perature change in the outermost line positions was not observed in n-C_4F_{10} at 77–160 K, while the five-line substructure is clearly seen even at 77 K[3] as shown in Figure 3. This may suggest that a_2 is essentially zero in this matrix. In such a case, marked line narrowing of the main triplet (a_1 = 63.0 G) by the CH_3 reorientation cannot be expected as is easily understood from the illustration in Figure 2. Therefore, the five-line substructure with a_3 = 8 G must be due to the four protons in the methylene group, as is assigned in our previous work.[3] The simulated spectra along this line nicely reproduce the observed temperature change giving essentially the same activation energy as shown in Figure 3 and in Table I. The temperature change in $CFCl_2CF_2Cl$ also suggests that the activation energy is similar to that in $CFCl_3$. Thus, it is concluded that the planar extended structure is maintained throughout the observation temperatures in all the matrices and the small variation of the coupling constant from matrix to matrix is ascribable to the interaction with matrix.

The interpretation in terms of a slight nonplanarity by Lund and his co-workers[7] should be reconsidered in the light of the present study.

Book Reviews

Comprehensive Chemical Kinetics. Volume 25: Diffusion-limited Reactions. By Stephen A. Rice (Shell Research B. V., Rijswijk, The Netherlands). Elsevier Science Publishers: Amsterdam and New York. 1985. xiv + 404 pp. $132.25. ISBN 0-444-42354-0.

This book consists of a critical review of theoretical treatments of diffusion-limited reactions. In the first half of the book, these are compared with experimental data. First is discussed the basic theory of diffusion-limited reactions (Smoluchowski etc.) and limitations of same (Chapter 2). Modifications include coulombic effects (ion/ion reactions), long-range transfer effects (dipole/dipole interactions, exchange interaction, and electron tunnelling), and rotational diffusion (Chapters 3–5). Chapters 6 and 7 treat the escape or recombination of reactants formed in pairs, both uncharged (atom/atom and radical/radical) and charged (ion/ion). The last five chapters are devoted to theory, which is interpreted with lucid commentary, comprising a critique of the diffusion equation and molecular-pair treatments, refinements to include many-body effects, the variational principle, phenomenological Brownian motion, and the kinetic theory of fluids.

This is a research monograph addressed to the specialist and will, I suspect, be most appreciated by experimenters trying to keep abreast of theory. The book, unlike previous volumes in this series, is written by a single author. It is well organized and clearly written, and the author has definite opinions to express. Data from radiation chemistry are cited extensively; thus coulombic effects are discussed with use of data on hydrated and solvated electrons; and there is a section on ions formed in spurs.

Any book on this subject will be dense. Here some 550 references are cited in 400 pages. Despite a full Table of Contents, the author's hard work is rendered inexcusably inaccessible to the reader by the absence of an author index and by an inadequate subject index, compiled by another hand.

Michael Henchman, *Brandeis University*

Advances in Polymer Science. Volume 75. Epoxy Resins and Composites II. Edited by K. Dusek (Institute of Macromolecular Chemistry, Czechoslovak Academy of Sciences). Springer-Verlag: Berlin, Heidelberg, New York, Tokyo. 1986. viii + 180 pp. $45.00. ISBN-3-540-15825-1, hardcover; ISBN-0-387-15825-1, softcover.

This volume contains four readable and informative critical reviews on aspects of epoxy resins and composites, a subject of great technological importance. It is well edited and produced. Each article provides good perspective on its subject and offers examples of recent research.

In The Interphase in Epoxy Composites, L. T. Drzal demonstrates that the heterogeneous region near the surfaces of both the matrix and the reinforcing fiber strongly affects the properties of epoxy composites, often deleteriously. Advances in composite performance may depend on better understanding and control of this interphase region.

In Epoxy Adhesion to Metals, R. G. Schmidt and J. P. Bell emphasize the importance of adhesion under wet conditions. Substantially improved structural adhesives and corrosion-resistant coatings will become possible if ways are found to improve wet adhesion. The authors recommend a search for better chemical coupling agents and better metal pretreatments.

Application of FT-IR and NMR to Epoxy Resins, by E. Mertzel and J. L. Konig, includes a lucid introduction to FT-IR and NMR and examples of how they have been used to characterize epoxy resins, curing processes, and properties of cured materials. The authors point out the advantages of diffuse reflectance and photoacoustic FT-IR techniques for studies of surfaces.

In Kinetics, Thermodynamics and Mechanism of Reactions of Epoxy Oligomers with Amines, B. A. Rozenberg details the complexities of catalysis, autocatalysis, autoinhibition, and side reactions that affect the properties of amine-cured epoxy resins. Information gained from model compound studies is analyzed, and a useful discussion of kinetics during the critical late stages of crosslinking is provided.

The editor plans a four-volume series that will contain 21 reviews by authorities on epoxy materials. The high quality of the present volume indicates that the series will be a valuable resource for those interested in the field.

Frank N. Jones, *North Dakota State University*

Fluidization. Edited by J. F. Davidson (Cambridge University), R. Clift (University of Surrey), and D. Harrison (University of Exeter). Academic Press Inc.: London. 1985. xiv + 733 pp. $96.50. ISBN 0-12-205552-7.

Fluidized beds are an important tool of the chemical industry and find wide use as reactors in petroleum and metallurgical processing, for syntheses and polymerizations, for gasification and liquefaction of solid fuels, and in many other areas. However, this book does not deal with the how and why of any of this. Instead, it deals with the research efforts going on at present aimed at understanding the basic physics of this form of gas/solid contacting. If you want to know that researchers are doing in this area and what they have found, this is your book.

As with the first edition published 15 years ago, this volume consists of contributions by researchers into various aspects of fluidization. The 21 chapters (29 contributing authors) fall into three groups. First, there are eleven chapters dealing directly with the physical aspects of the normal dense-phase fluidized bed (bubbles and slugs, distributors and jetting, self-mixing and mixing of different solids, hydrodynamic theory and stability, heat transfer and influence of internals, and so on). Six chapters deal with related phenomena (spouted, high-velocity and large-particle fluidized beds, flow of solids through pipes and valves, elutriation, and gas/liquid/solid fluidization). The remaining four chapters of this volume deal with aspects of particular applications (drying of solids, growth and coating of particles, modeling of solid-catalyzed gas-phase reactions, coal combustion).

