solving diffusion problems ends the formal presentation of analytical techniques.

Woven into the text is a convincing argument that a grasp of analytical methods is a prerequisite to the development of sensible numerical methods.

Given the author's evident facility with mathematics and recognizing his desire to keep the text brief, it is not surprising that quite a bit of what might be expected in the way of explicit mathematical development is replaced by verbal instructions designed to guide the reader's individual manipulations. This may make the book somewhat heavy going for a student prepared with only "a serious year of calculus through ordinary differential equations". The problems set by the author are challenging and the selection of references is excellent.

My chosen difference with the author relates to his attribution to Darken of credit for recognizing why the diffusion coefficient in a binary thermodynamically non-ideal system varies. While Darken certainly deserves credit for introducing the idea to metallurgists in 1948, fussy people will assign clear priority to Hartley in 1931. A few even fussier people will argue that Nernst anticipated the gist of the matter in 1888 when he related diffusive flow to the gradient of osmotic pressure. But then Dr. Ghez did not propose to write history. What he did set out to do he has realized admirably and his book will be welcomed by those researchers, teachers, and students whose interests are congruent with the author's aims.

P. A. Lyons, *Yale University*

Rodd's Chemistry of Carbon Compounds. Second Edition. Supplement to Volume IV, Part L. Edited by M. F. Ansell. Elsevier Science Publishers: Amsterdam and New York. 1988. 276 pp. $136.75. ISBN 0-444-42978-6.

This volume continues the supplementing of the second edition and is addressed specifically to Chapters 57 to 60 (Purines; Nucleosides, Nucleotides and Nucleic Acids; Pteridines, Alloxazines and Flavins; Biosynthesis of Plant Alkaloids and Nitrogenous Microbial Metabolites). The subjects included in Part L are thus heavily concerned with the chemistry of life processes.

As has been customary with recent volumes of this series, the content is reproduced from camera-ready copy. There is a rather wide variation in typeface used by the several contributors, and the styles shown in the many structural formulas also vary substantially, but nearly all are clear and tidy and are free from the hand-drawn features that marred some earlier volumes. However, the erratic use of dots in place of lines for bonds is at best annoying and at worst misleading; a pair of dots today represents an electron pair, and to find it used (and inconsistently) to mean a double bond is confusing. The index of 10 pages is good, and it is preceded by a helpful explanation of the principles used in its construction. An Author index would have been helpful.

It should be borne in mind that this volume is a supplement, and the chapters are not intended to stand independently of the chapters in the main work. Their intent is to provide the non-specialist an overview of the advances in the fields covered, which in this case is a major segment of biomedical chemistry. The preface is dated March 1988, but there is unfortunately no explicit statement about the cut-off dates for the individual chapters.

Chemistry of Oxide Superconductors. Edited by C. N. R. Rao (Indian Institute of Science). Blackwell Scientific Publishing: London and Boston. 1988. viii + 199 pp. $23.00. ISBN 0-632-02302-3.

This volume is stated to be a book composed of specially solicited chapters, but the content closely resembles a volume of proceedings. The articles are mostly reports of original research, complete with descriptions of the experimental procedures and, in some cases, acknowledgement of the financial support for the research. They are reproduced from rather varied typescripts, and there is no index.

The subject, however, is one of great current interest and importance and is advancing rapidly. A book on it is thus most timely. The opening article is a useful review of the subject, with 68 references, a great many of them dated in 1987. Other articles are about specific oxide combinations, oxygen uptake, preparation of their films, Raman scattering, theory of superconductivity, etc. They are well illustrated with photographic and drafted figures.

Theilheimer's Synthetic Methods of Organic Chemistry. Volume 42 (Yearbook 1988). Edited by A. F. Finch. S. Karger AG: Basel. 1988. xx + 596 pp. $447.50. ISBN 3-8055-4698-X.

