

of a single product ($^1\text{H NMR}$ δ 5.74 (q, $J = 1.1$ Hz, 1 H), 2.46 (d, $J = 18$ Hz, 1 H), 2.30 (d, $J = 18$ Hz, 1 H), 2.03 (d, 3 H, $J = 1.1$ Hz), 1.2–2 (m, 11 H, 0.71 (d, $J = 7$ Hz, 3 H); $^{13}\text{C NMR}$ δ 208.1, 175.0, 130.2, 54.9, 50.5, 41.7, 38.6, 32.0, 30.4, 30.3, 23.7, 18.9, 18.1). On the basis of the anticipated migration with retention of configuration, the stereochemistry is assigned as depicted in **12**.

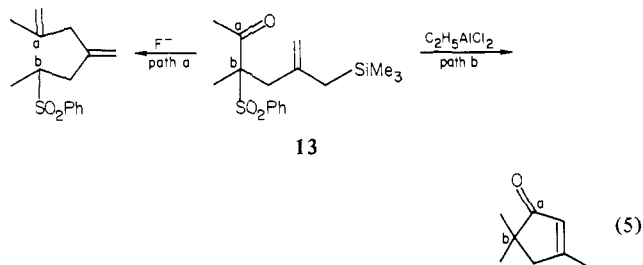
The sensitivity of the sulfone group to Lewis acid induced ionization should open a new dimension to the utility of sulfones in synthesis.⁶ As this example illustrates, a total reorientation

(6) While an arenosulfonyl group serves as a leaving group leading to eliminations, cyclizations, and fragmentations under basic conditions, to our knowledge such reactions have not been recorded in the presence of Lewis acids.

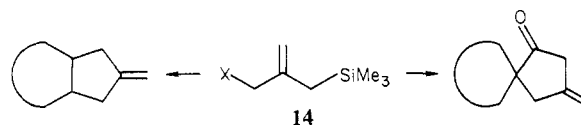
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(8) Hosomi, A.; Hashimoto, H.; Sakurai, H. *Tetrahedron Lett.* **1980**, *21*, 951. Knapp, S.; O'Connor, V.; Mobilis, D. *Ibid.* **1980**, *21*, 4557; Henning, R.; Hoffmann, H. M. R. *Ibid.* **1982**, *23*, 2305. Hoffmann, H. M. R.; Henning, R.; Lalko, D. R. *Angew. Chem., Int. Ed. Engl.* **1982**, *21*, 442.

of **13** from an intercalation (eq 5, path a) to a cyclocontraction-



spiroannulation⁹ (eq 5, path b) results upon switching from a catalyst that behaves as a nucleophilic trigger (path a) to an electrophilic acceptor (path b). In addition, the versatility of the bifunctional reagents represented by **14**^{2,7,8} in synthesis in general, and cyclopentane ring synthesis in particular, is enhanced.



Acknowledgment. We thank the National Science Foundation and the National Institutes of Health, General Medical Sciences, for their generous support of our programs.

Registry No. **1**, 74532-54-0; **2a**, 74532-82-4; **2b**, 74546-10-4; **2c**, 67886-41-3; **3a**, 85923-85-9; **3b**, 74532-64-2; **3c**, 74532-57-3; **4a**, 81302-85-4; **4b**, 85923-86-0; **4c**, 85939-40-8; **6**, 563-43-9; **8a**, 85923-88-2; **8b**, 85923-89-3; **8c**, 85923-87-1; **10**, 85923-90-6; **11**, 85923-91-7; **12**, 85923-92-8; **13**, 85939-41-9.

(9) For reviews of spiroannulations see: Marshall, J. A.; Brady, S. A.; Andersen, N. H. *Fortschr. Chem. Org. Naturst.* **1974**, *31*, 283. Krapcho, A. P. *Synthesis* **1974**, 383; **1976**, 425. Martin, S. F. *Tetrahedron* **1980**, *36*, 419.

Book Reviews*

Environmental and Climatic Impact of Coal Utilization. By J. J. Singh (NASA Research Center) and A. Deepak (Institute for Atmospheric Optics and Remote Sensing). Academic Press, New York. 1980. xvi + 655 pp. \$39.50.