In recent years there has been an enormous outpouring of reports and technical papers on fluidization, many appearing only in obscure proceedings of limited circulation, or as preprints of oral presentations. Just the thought of keeping abreast of all this literature is depressing. Hence, this volume is welcome in that it aims to bring all these findings together. There are over 1600 references and numerous tables listing the reported data and correlations. This is a handsome and carefully edited volume which should be invaluable to researchers in the basics of fluidization.

Octave Levenspiel, *Oregon State University*

Superacids. By G. A. Olah and G. K. Surya Prakash (University of Southern California) and J. Sommer (Louis Pasteur University). John Wiley & Sons: New York. 1985. xv + 371 pp. $57.95. ISBN 0-471-88469-3.

This book is a survey of superacids and their chemistry and represents the culmination of several review articles by the principal author. The book is essentially divided into three parts. The first part details the various superacid systems available. These include liquid Brønsted acids, Lewis acids, and solid superacids and lists relative acidities of these systems in terms of the H_0 acidity function. The second and most extensive portion of the book deals with carbocation structures. The whole range of classical trivalent "carbenium" ions to pentacoordinate non-

classical species is covered. This is followed by a section on nonmetallic heterocations. The last section covers chemical reactions which are initiated or catalyzed by superacids. These reactions include transformations of saturated hydrocarbons, electrophilic substitutions of aromatics (but not those which involve the conventional Friedel-Crafts type of catalyst), oxyfunctionalization using electrophilic species derived from peroxide and ozone superacid mixtures, electrophilic addition polymerization of alkenes, and miscellaneous reactions catalyzed by superacids.

This work represents a comprehensive review of the subject matter and will appeal to the research chemist as an authoritative reference text. However, it follows the same genre of many such treatises in which is the dry cataloguing of complete collections of type reactions and chemical species found in many review articles. The introductory chapter on general concepts of acidity and acidity measurements is of wider interest but is treated rather briefly. I would have expected the principal author, being the leading contributor in this field, to have added some of his personal touches to the book and include additional historical anecdotes such as the reference to the Christmas incident leading to coining of the term "Magic Acid".

In particular, the section on the 2-norbornyl cation could have contained some of the colorful arguments and interpretations of the classical-equilibrating-cation camp, but it is understandably brushed off. The two following sentences illustrate the point. In an NMR study of substituted 2-norbornyl cations supporting its nonclassical nature, the quotation "These conclusions were critized by Brown. In a recent paper, Olah and Farnum have shown major flaws with such criticism" is not further elaborated. One other minor criticism is a scheme detailing the rearrangement of C_{10} hydrocarbons to adamantane which appears to the uninitiated as a hand-drawn facsimile of a major airline route map and adds to some confusion. This book will serve as a valuable practical guide and reference text for chemists involved in superacid research.

E. Lee-Ruff, *York University*

Annual Reports on Analytical Atomic Spectroscopy. Volume 14. Edited by M. S. Cresser and L. Ebdon. Royal Society of Chemistry: London. 1985. xiii + 445 pp. $117.00. ISBN 0-85186-677-8.

This book is a review of the literature of analytical atomic spectrometry covering 1984. It is similar to the fundamental reviews published every other year in *Analytical Chemistry*, but the treatment here is more detailed and more highly organized. The book consists of 125 pages of text, 148 pages of tables, 2635 references, an author index, and a subject index. It covers the fundamentals, instrumentation, and applications of analytical atomic emission, absorption, and fluorescence spectrometry in arcs, sparks, glow discharges, plasmas, flames, and electrothermal atomizers.

This volume differs from similar reviews in several ways. First there are a large number of tables. These include applications to chemicals, petroleum, metals, minerals, air, water, soils, plants, fertilizers, food and beverage, and body tissues and fluids, which are organized by element(s) and list the wavelength, matrix concentration, measurement, technique, atomization, analyte form, sample form, and reference. Other useful tables list commercial instrument suppliers, standard reference materials, reference methods of analysis, and suppliers of supplies and reagents.

Another characteristic of this review is that the authors include many evaluative comments in the text, pointing out developments which they feel are of particular importance or expressing surprise that work is still being published in certain areas. Such comments, of course, reflect the personal views of the authors, but they make for far more useful and interesting reading than the simple dispassionate exposition of published work found in the usual literature reviews.

One final useful device is the inclusion of the author's address in the literature citations.

The book has the typical "typed look" which suggests it was prepared by photoreducing camera-ready copy supplied by the authors. It is moderately easy to read.

Overall, this volume is an exceptionally useful reference work for the analytical atomic spectroscopist.

T. C. O'Haver, *University of Maryland*

Electrochemistry. Volume 10. Specialist Periodical Reports. Senior Reporter: D. Pletcher (Department of Chemistry, University of Southampton). The Royal Society of Chemistry: London. 1985. x + 214 pp. £66.00 ($119.00). Available from the ACS. ISBN 0-85186-087-7.

This volume retains the same format as its predecessors in the series, with materials written by several contributors. It contains five chapters of recent literature review on a few selected topics in electrochemistry.