The arrival of a new volume of *Theilheimer* (which the publishers now refer to as *Synthetic Methods*) is always a significant event for organic chemists, for it provides an efficient means of becoming aware of much of what one has missed in the recent literature. The present volume includes material published in 1986 and early 1987. It is largely drawn from the alerting/abstracting publication, *Journal of Synthetic Methods* (Derwent Publications, Ltd.). The highly organized content, consisting of concise notations of the type of transformation, succinct descriptions of the experimental process, formulas or equations, and reference, is of course familiar to most organic chemists. It has stood the test of long use, but is not completely frozen; the editor is aware of the need to make modifications to match new scientific developments.

The usual essay, Trends in Synthetic Organic Chemistry 1988 (6 pages) appears at the beginning and is interesting, although dense, reading. In it, the Editor points out some of the important areas that have received much attention, such as the use of selenium and tellurium reagents, new silane chemistry, radical ring closure, organopalladium chemistry, new means of asymmetric synthesis, homogeneous hydrogenation, trivalent iodine compounds, and peptide synthesis.

The subject index, 122 pages, covers both this volume and Volume 41 and is, as usual, exemplary. It is followed by an innovative and very useful feature, a formula index of "complex functional groups". In this, it is only the elements of the functional group that are entered. Thus, under Hal NOC_3 are found two terms: enecarbonyl halides, and α-halogenenisocyanates. One then looks up these terms in the subject indexes for the actual entries, which may be in any of the 42 volumes. Finally, there are several pages showing supplementary references to be found in Volumes 41 and 42, keyed to each of the previous volumes with the appropriate entry number.

If only the Editor would spell amino acid and amino alcohol with an intermediate space, the synthetic organic chemist's cup would indeed be overflowing!

Polymer Electrolyte Reviews. Volume 1. Edited by J. R. MacCallum and C. A. Vincent. Elsevier Applied Science Publishing Co.: New York. 1987. 351 pp. $85.50. ISBN 1-85166-071-2.

This is apparently the first volume of a series on electrically active polymer systems. Of the ten chapters in the present volume, the majority are contributions from laboratories in Scotland. There is a chapter by Watanabe and Ogata from Sophia University in Japan, a chapter by Ratner from Northwestern University in the U.S., and two contributions from groups in St. Martin d'Heres, France. As an initial volume of a series this can be accepted provided that the next and future volumes have a broader scope of contributors. In the present offering about half of the chapters review conductivity in various ether linked polymer systems. This provides a good survey of these types of polymer electrolyte systems that are currently of high interest. Some of the experimental techniques that have been used in evaluating and characterizing these systems are covered in the last three chapters. The chapter by Ratner provides a very good discussion of the theoretical treatment of solid polymer electrolytes.

Overall this volume is well written and edited and provides a good initial reference for both novice and knowledgeable investigator. This is a relatively new area of polymer research and it is growing rapidly so that a survey reference work of this kind is a welcome addition to the literature.

Robert Zand, *University of Michigan*

Organic Chemistry. By Francis A. Carey (University of Virginia). McGraw-Hill Book Company: New York. 1987. XXVIII + 1219 pp. $43.95. ISBN 0-07-009831-X.

This book, which consists of 29 chapters, is designed for an organic chemistry text book for the undergraduate courses of Organic Chemistry. The author takes a very classical approach. The first chapters (1–10) discuss the structures, methods of preparation, and reactions of alkanes, alkenes, alkynes, alkyl halides, and alcohols and then the conjugation of alkadienes, arenes, and their reactions (Chapters 11–13).

The author has written a single chapter to cover the basic information of spectroscopy (Chapter 14) and another chapter (15) covers organometallic compounds that are regarded as very important in the development of organic synthesis.

The latter chapters (16–26) discuss in detail the functional groups of organic chemistry, including alcohols, ethers, aldehydes, ketones, enols, enamines, carboxylic acids and their derivatives, amines, aryl halides, and phenols.

The last chapters (27–29) discuss the biomolecules of carbohydrates, fatty acids, amino acids, proteins, and nucleic acids. However, this book suffers from lack of molecular orbitals, electrocyclic and cycloaddition reactions, and heterocyclic compounds.