The proceedings of the Symposium on Environmental and Climatic Impact of Coal Utilization held in Williamsburg, Virginia, April 1979 contains 32 papers divided into the following research areas: Aerosol Emissions from Coal Plants (13 papers); Gaseous Emissions from Coal Plants (7 papers); Climatic Impact of Coal Plant Emissions (4 papers); and Environmental Impact of Coal plant Emissions (8 papers). The title of the book is misleading in part because the large majority of papers are concerned with the physics and chemistry of aerosols, sulfur compounds and carbon dioxide in the atmospheric environment, and climatic effects. Topics that are related to the atmospheric environment and climate are well treated, for example aerosol formation and characterization, the COS and CS₂ budget in the atmosphere, and the optical effects of aerosols. However, the book contains little on the effects of coal utilization on the aquatic or terrestrial environment. There is one review of analytical techniques for the determination of trace elements in air particulates but this is somewhat out of place because only one other paper is principally concerned with the trace element contents of aerosols. The environmental fate of trace elements and their species emitted by coal-fired power plants is largely ignored. Other important environmental concerns such as the effects of coal combustion on the carbon dioxide cycle (3 papers) and acid rain effects (1 paper) receive little attention. Only one short general paper addresses the increasingly important contribution of coal gasification and liquefaction processes to coal utilization. Probably the major criticism of the book is that there is no discussion of

some major environmental problems of coal utilization such as thermal effects of discharges to lakes, ash pond discharges to the aquatic environment, and effects of coal combustion on the terrestrial environment. A less general title to the work would have been more appropriate.

Royston H. Filby, *Washington State University*

Laser Probes for Combustion Chemistry. ACS Symposium Series. No. 134. Edited by David R. Crosley (SRI International) The American Chemical Society, Washington, D.C. 1980. xii + 495 pp. \$44.50.

This book is based on a symposium sponsored by the Division of Physical Chemistry at the 178th Meeting of the American Chemical Society, Washington, D.C., September 9–14, 1979. It is divided into seven major sections: Overviews; Laser-Induced Fluorescence: Molecules; Laser-Induced Fluorescence: Atoms; Spontaneous Raman Scattering; Coherent Raman Spectroscopy; Modelling and Kinetics; and Other Diagnostic Techniques. The first article in most of the major sections functions as a review and/or overview of the particular technique that the section addresses, although more specific results from the author's own laboratories are usually given in the article as well. These review/overview articles are based on invited lectures at the symposium. Included in this category are the general overviews by David R. Crosley and J. R. McDonald and the articles on Laser-Induced Fluorescence Spectroscopy in Flames by John W. Dailey, on Raman-Scattering Measurements of Combustion Properties by Marshall Lapp, on Spatially Precise Laser Diagnostics for Practical Combustor Probing by Alan C. Eckbreth, and on Detailed Modelling of Combustion: A Noninterfering Diagnostic Tool by E. S. Oran, J. P. Boris, and M. J. Fritts. Following these in each section are shorter articles taken from contributed oral and poster sessions at the Symposium.

The book provides an excellent introduction to the wide variety of

*Unsigned book reviews are by the Book Review Editor.

applications of lasers to combustion problems and also allows the reader to assess the state of the art through the end of 1979. (Most manuscripts were submitted in early 1980 although the Symposium was in September 1979.) Since many of these laser techniques are in their infancy, significant developments have been made in the past 3 years which are, of course, not contained in the book. One can only hope another symposium and Proceedings will be forthcoming in the next few years. The reviews and overviews are quite well done, although in many ways the one by Marshall Lapp should be read immediately after the initial Crosley overview, even though it falls in the middle of the book, because its first 10 pages do an excellent job of classifying and categorizing most all of the other techniques described elsewhere in the book. The 30-page subject index is quite detailed and useful.

John R. Eyles, *University of Florida*

Alternative Energy Sources. Volumes A and B. Edited by Jamal T. Manassah. Academic Press, New York. 1981. Volume A: 515 pp. \$49.5 (hard bound). Volume B: 415 pp. \$45.00 (hard bound). \$45.00 (hard bound).

This book is an assembly of the papers on alternative energy sources which were presented in a symposium held in Kuwait in February 1980. Leading experts in different fields reviewed the state of the art of their respective fields of studies. Part A contains a chapter on each of the following subjects: enhanced oil recovery, tar sands technology, synthetic fuels from coal, synthetic fuels from biomass, ethanol from biomass, photovoltaic conversion of solar energy, and wind energy research program. Part B contains chapters on nuclear fission on fusion power, energy storage in utilities, the relation between future transportation needs and energy availability, integrated evaluation of alternative energy sources, risk evaluation in energy-related ventures, and alternative energy systems and developing world needs.

The books cover a very wide range of subjects at variable levels of depth. For the most part each chapter is a very good review of the respective field and most chapters cite the important pertinent references (although some chapters have no references at all). The discussions are qualitative but in general they point out the difficulties still faced and areas of research needs in each field.

In my opinion these books can serve best as textbooks for a general elective course on alternative energy sources. Each chapter can of course be an excellent introduction for professionals who are entering specific research in the respective fields, although readers will have to go to the referenced material to gain more indepth knowledge. The books will be a useful addition to University and to other public libraries.