The first chapter is an extensive review on adsorption at solid electrodes, with emphasis on its effects on the technology of electrochemistry. The solid electrodes surveyed include aluminum, bismuth, cadmium, carbon, chromium, cobalt, copper, gallium, gold, indium, iron, lead, maanganese, molybdenum, nickel, precious metals, silver, tin, titanium, and zinc. An impressive list 563 references (563) is cited covering a period mostly between 1980 and 1983. In chapter 2, recent work (161 references ending in 1984) on localized corrosion of ferrous alloys is discussed. Much of the chapter is devoted to phenomenological and mechanistic investigations of pitting attack on these alloy systems. Chapter 3 treats the subject of the electrochemistry of conducting polymers. It surveys the work done largely in a 5-year period prior to 1984 with 191 references. The polymer systems discussed are polypyrrole and related polymers, polyacetylene, polyparaphenylene, polythiazyl, polyanilines, and other systems including tetrathiafulvalene and tetracyanoquinodimethane salts. The authors characterize the conducting polymers as those with conductivities up to 10^4 ohm^{-1} cm^{-1}, and thus capable of acting as their own current collector (not to be confused with other types of redox polymers). Chapter 4 deals with electron-transfer reactions initiated by pulsed high-energy radiation. It concentrates on the reactions of radical cations and anions (82 selected references up to early 1984). Reactions resulting from hydrogen and hydroxyl radicals with solute molecules are excluded. The final chapter is a traditional annual review of organic electrochemistry, with literature coverage from 1982 through 1983 (268 references). The organic systems reviewed include hydrocarbons, halogen-containing compounds, alcohols, ethers, carbonyl compounds, activated olefins, nitro and nitroso compounds, and sulfur compounds. The depth and scope of the redox reactions surveyed are quite adequate for such a broad topic.

In summary, this volume continues the fine tradition of the series as being a valuable reference source to those who desire to keep abreast of the recent developments in specific areas of electrochemistry. To do a review in a field in which the literature is so prolific is no easy task. The authors have successfully edited the materials down to tolerable levels, but still retaining essential information. In their attempt to maintain brevity, the authors have, in some instances, paid a price in clarity and continuity. The readers will find Volume 10 well organized and its writing style concise but easy to comprehend. However, this reviewer feels that it would be more convenient to the readers if author and subject indices were included at the end of the volume.

Chia-yu Li, *East Carolina University*

Herbs, Spices, and Medicinal Plants: Recent Advances in Botany, Horticulture, and Pharmacology. Volume 1. Edited by Lyle E. Craker (University of Massachusetts) and James E. Simon (Purdue University). Oryx Press: Phoenix, AZ. 1986. vii + 359 pp. $55.00. ISBN 0-89774-143-9.

This publication is the first in a series devoted to the study of herbs, spices, and medicinal plants. Although a Chinese herbal dates from 2700 B.C. and Egyptian papyri from 2000 B.C. provide directions for preparing medicines from plants, scientific information on this group of plants is limited. This volume is composed of nine invited papers, most of which assume a considerable knowledge of chemistry, botany, and pharmacology. This is not a book for laymen, but it will be of interest to biochemists, botanists, pharmacologists, and workers in related fields.

The paper concerned with chemotaxonomic aspects of essential oils proposes that there are biochemical connections between plants that may help to solve taxonomic puzzles. The biochemistry of monoterpenes and sesquiterpenes of the essential oils is discussed in relation to their sites of synthesis, biological function, biosynthetic routes, and catabolism. Little is known of the regulatory processes at the enzyme, cell, or whole organism level. A paper devoted to the pharmacology of plant alkaloids includes their effects on subcellular structures, membrane transport processes, neuroreceptors, and nucleic acids and protein synthesis components, as well as inhibition or activation of enzymes. The pharmacological activity of flavonoids is the major topic in the chapter on the polyphenolic compounds with biological and pharmacological activity. An entire paper is devoted to chamomile. This includes its botany, taxonomy, chemical constituents and their isolation, as well as medicinal and other commercial uses. Other papers are concerned with the effects of the environment on plant products, botanical nomenclature of culinary herbs and potherbs, and an ethnobotanical survey of the medicinal plants of Israel. Extensive references as well as an index are included.

M. C. W. Smith, *Ann Arbor, MI*

Crystal Structure Analysis: A Primer. Second Edition. By Jenny Pickworth Glusker (The Institute for Cancer Research, Philadelphia) and Kenneth M. Trueblood (University of California at Los Angeles). Oxford University Press: New York and Oxford. 1985. xvii + 269 pp. $37.50 cloth; $18.95 paper.

This second edition of one of my favorite books is appreciably larger than the first—260 pages vs. 190. The additional material consists mostly of amplifications rather than new topics. There is added emphasis on biological applications, and the discussions of anomalous dispersion,

electron-density syntheses, and other topics have been expanded. Many sections have been rearranged; and while sentences and paragraphs often remain unchanged, it is apparent that the authors have carefully reconsidered every word in the original edition.

Unfortunately, some of the added material, instead of amplifying on topics, seems to confuse them. For example, in describing Fourier series the authors have added the concept of "density wave"; several pages of discussion and drawings are devoted to an attempt—unsuccessful, I believe—to impart some insight as to the significance of these "waves". For my money, a more traditional derivation of the Fourier transformation process would have been preferable. The description of oscillation photographs now includes copies of prints made in a "Vee" cassette, adapted for a synchroton radiation source; lengthy legends to these figures attempt to explain the complicated diffraction patterns in detail. But this is an impossible task in an elementary text. (Furthermore, the legends have serious errors, the most important being a "perpendicular" that should be "parallel".) In the discussion of reciprocal space, a drawing has been added in which a two-dimensional net in the shape of a rhombus has, as its reciprocal, a distinct rhomboid; this simple mistake could seriously confuse a beginner.

A "primer" is, in my dictionary, a "small book of elementary principles". The first edition of Glusker and Trueblood qualified. In this second edition the authors have often succumbed to the temptation to explain things more thoroughly, to go beyond the elementary principles. Since the book remains small, some of these added explanations are incomplete; to the beginner they are confusing, to the more knowledgeable they are unsatifactory.

But I do not want to sound too harsh. This book is a truly excellent introduction to the concepts and practices of single-crystal diffraction. It is written in a comfortable style, and the illustrations (and often copious legends) are generally excellent. It may not be as good a "primer" as the first edition, but I enthusiastically recommend it to beginning students.

Richard E. Marsh, *California Institute of Technology*

Principles of Clinical Chemistry. By Kenneth E. Blick (University of Oklahoma Health Sciences Center) and Suzanne M. Liles (Deaconess Hospitial, Evansville, Indiana). John Wiley and Sons, Inc.: New York. 1985. IX + 697 pp. $28.95. ISBN 0-471-88502-9.