This book is accompanied by a complete package of supplements to assist both the teacher and the student. Overall, the book is well-written and organized in such a way as to be an excellent text book. Instructors who teach the basic undergraduate organic chemistry course should seriously consider this text for adoption.

Sultan T. Abu-Orabi, *Yarmouk University, Jordan*

Advances in Molecular Modeling. Volume 1. Edited by Dennis Liotta (Emory University). JAI Press: Greenwich and London. 1988. xii + 213 pp. $34.25. ISBN 0-89232-871-1.

This volume begins a new series examining molecular modeling. On the basis of the title, one might have expected a slew of color computer-generated graphics like those that are now de rigueur for the cover of *C&E News*. Surprisingly, only two color plates of rather poor quality are found in this volume. The editor has chosen a very broad definition of molecular modeling—"the application of computational and theoretical methods to the solution of problems involving molecular structure and chemical reactivity"—one that does not focus on just advancements in predicting large structures via molecular mechanics (MM) and the visual representation of such molecules. Accordingly, the five chapters span a broad spectrum of topics.

The first two chapters, "Theoretical Interpretations of Chemical Reactivity" by G. Klopman and O. T. Macina and "Theory and Experiment in the Analysis of Reaction Mechanisms" by B. K. Carpenter, deal with the direct application of theoretical methods (primarily FMO and perturbation theory) to organic and organometallic chemistry. These chapters offer a brief survey of mechanistic problems where the authors have been personally involved.

The third chapter, "Barriers to Rotation Adjacent to Double Bonds" by K. B. Wiberg, succinctly reviews Wiberg's recent activity in this area. This work involves using fairly large ab initio calculations to predict geometries and energy barriers, information that could be incorporated into MM schemes.

The last two chapters form a "Point–Counterpoint" duet concerning the relationship between distance and reactivity. A. E. Dorigo and K. N. Houk, in their chapter "Proximity Effects on Organic Reactivity: Development of Force Fields from Quantum Chemical Calculations, and Application to the Study of Organic Reaction Rates," argue that distance separating reactive groups is not the sole, or necessarily dominant, factor affecting rates. Their method involves a synthesis of ab initio and MM calculations. F. M. Menger, in his chapter "Organic Reactivity and Geometric Disposition," rebuts the arguments of Dorigo and Houk by pointing out the limitations of the calculational methods they employed. However, one is left with the impression that there is more agreement between the two parties than either is willing to admit.

Overall, this first volume of *Advances in Molecular Modeling* bodes well for an exciting and provocative series in the future.

Steven M. Bachrach, *Northern Illinois University*

Computation of Solution Equilibria: A Guide to Methods in Potentiometry, Extraction, and Spectrophotometry. By M. Meloun (College of Chemical Technology, Pardubice, CK), J. Havel (J. E. Purkyne University, Brno, CK), and E. Hogfeldt (Royal Institute of Technology, Stockholm). Translation Edited by Mary R. Masson (University of Aberdeen). John Wiley & Sons: New York. 1988. x + 297 pp. $69.95. ISBN 0-470-20975-5.

Although this book contains a very good review of computation methods applicable to equilibrium systems, most of the book is dedicated to the description and evaluation of computer programs available for doing such calculations. As stated in the preface, the authors (two "computniks" and a user of graphical and computer methods) have joined forces in order to present the reader with the points of view of both the creator and user of modern computer program tools available for the study of solution equilibria. As is inevitable in such an endeavor, the result gives many fascinating bits of insight and information, while leaving the average reader looking eagerly for additional information, which is not there. This information can, of course, be obtained from additional sources. The integration of basic equilibrium theory, from potentiometry, extraction, and spectroscopy, with the algorithms and programs available to extract knowledge from the experimental methods most commonly used, will be of great value to anyone involved in equilibrium studies. The additional discussion of experimental methods includes a very concise, well-thought-out, and well-presented review of practical experimental details, with an admirable emphasis on the effect that parameter (concentration, purity, etc.) and data uncertainty (or error) will have on the results or model that one obtains using computerized numerical methods.