A. Attar, *North Carolina State University*

Origin of Life: Proceedings of the Third ISSOL Meeting and the Sixth ICOL Meeting, Jerusalem, 1980. Edited by Y. Wolman (Hebrew University). D. Reidel Publishing Company, Dordrecht, Holland. xv + 613 pp. \$73.50.

Origin of life studies have achieved respectability, but the field is probably best described as adolescent—full of ideas, enthusiasm, and a sense of movement, free of dogma, uneven in quality, sometimes unsure of direction, and given to exaggeration. These qualities are reflected in the present compilation of 77 articles; most of them report first-rate research rooted in a sound grasp of chemical principles, but there is naive speculation and murky mysticism as well. The international flavor is refreshing, with 34 articles authored or co-authored by North Americans, 24 by Western and 4 by Eastern Europeans, 10 by Israelis, and 13 by Japanese. All are in English and the editor has succeeded in keeping most of them concise and readable, though the difficulty of expressing French ideas in English is sometimes annoyingly evident.

The organization of this volume is simple; the articles are arranged in a single sequence in order of increasing system complexity with no cumbersome apparatus of headings, subheadings, editorial explication, etc. The reader must search around a bit to locate the articles most relevant to his interests, but this task is made easier by an excellent index.

The first 9 articles address the problem of abiotic synthesis of simple organic molecules in comets, meteorites, and interstellar gas clouds and the possible role of such extraterrestrial sources in "seeding" the early Earth. The coverage is fair, with due attention given to the ideas of Hoyle and Wickramasinghe. Especially good are the introductory review by Brown and the discussion of the origin of nitrogenous compounds in meteorites by Stoks and Schwartz. The next 21 articles deal with the most familiar and venerable area of inquiry in the field, the problem of abiotic synthesis of biomolecule building blocks—sugars, amino acids, and purine/pyrimidine bases and nucleotides—in the early terrestrial chemical environment. All major current themes are touched upon, including the relative importance of CH₄, HCN, CO, and CO₂ as carbon sources, the possible role of clays as catalysts and/or templates, the influence of concentration and temperature, and the nature of energy

inputs to the process (if any). Impressive are the article of Miller and van Trump on the Strecker synthesis, Voet and Schwartz' study of the mechanism of adenine synthesis from HCN, and Ingmanson and Dowler's provocative discussion of oceanic rift zones as a possible milieu for abiologic syntheses. There follow 12 articles on the assembly of more complex biological units—polypeptides, nucleic acids, membranes, and proto-cellular structures—featuring a stimulating article by Orgel and co-workers on the Zn²⁺ catalysis of oligonucleic acid formation and an illuminating review by Oró and co-workers. The next eight articles take up the origin of stereospecificity in chiral biomolecules. No firm conclusions are reached, but some fascinating chemistry is displayed. Ten articles are then devoted to the central problem in the field: the origin of the genetic code and the nature of the original coupling between protein synthesis and information storage in polynucleotides. Unfortunately, most of these are unconvincing when not downright impenetrable. However, White gives a clear account of his seminal model for the beginning of Darwinian evolution and Lacey and Mullins offer persuasive arguments for an original amino acid-anticodon correlation. The final 15 articles take up later stages in evolution, coincident with and subsequent to the appearance of the genetic code. Especially valuable here are Visser's incisive ideas on the evolution of biocatalysts, articles by Schwarz and Dayhoff on phylogenetic relationships between prokaryotes and eukaryotes, Rambler's compilation of data on bacterial UV sensitivity, and Seckbach and Fredrick's discussion of a possible prokaryote/eukaryote intermediate.

In summary, this book offers a representative and stimulating overview of the field. Not everything here is worthy of attention, and few questions are definitively answered, but on balance it is essential reading for anyone seriously thinking about bioorigins. Chemists should find it exciting and a fertile source of ideas.

Mario E. Baur, *University of California at Los Angeles*

Patenting in the Biological Sciences. By R. S. Crespi (British Technological Group). John Wiley & Sons, Inc., New York. 1982. 211 pp. \$38.00 (U.S.).

This book should be required reading for every scientist in the chemical and biological areas who has any interest in seeking patent protection on inventions. The book is well written and is easily understood. While the title would suggest applications only to the biological sciences, it is equally valuable to any area in which the chemical sciences apply.

The bulk of the examples and discussion relate directly to the U.S. and U.K. systems. However, there is limited but informative treatment of the European Patent System and the Japanese Patent System.

The essential aspects of the patent process all receive good treatment, including: the patent disclosure; categories of patentable invention; conditions of patentability; the mechanism of patenting; enforcement of patents; and the exploitation of patents. There is a very good section on patents in genetic engineering and microbiological inventions. Inventors receive excellent advice on the mechanism to follow in protecting and exploiting their invention.

The book contains a limited number of examples but these are generally quite informative. The best advice in the book is to consult expert patent attorneys in seeking protection for an invention. My advice to the novice inventor is to read this book!