A primary purpose of this book is to provide a clinical chemistry text for the training of third- and fourth-year medical technology students enrolled in a baccalaureate program. A secondary feature of this textbook is that its style allows one to use it as a self-instruction device for those students who are reviewing Clinical Chemistry for the board examination in Medical Technology or for certification in the specialty of Clinical Chemistry. There is some brief attention devoted to balancing equations and acid–base chemistry, including the definition and derivation of the much-used Henderson–Hasselbach equation. Each chapter begins with objectives to be instilled in the student and a glossary of terms that will enable that student to better understand what the chapter intends to cover.

In its desire to be all inclusive as a text, the book begins with very basic but instructive information on the periodic table followed by a review of basic chemistry and some very necessary laboratory mathematics. Included in the early chapters are required acid–base concepts and the discussion of calculations as they pertain to the analytical quantification aspects of clinical chemistry and as they apply to the hospital laboratory environment. From here it goes into a description of the current practice of quality control, covering terminology with some discourse on Levy–Jennings charts, the early charting system, along with the current extension to Westgard rules, the more recent evaluation technique for quality control in a clinical laboratory. A discussion then follows on the subject of laboratory management, an employment circumstance aspired to in general by most medical technologists as a final career goal. Some attention is given to the varied areas involved in management, including specimen handling, testing, reporting and billing and all that it entails, including stats, batching, turn-around time and how all of the work of the laboratory must be arranged. This chapter is followed by a fairly complete review for medical technologists on clinical chemistry instrumentation and includes discussions and figures in all of the areas of spectrophotometry that apply, along with scintillation counters for radioimmunoassay and automated systems including on-stream, discrete sampling systems, centrifugal analyzers, and dry chemical reagent systems. Liquid, thin-layer, and gas chromatography and immunoassay techniques such as enzyme-multiplied immunoassay (EMIT), enzyme-linked immunoabsorbent assays (ELISA), and fluorescence immunoassays (FIA) complete this chapter. Electrophoresis, another key tool, is described in the protein and lipid chapters.

The remaining chapters are concerned with the ingredients of laboratory testing and what that entails, such as, classifications as exemplified by carbohydrates, their metabolism, pathophysiology, regulation, methodologies, and pathological conditions. Just as with the introductory chapters, each chapter begins with an outline of what is to be discussed, the objectives for the student, and a glossary of terms and ends with test-questions and the answers to those questions. The methods in each chapter are not described in recipe fashion, but the general principle of each method is described. Because, in the tradition of the Persian rug, nothing should be perfect, one might challenge the value of detailing such obsolete clinical tests as Folin-Wu, ferricyanide, or neocuproine–copper(II) oxidation procedures because they had been used for glucose or Clark–Collip titrations and chloranilate procedures for calcium. However, their inclusion perhaps helps complete methodology descriptions by including such historical procedures. An error, such as calling the phenol method for proteins "a biuret and phenol reduction", could have been avoided by understanding that the absorption peak of the Lowry reaction is well beyond that of the biuret reaction and so the latter cannot truly contribute to the measurement. However, the book, in general, seems free of error problems.

Finally, on considering the intent of the authors as to the purposes for which this book is to be used by the medical technology students it is aimed at, one can readily see that it is a worthwhile instrument for achieving the ends of the authors. So it seems quite appropriate to recommend it as a text and/or as a self-teaching device for board and registration studies for medical technology students. Its clear writing and moderate price help to make it quite attractive as well.

Bennie Zak, *Wayne State University, Detroit*

Inorganic Solid Fluorides: Chemistry and Physics. Edited by Paul Hagenmuller (Université de Bordeaux). Academic Press, Inc.: Orlando, FL. 1985. XV + 628 pp. $99.00. ISBN 0-12-313370-X.

This book contains 21 chapters by 31 contributors and ranges in topics from basic, solid-state subjects such as preparative methods and crystal chemistry of solid fluorides through their physical properties to chapters on fluorides and biomineralization, applications of fluorine chemistry to energy, and industrial uses of inorganic fluorides. Some of the later chapters are brief and narrow in scope or go rather far afield from the implications of the title and provide a kind of "catch-all" flavor.

After an excellent introduction by the editor pointing out the unique characteristics of fluorine and its compounds comes a chapter giving a general review of the equipment and methodology of the synthesis of solid fluorides. The next 197 pages (roughly one-third of the book) focus on crystal chemistry of fluorides (Chapter 3) and oxyfluorides (Chapter 4) and defects in fluoride structures (Chapter 5). These provide a very thorough coverage of the structures of these systems. Chapter six is a somewhat unconventional discussion of high-oxidation-state fluorides that (deliberately) raises more questions than it answers and points up numerous areas where more research is needed. The remaining 15 chapters cover such topics as fluoride glasses, graphite–fluorine intercalation compound, magnetic, electric, and optical properties of solid fluorides, as well as other subjects. Examples of actual or potential applications of fluorides are well covered. Most chapters are well referenced (Chapter 4 has roughly 450 references, but this is exceptional) with an occasional reference as late as 1985.

This volume is clearly of value to fluorine chemists and to solid-state chemists interested in fluoride systems. It also provides a useful overview of the scope of inorganic fluoride chemistry, although with more detail in many areas than the nonspecialist would want.

R. A. Bailey, *Rensselaer Polytechnic Institute*

Economic and Medicinal Plant Research. Volume 1. Edited by H. Wagner, H. Hikino, and N. Farnsworth. Academic Press: London and Orlando. 1985. xi + 295 pp. $69.50 (paperback $39.95). ISBN 0-12-730060-0.