The successful presentation of such a complicated amalgamation of concepts is greatly aided by the structure of the book, which begins with a brief but thorough discussion of equilibrium concepts in general, followed by an equally brief discussion of experimental methods used to study equilibria with potentiometric, extraction, and spectroscopic methods. These sections would not be sufficient to teach these topics to the beginner but offer an informative presentation of concepts in relation to one another to those already familiar with basic equilibrium concepts. The importance of evaluating and analyzing the suitability of data for further analysis is then presented before an in depth (by a chemist's standards) look at the individual parts that make up a detailed equilibrium analysis program. The next one-third of the book is an examination of specific equilibrium problems and the programs available to study them. These are divided into chapters devoted to potentiometric, extraction, and spectroscopic methods. The format is to discuss a variety of programs, one at a time, including the parts of the program, the types of problems to which it has been applied, and the program's limitations. A number of problems are then presented, which are representative of the type of questions that are normally addressed by research projects in the area. The application of the programs is then discussed in terms of applicability or appropriateness to the problem at hand. This type of presentation will be useful for anyone planning an equilibrium study, who would like to know what programs will be most suitable for obtaining the desired results.

The final chapter of the book discusses the use of computer programs in building and testing chemical models of equilibria systems.

Overall, the book will be quite useful as a concept-integration tool for those involved in equilibrium studies, but unfamiliar with the use of computers in such studies. The translation of this book is excellent in terms of uniform flow from one section to another, use of terminology, and expressions common to the field and overall ease of reading. I would not have guessed that it was a translation, except that this is stated on the cover.

The book's main weaknesses are its rather limited references, the limited number of programs mentioned, and the lack of any information (except what may be available in individual references cited) about how to obtain any of the programs discussed. At least a mention of any current, easily obtained programs, which will run on an IBM compatible (or other commonly available) computer, would make it easier for the non-expert in the field to apply the knowledge gained from reading this book.

Richard A. Butler, *DuPont Agrichemicals Caribe, Inc.*

Carbon-13 NMR Spectroscopy. By Hans-Otto Kalinowski (Justus Liebig University), Stefan Berger (University of Marburg), and Siegmar Braun (Technical University of Darmstadt). Translation by Jack K. Becconsall. John Wiley & Sons: New York. 1988. xvi + 776 pp. $178.00. ISBN 0471-91306-5.

The heart and soul of this text are Chapter 3 on "The ^{13}C Chemical Shift" and Chapter 4 on "^{13}C–X Spin–Spin Couplings." These two chapters account for more than 500 pages and are an organic chemist's delight as a source of reference data. The chemical shift chapter is organized by functional groups, while the spin–spin couplings are grouped by type of the second nucleus and number of intervening bonds. Remarkably extensive data are compiled in a pleasing mix of tables and listings associated with structural formulas. At least several examples may be found even for compound classes that are often unrepresented in other sources (e.g., allenes, imines, selenium compounds). However, these two chapters are much more than just a compilation, as the data are thoroughly and knowledgably discussed in regard to structural dependence, general trends, empirical correlations, and special cases. In addition to individual literature references to sources of data, the chapter on chemical shifts has well-organized bibliographies for each compound class.

The remaining six chapters are less extensive and thorough. Chapter 1 on the "Foundations of Magnetic Resonance" and Chapter 2 on experimental techniques serve primarily as introductions. Chapter 2 has sufficient descriptions of data processing, the pulsed Fourier transform method, and double resonance techniques to assist in understanding the appearance of typical spectra, but a more limited description of the newer multipulse techniques. Chapters 5–8 use selected examples rather than compilations in covering the following topics as indicated by the chapter headings: "^{13}C Spin–Lattice Relaxation and the Nuclear Overhauser Effect"; "Dynamic ^{13}C NMR Spectroscopy"; "Use of Lanthanide Shift Reagents"; and "^{13}C NMR Spectroscopy in the Study of Reaction Mechanisms". Another feature of the text is student exercises, which appear in each chapter and for which answers are given in an Appendix.