This is the first volume of a series designed to review areas of natural products research that are of present or potential economic importance. The topics covered in it are the following: the current status of stevioside as a sweetening agent for human use (by A. D. Kinghorn and D. D. Soejarto); recent research on oriental medicinal plants (specifically glycyrrhizae radix, zingiberis rhizoma, hoelen, paeoniae radix, zizyphi fructus, cinnamomi cortex, and atractylodis rhizoma) (by H. Hikino); the pharmacology and current status of gossypol as a male contraceptive (by D. R. Waller, L. J. D. Zaneveld, and N. R. Farnsworth); immunostimulatory drugs obtained from fungi and higher plants (H. Wagner and A. Proksch); the current status of siberian ginseng as an adaptogen (N. R. Farnsworth, A. D. Kinghorn, D. D. Soejarto, and D. P. Waller); and the chemistry and pharmacology of panax (by S. Shibata, O. Tanaka, J. Shoji, and H. Saito). All of these reviews appear to be careful and concise summaries a strong feature being the coverage of the pharmacological literature, including a good deal that is not readily available. This augurs well for the series, which is accordingly recommended for

acquisition by libraries serving pharmacologists, medicinal and natural products chemists, and their ilk.

M. H. Benn, *The University of Calgary*

Multiple Photon Infrared Laser Photophysics and Photochemistry. By V. N. Bagratashvili, V. S. Letokhov, A. A. Makarov, and E. A. Ryabov (Institute of Spectroscopy, U.S.S.R.). Harwood Academic Publishers; London. 1985. xii + 512 pp. $65.00. ISBN 3-7186-0269-5.

In the preface to this monograph, the authors state their purpose in writing the text is "systematizing the theoretical and experimental data accumulated in the field of infrared laser photophysics and photochemistry". They have been successful in attaining that goal. The text is a compilation and amplification of a series of articles that have been previously published in various volumes of the journal *Laser Chemistry*.

The authors begin with a chapter covering the physics necessary to the understanding of the interactions of light with matter. Topics include the Schrödinger equation, molecular symmetry, and IR and Raman selection rules. A 100-page chapter is usually insufficient for the development of a deep understanding of these concepts by the reader, and this section of the text is no exception to the rule. However, this chapter will serve as an excellent "refresher" for graduate students, as well as a primer on the terminology and physics of energy transfer and line broadening for those unfamiliar with the field.

The next four chapters relate, in a very thorough manner, the theory of IR radiation–molecule interactions and the physics of multiphoton pumping. Considerable mathematical detail is provided, and extensive use is made of diagrams and examples. A careful reading of these chapters will permit a newcomer in the field to attack the applications described in the chemical literature.

The remainder of the book is devoted to applications and it is in this regard that the monograph will be of service to those already active in this area of research. The authors have chosen to discuss unimolecular reactions, isotopic selectivity, and "multiple-photon IR laser photochemistry" in the final three chapters. The latter considers processes such as successive decay, reaction channel competition, and secondary reactions involving IR MP dissociation products. Each of these sections begins with a short introduction to the topic followed by one or more tables summarizing the appropriate literature. (References are current through 1983.) The subject is then described in detail, making extensive use of the material cited in the tables. Active researchers will find these chapters a useful and fairly complete reference to recent results. Neophytes will appreciate the readability of the text as well as the authors ability to convey, from the widely scattered laser chemistry literature, a sense of the essential data and its interpretation.

To summarize, the monograph is well written, complete, and recommended to those active or contemplating activity in IR MP chemistry.

Joseph J. BelBruno, *Dartmouth College*

Crystals: Growth, Properties and Applications. Volume 10. Growth and Defect Structures. By V. V. Osiko (USSR Academy of Sciences), V. I. Polezhaev (USSR Academy of Sciences), A. A. Sobol (USSR Academy of Sciences), Yu. M. Tairov (Leningrad Electrical Engineering Institute), V. F. Tsvetkov (Leningrad Electrical Engineering Institute), and Yu. K. Voron'ko (USSR Academy of Sciences). Springer-Verlag: Berlin, Heidelberg, and New York. 1984. iv + 150 pp. $44.50. ISBN 3-540-13600-2.

This collection of three unrelated review articles provides a summary of specific schools of thought in crystal physics and chemistry. Tairov and Tsvetko review the phenomenology of polytypism in many kinds of crystals, including silicon, III–V compounds, metals, silicates, and organic crystals. Polytypism describes the observed ability of solids of specified chemical composition to form a host of distinct crystals which differ in the number, nature, and arrangement of layers in the unit cell. Perhaps the best known example is the characterization of the difference between face-centered cubic (fcc) and hexagonally closed-packed (hcp) crystals in terms of ABC and AB stacking of close-packed layers. The complexity of the phenomenon is emphasized in the discussion of the polytype of silicon carbide with the repeating 15-layer sequence ABCBACABACBCACB. The authors discuss the role of chemical bonding, thermodynamic properties, phase transformation, and growth of polytypic crystals. The conclusion is that we are blessed with a wonderful variety of methods for controlling the growth of different polytypes (and making materials with desirable properties), and almost no understanding of why or how they work.

The second article by Osiko, Voron'ko, and Sobol summarizes a narrow cross section of investigations of defect structures using the optical spectroscopy of Lanthanide ions. It may be recommended to readers who need detailed knowledge about defects in non-stoichiometric crystals or solid solutions.

Hydrodynamics, heat and mass transfer during crystal growth are discussed by Polezhaev. This article is a readable and careful presentation of the numerical solution of hydrodynamics problems. There has been tremendous progress in this area recently (although still only in one-and two-dimensional problems), and unfortunately this article is well behind the times, with few references beyond 1980. It does discuss clearly some early work on mathematical models of the Bridgeman, Czochralski, and floating zone crystal growth techniques and is careful to point out the many cases in which two-dimensional hydrodynamic equations fail to describe real experimental growth.

A. D. J. Haymet, *University of California, Berkeley*

Spectroscopy of Condensed Media: Dynamics of Molecular Interactions. By C. H. Wang (University of Utah). Academic Press, Inc.: Orlando, FL. 1984. X + 356 pp. $74.00. ISBN 0-12-734780-1.

Time correlation functions and linear-response theory are the things of spectroscopy. Some texts do introduce this important formulation; however, most texts concentrate on spectroscopic nomenclature, symmetry, and the relation of spectroscopic results to molecular-structure theory. Molecular-dynamics effects are usually abbreviated.

Wang has given us a much-needed alternative view of spectroscopy, using time correlation functions. He presents, in careful, precise language, derivations of such important relations as the fluctuation-dissipation theorem and the memory-function formalism every capable spectroscopist should know. The derivations are complemented with examples of the uses of this approach in interpreting spectroscopic results in terms of molecular dynamics, from both optical and magnetic resonance spectroscopies. In all cases, his concern is for the reader's comprehension of the approximations involved and the origins of complex expressions.

Wang's beautiful book is not for those who wish to *use* spectroscopy; it is appropriate for a special graduate course to investigate the elements of the spectroscopic process and their relation to molecular dynamics. For the spectroscopist who wishes to peer deeply into the connections between the chaotic motions of the molecular world and the relatively regular properties of spectra, reading this book is essential. It has been a much used part of my collection since its publication.

Cecil Dybowski, *University of Delaware*

Progress in Polymer Science. Volume 10. Edited by A. D. Jenkins (University of Sussex) and V. T. Stannett (North Carolina State University at Rayleigh). Pergamon Press: Oxford and Elmsford, NY. 1985. vii + 347 pp. $132.00. ISBN 0-08-032721-4.

This book is a compilation of reviews from the series "Progress in Polymer Science", Volume 10, Numbers 1–4, 1984, which accounts for the fact that some readers may find these reviews already somewhat out of date, with few references beyond 1981. There are six, generally well written reviews covering the following specialized topics: (1) Grafting of Vinyl Monomers to Cellulose by Ceric Ion Initiation (D. J. McDowall, B. S. Gupta, and V. T. Stannett, 50 p, 272 references), (2) Charge-Transfer Initiation and Termination (N. N. Dass, 35 pp, 127 references), (3) New Developments in Block Polymerization (R. Jerome, R. Fayt, and T. Ouhadi, 84 pp, 308 references), (4) Graft Copolymerization onto Cellulosics (S. N. Bhattacharyya and D. Maldas, 100 pp, 382 references), (5) Intramolecular Diffusion-Controlled Reactions and Polymer Dynamics (C. Cuniberti and A. Perico, 46 pp, 61 references), and Alternating Copolymers from Macrozwitterions (I. J. McEwen, 24 pp, 68 references). The style of these reviews tends to be more comprehensive than critical, with extensive numbers of references. The emphasis of most of these reviews is on synthetic methodology and kinetics with relatively brief sections on physical characterization and applications. Chapter 5 is an exception and contains a good deal of theory development on the topic, followed by a discussion on interpretation of experimental results. These reviews will be useful to workers in the respective fields and to those wishing an overview of research on these specific topics.

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Hormonal Proteins and Peptides. Volume XII. Growth Factors. Edited by C. H. Li (University of California, San Francisco). Academic Press: New York. 1984. XIII + 307 pp. $65.00. ISBN 0-12-447212-5.

Various types of growth factors are surveyed in this volume, including possible structural and functional relationships between the growth factors. Levi-Montalcini reviews nerve growth factor (NGF); Humbel, the insulin-like growth factors (IGF), somatomedins and multiplication stimulating activity (MSA); Van Wyk, the somatomedins, biological actions; Nissley and Rechler, the IGF, synthesis, receptors, and carrier proteins; Gospodarowitz, the brain and pituitary growth factors; Antoniades and Owen, human platelet-derived growth factor (PDGF); Baylink et al., skeletal growth factor (SGF); and Cohn, epidermal growth factor

(EGF). The growth factors are all homone-like peptides which are produced by cells both in vivo and in vitro. More than ten growth factors have now been identified and subjected to various methods of protein chemistry. Most have been purified to homogeniety, and primary structures for many are known. One IGF has been synthesized. Somatomedin appears to be under control of pituitary growth hormone, and other growth factors are being investigated for pituitary growth hormone effects.

It is most interesting that the predicted amino acid sequence of simian sarcoma virus transforming gene product is closely related to that of human platelet-derived growth factor. This suggests the possibility that viral oncogenes may be derived from growth factor genes. Also epidermal growth-factor gene sequences have been found to be amplified in A-431 human carcinoma cells. Thus there seems to be an increased possibility for a role of growth factors in cell proliferation, differentiation, and malignancy.

In reading over the current information on NGF, for example, we are impressed with the variety of different in vitro and in vivo effects of this polypeptide. Also the complex pathways involved in biosynthesis, activation, and transfer of growth factors are intriguing. As for most growth factors, they are produced as pro- or prepropeptides which are activated by proteolysis and in some cases by kinases which catalyze phosphorylation of tyrosine or serine residues. They bind to carrier proteins for transfer to other cells and are trapped at target cells by large receptor proteins.

Modern methods of protein chemistry such as gel filtration, isoelectric focusing, slab-gel electrophoresis, affinity chromatography, radioimmunoassay, etc., have made these investigations possible, as the growth factors are present at physiological concentrations of pico- and nanomol levels. It will be very useful to have this progress report on growth factors available in one volume.

Paul Melius, *Auburn University*

Spectroscopic Properties of Inorganic and Organometallic Compounds. Volume 17. Specialist Periodical Reports. Senior Reporters: G. Davidson and E. A. Ebsworth. The Royal Society of Chemistry: London. 1985. xvi + 395 pp. $138.00. ISBN 0-85186-153-9

The purpose of the "Specialist Periodical Reports" is to provide systematic and detailed review coverage of progress in the major areas of chemical research. That aim is admirably fulfilled in this volume which reviews slightly more than 5000 books, reports, and journal articles from the time period of late 1982 to late 1983. Most extensive coverage is given to nuclear magnetic resonance spectroscopy (2856 references), vibrational spectroscopy (1120 references), and Mössbauer spectroscopy (771 references). Also included are chapters on nuclear quadrupole, rotational, and electron diffraction spectroscopy. The organization of material and the reviewers are essentially the same as in the previous volume. However, the layout of the chapter on Mössbauer spectroscopy has been altered to give more emphasis to the rapidly developing area of conversion-electron Mössbauer spectroscopy (c.e.m.s.). This reflects the fact that the number of papers dealing with the development and applications of this technique had more than doubled since the previous review period.