This book is a translation of a 1984 German version, with some rewriting and incorporation of references up to early 1986. The translation is very smooth. The only evidence of a translation apparent to this reader was in the occasionally imperfect conversion of commas to decimal points in numbers accompanying structural formulas. The stated purpose of publishing a translation was to allow the book to reach a wider readership. In this context, it is disturbing to find the version in English selling at a very high price, which is roughly three times the price at which the German version is available in the Federal Republic of Germany.

David A. Forsyth, *Northeastern University*

Polysiloxane Copolymers/Anionic Polymerization. Advances in Polymer Science 86. Springer-Verlag: Heidelberg and New York. 1988. 255 pp. $99.00. Heidelberg: ISBN 3-540-18506-2. New York: ISBN 0-387-18506-2.

This volume consists of four excellent reviews written by an international group of well-known scientists. The title of this volume is slightly misleading, since one of the reviews concerns cationic polymerization. The theme of this book is polysiloxane copolymers and ionic polymerization.

I. Yilgor, Mucor, Inc., Berkeley, Ca., and J. E. McGrath, Virginia Polytechnical & State University, Blacksburg, VA, have written a comprehensive review, with 420 references, on "Polysiloxane Containing Copolymers: A Survey of Recent Developments", which encompasses both the synthesis and properties of such copolymers. Topics covered include the synthesis of reactive functionally terminated siloxane oligomers and of siloxane-containing copolymers by anionic, free radical, step-growth, hydrosilation, and ring-opening polymerization. Synthesis of network structures and liquid crystalline copolymers is included. In addition, there are comments on morphology, bulk properties, and surface properties of these copolymers. For example, the siloxane constituents of these copolymers and their blends generally migrate to the surface of the samples. Applications of the copolymers as surfactants and in biomedical devices are presented.

M. Van Beylen, S. Bywater, G. Smets, M. Szwarc, and D. J. Worsfold, variously representing the University of Leuven, Belgium, the National Research Council of Canada, and the University of California, San Diego, have written "Developments in Anionic Polymerization—A Critical Review" with 164 references (actually over 200 since many references have many parts). The following topics are discussed: different types of "living polymerizations", anionic polymerization of methyl methacrylate, dienes, and styrene and its derivatives, aspects of initiation of polymerization, problems of copolymerization, and complexes of ion pairs with coordinating agents.

P. Rempp, E. Franta, and J.-E. Herz have contributed "Macromolecular Engineering by Anionic Methods", with 148 references. This review concerns the synthesis of well-defined polymers of known structure, of low compositional heterogeneity, and of narrow molecular weight distribution. After a listing of monomers, initiators, solvents, and temperatures suitable for such syntheses, the types of materials that can be synthesized are discussed. These materials include macromonomers, cyclic macromolecules, comb-like polymers, star-shaped polymers, model networks, and block and graft copolymers.

The fourth review, with 163 references, is on "Elucidation of Cationic Polymerization Mechanisms by Means of Quantum Chemical Methods" by P. Hallpap, M. Bolke, and G. Heublein of the Friedrich Schiller University, Jena, DDR. This interesting, nonmathematical paper reviews the application of quantum mechanical calculations to the cationic polymerization of vinyl monomers. There is a brief discussion of the methods and approximations used in these calculations and how these methods are used to characterize reactants, products, intermediates, and activated complexes, to determine reactivity parameters and potential energy surfaces, and to evaluate the influence of solvent. Some examples of the results of these calculations are discussed, including the reactivity of monomers and their cationic polymerization ability, the initiation process, the interaction between cationic chain end and counterion, between cation and monomer, and between cation, monomer, and counterion.

Sonja Krause, *Rensselaer Polytechnic Institute*