The vast number of publications reviewed in the book makes it difficult for the reviewers to provide any critical discussion of the results; however, they have organized the material in a highly effective manner so that the reader can easily find the most pertinent references. Since the amount of research being conducted in this area is so extensive, it is difficult for any individual to remain adequately informed without the assistance of reviews such as this. It should definitely be included in the library holdings of all chemistry departments which are attempting to conduct research in the areas of inorganic and organometallic chemistry.

Perry C. Reeves, *Abilene Christian University*

Methods in Enzymology. Volume 117. Enzyme Structure. Part J. Edited by C. H. W. Hirs (University of Colorado Medical Center) and Serge N. Timasheff (Brandeis University). Academic Press, Inc.: Orlando, FL. 1985. XXII + 548 pp. $64.50. ISBN 0-12-182017-3.

This is the tenth volume to be published in the series "Enzyme Structure". In contrast to previous volumes, this one is devoted mainly to the structural properties and interactions of the macromolecule as a whole. A wide variety of important proteins, enzymes, and zymogens are included in the application of the various techniques used to measure molecular weights and ligand–macromolecular interactions. In most instances, as each topic is developed there is an excellent description of the experimental equipment together with a sufficient theoretical treatment to give the reader a workable knowledge of the subject and a clear understanding of the limitations and significance of the results.

The first part of the book deals with applications of the air-turbine centrifuge to measure molecular weights, protein self-association, and ligand binding. The use of the ultracentrifuge to determine the partial specific volumes of proteins in 8 M urea is outlined. Radiation inactivation is described as a means of estimating the molecular weights of active units even in in situ, in membranes or intact cells. Considerable attention is given to the determination of hydrodynamic parameters by active enzyme centrifugation, computer-controlled scanning gel chromatography, and small-angle X-ray scattering.

The determination of covolume and axial ratios as well as protein hydration can be found in this volume. A survey of photon correlation spectroscopy for the measurement of time correlation functions is discussed and the mathematical background is developed in great detail.

The second section of this volume is a source of information concerning the interaction of macromolecules with ligands. It refers to the kinds of techniques used, and the subject is introduced with an extensive presentation of nonlinear least-squares analysis. The following methods used to study ligand–protein interactions are included: equilibrium gel-penetration, ultrafiltration, electrophoretic and spectroscopic methods, and extended X-ray absorption fine structure. The latter technique, which is in its infancy, is treated extensively. Other topics include protein chromatography on hydroxyapatite and two comprehensive articles on protein self-association; ligand induced (measured by velocity sedimentation) and ligand-binding isotherms (measured by specific electrodes, equilibrium dialysis, or batch gel filtration) as a method of probing multiple equilibria systems. The theory of multiple equilibria systems and data plotting methods for ligand-binding isotherms are discussed.

This volume is an excellent reference source for current techniques employed to investigate properties of macromolecules. Since most of the information relates to the "exterior" aspects of a variety of macromolecules, its contents will be of interest not only to enzymologists but to biochemists and chemists working with proteins and other polymers.

James A. Stewart, *University of North Dakota*

Desorption Mass Spectrometry: Are SIMS and FAB the Same? (ACS Symposium Series No. 291). Edited by Phillip A. Lyon (3M). American Chemical Society: Washington, D.C. 1985. vii + 248 pp. $44.95. ISBN 0-8412-0942-1.

Recent advances in mass spectrometry have revolutionized the field in the past few years. In no area is that more evident than in the extension of MS capabilities to labile, involatile, and high molecular-weight compounds. This has resulted primarily from the evolution of a suite of desorption ionization methods [including fast atom bombardment (FAB), secondary ion mass spectrometry (SIMS), ^{252}Cf plasma desorption (PD), and laser desorption (LD)] which has made it possible to routinely generate long-lived ion currents from such compounds. This volume focuses on two of these methods: the new contender, FAB, introduced just 5 years ago, and the similar but established surface analysis technique, SIMS, modified for molecular analysis. Included are five chapters dealing with fundamental aspects of desorption ionization (including PD and LD), three chapters discussing FAB and SIMS instrumentation, and finally six chapters displaying the breadth of their application.

The book's subtitle "Are SIMS and FAB the same?" is an intriguing question. The introduction of FAB 5 years ago was carefully orchestrated by mass spectrometer manufacturers, based upon research performed at the University of Manchester Institute of Science and Technology the preceding few years. Despite the fanfare accorded the "new discovery", it was in reality a straightforward extension of earlier SIMS studies. Indeed, the name "fast atom bombardment" hid (as did the early talks and publications) the critical feature of FAB, the use of an involatile liquid matrix to provide a renewable sample surface and the resultant long-lived ion signal; the use of atoms rather than ions as the bombarding species is little more than an instrumental convenience on the sector MS instruments on which FAB was developed. The symposium was organized "to provide an open dialogue between researchers in the fields of SIMS and FAB". Unfortunately, this volume is more a collection of monologues, with none really addressing the question at hand. As a result, the reader is left to draw his own conclusions.

As in most symposium series volumes, chapters are uneven in their depth and breadth of coverage, varying from 8 to 43 pp in length and from 8 to 123 references. Two of the chapters on fundamentals deserve special attention: one by Pachuta and Cooks which clearly outlines the mechanism of ion ejection in FAB and SIMS, and one by Macfarlane which puts the FAB and SIMS work of others in perspective with each other and with PD. The chapter by Magee describes an extensive base of experience with SIMS instrumentation and extends it to delineate crucial requirements for FAB instrumentation which have not yet been implemented. Particularly useful are chapters on SIMS and FAB applications by Colton et al. and Caprioli. The former presents a broad range of applications, including the role of various matrices (e.g., liquid Ga/In alloy and carbon) and the use of derivatization. Caprioli reviews the use of FAB to study chemical reactions (e.g., enzyme kinetics) in

glycerol/water solution on the FAB probe.

In summary, do not expect to find a direct answer to the title question in this volume. You will not. What you will find is an interesting collection of research papers spanning the field of desorption ionization and published only 12 months after the symposium was held.

Richard A. Yost, *University of Florida*

Polymer Photophysics. Edited by D. Phillips (Royal Institution, London). Chapman and Hall, Ltd.: London and New York. 1985. 437 pp. $59.95. ISBN 0-412-16510-4.

This book, with the subtitle "Luminescence, energy migration and molecular motion in synthetic polymers", is mainly devoted to luminescence spectroscopy of polymers. It consists of eight chapters, all written by acknowledged specialists in that field.

The first chapter is a brief sketch of photophysics of organic compounds, which is helpful to those who are not expertise in this regard. Next comes a review of the experimental results of phosphorescence and delayed emission in glassy matrices, films, and fluid solutions. The third chapter is concerned with the different pathways and mechanism of energy migration and transfer. The study of polymer orientation by means of polarized fluorescence is presented in chapter four, in which theoretical understanding is developed and compared with the experimental results. Chapter six is a description of dynamic depolarization of luminescence, which is a time-resolved technique relating to the segmental motion and whole molecule motion of polymers. The rest of the chapters deal with luminescence studies of polymers in fluid solution, synthetic polyelectrolytes, and optically active vinyl polymers.

The technique of luminescence is a very sensitive one in studying the molecular motion and energy transfer in polymers, and the instrument is not expensive either; rapid advances are foreseen in the near future. The only trouble is that most synthetic polymers are not luminescent by themselves; a probe or label must be introduced, and the investigation is mostly indirect in nature.

This book is well-written and is a timely review of the theories and experimental results of luminescences. It is a good reference book to those who are interested in this field.

Tong-yin Yu, *Fudan University, Shanghai*

Inorganic and Organometallic Reaction Mechanisms. By Jim D. Atwood (State University of New York, Buffalo). Brooks/Cole Publishing Co.: Monterey, CA. 1985. xii + 322 pp. $26.50. ISBN 0-534-03777-1.

This book is intended to be used as a text for an advanced undergraduate or graduate-level course in inorganic/organometallic reaction mechanisms. Although not stated in the title, the coverage is limited to the transition metals, with no mention of main group or f-element chemistry. The strongest features of the book are the inclusion of problems at the end of each of the eight chapters and a functional index. Many of the problems are referenced; they represent various levels of difficulty and follow closely the topics covered in the chapters.

The first chapter is a short introduction to the types of information used to determine a mechanism. For transition-metal reaction mechanisms, the area of kinetics is especially significant and is covered in some detail. Besides showing the common inorganic rate laws and how they are derived, descriptions of some of the basic techniques for collecting kinetic information are included with inorganic examples. Not all the techniques mentioned in the later chapters are included here (temperature jump, ultrasonic absorption, specialized pulse-NMR methods, isotope effects, etc.), a fact that may cause some confusion when presenting these topics.

Chapters 2 and 3 cover lightly the classical areas of substitution reactions in inorganic square-planar and octahedral complexes, respectively. Examples are selected to illustrate the limiting dissociative and associative mechanisms along with the associative interchange and dissociative interchange mechanisms. The presentation is improved by including pertinent data from important references. The coverage is slightly above that found in undergraduate advanced inorganic texts.

Substitution in organometallic complexes is the topic of Chapter 4, which is about twice as long as the others (60 pages). Mononuclear metal carbonyls are discussed at some length, along with substitution in metal carbonyl dimers and clusters. For metal–alkyl complex substitution, a description of migratory insertion in alkyl carbonyls is provided. It would have been better to cover this latter topic by itself in a separate chapter, as it is mentioned many times in subsequent chapters, and there is a wealth of unique mechanistic work to discuss. Significant topics such as using optical activity to probe stereochemistry at the migrating carbon as well as at the metal center could have been covered in more detail. Migration of optically active alkyl groups is mentioned; however, the references and examples given deal with optically inactive diastereomers. The chapter also presents short descriptions of substitutions in methyl hydride, nitrosyl, and allyl complexes.

Chapter 5 examines oxidative-addition/reductive-elimination in organotransition-metal complexes. The two topics are separated and presented by first giving a short list of examples and then exploring the proposed mechanisms and evidence to support them.

Chapter 6 is devoted to a presentation of several industrial processes that involve homogeneous catalysis by transition metals. The topics presented are the following: hydrogenation; hydroformylation; Wacker process; adiponitrile synthesis via hydrocyanation of butadiene; olefin metathesis; alkene polymerization; and the Monsanto acetic acid process. The proposed catalytic cycles are given with little justification but are related to topics discussed in earlier chapters.

Stereochemical nonrigidity is the title for Chapter 7 and is separated into coordination number isomerization (i.e., tetrahedral to square planar for four-coordinate complexes), "ring-whizzing", and rearrangements in metal clusters. NMR techniques dominate in this section which illustrates the importance of these methods in organometallic mechanism investigations.

Chapter 8 looks at electron transfer reaction mechanisms of coordination complexes. It seems as though this chapter was added as an afterthought, and it does not fit into the common nature of the other chapters. Other topics such as photochemistry and theoretical calculations in inorganic/organometallic systems, which were not covered, would have had better correlation with the other topics.

In summary, the book is appropriate for an advanced undergraduate or graduate-level course in inorganic and organometallic reaction mechanisms. The information is fairly timely, with most of the chapters having several 1983 references. Individuals may want to supplement this text with other references to achieve a more complete coverage of the field. Although there may be shortcomings to the book, the problems at the end of each chapter, many with references, are a strong point. This will provide a route to encourage students to read the primary literature and will help develop a lasting appreciation of the field. The book will find little use by researchers in the area but would be helpful to those who have their training in peripheral areas and are looking for a short introduction.

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