Kelvin K. Ogilvie, *McGill University*

Modern Aspects of Electrochemistry. No. 14. Edited by J. O'M. Bockris (Texas A&M University), B. E. Conway (University of Ottawa), and R. E. White (Texas A&M University). Plenum Press, New York, NY. 1982. xv + 661 pp. \$55.00.

The latest issue of this well-established series contains eight chapters: Ultrasonic Vibration Potentials, by R. Zana and E. B. Yeager; Impedance Measurements in Electrochemical Systems, by D. D. MacDonald and M. C. H. McKubre; Photoelectrochemical Kinetics and Related Devices, by S. U. M. Khan and J. O. M. Brockris; Fundamental and Applied aspects of Anodic Chlorine Production, by D. M. Novak, B. V. Tilak, and B. E. Conway; Electrochemical Behavior of Titanium, by E. J. Kelly; Structural Properties of Membrane Ionomers, by K. A. Mauritz and A. J. Hopfinger; Bioelectrochemistry-Electrophysiology-Electrobiology, by E. Findle; and Small Particle Effects and Structural Consideration for Electrocatalysis, by K. Kinshita. If the titles of the eight reviews suggest that the topics covered range from the esoteric to the theoretical to applied industrial subjects, the inference may be reinforced by noting among the almost 1000 index entries such topics as Electrochemical Acupuncture, Algorithms for LaPlace Transformations, and Anode Compositions for Chlorine Evolution. The difficulties inherent in compiling a truly "modern" compendium, subject to the constraints on bringing a book into existence via the present procedures are reflected by the scarcity of references that date from later than 1978. Some of the reviews contain none in this category, and none contain more than

a scattering thereof, almost all 1979.

The difficulties of finding a topic sufficiently limited that a truly comprehensive review of it can be compiled are suggested by the assorted disclaimers to having achieved completeness that are scattered throughout the volume. That in the matter of reviews, style is a matter of individual taste is also evident. The chapter on photochemical devices is written, if not in telegraphese, at least in terse sentences and short paragraphs, which makes for efficiency in the perusing of the material, but which purists might find distracting. At the other extreme is the notably coherent presentation on ultrasonic vibration potentials.

Each of the authors has condensed a very large amount of information and yet retained enough intelligibility that the reader can usually readily decide the merits of seeking the original material. Persons needing or wanting to know what is being done in the areas corresponding to the eight major headings or most any of the hundreds of subheadings that can be imagined thereunder would find that this volume makes a useful starting point.

L. F. Koons, *Tuskegee Institute*

Computational Methods in Chemistry. Edited by Joachim Bargon. Plenum Press, New York and London. 1980. 320 pp. \$37.50.

This volume, one of the recent additions to the "IBM Research Symposia Series", is a useful collection of overviews in various selected areas in computational chemistry. The articles do not provide the details in their respective areas that one might like, but the references collected are helpful to the reader who is interested in pursuing a particular area in depth.

As one might expect from the title, this volume is heavily biased toward quantum chemical calculations. There are, however, several spectroscopic articles, most notably Birsch's discussion of the methods employed in the program DAVINS. [We note that the article by Bock et al. contains no *explicit* justification for being included in a volume devoted to computational methods!] Non-numerical applications are represented by a single article in which Ugi et al. discuss their analyses of reaction pathways.

Finally, the last article in this volume has, unfortunately, taken on only historical significance. This is a discussion of the programs and resources of the now-defunct National Resource for Computation in Chemistry.

F. A. Van-Catledge, *Central Research and Development Department, DuPont*

Thermal Electrocyclic Reactions. By Elliot N. Marvel (Oregon State University). Academic Press, New York, NY. 1980. ix + 422 pages. \$51.00.

This excellent book reviews one Woodward-Hoffmann class of pericyclic reactions—electrocyclic reactions—in excellent fashion. After introduction and succinct theory chapters, electrocyclic reactions ranging from solvolysis of cyclopropyl derivatives (2-electron electrocyclic ring openings) through a 22-electron electrocyclic ring closure are critically reviewed. The chapters are organized according to the number of electrons involved, except that all odd-electron systems are discussed together. Each chapter contains lucid and critical discussions of the literature through 1979, including complete tables of rate data and activation parameters, and a section on synthetic applications of electrocyclic reactions. All in all, a marvelous and indispensable book for synthetic and pericyclic chemists.

K. N. Houk, *University of Pittsburgh*

Rodd's Chemistry of Carbon Compounds. Second Edition. Supplement. Volume III. Parts D-F. Edited by M. F. Ansell. Elsevier Scientific Publishing Company, New York and Amsterdam. 1982. xx + 422 pp. \$111.50.

This volume is a supplement to Chapters 13–21 of Volume III, Parts D and E and part of F, the writing of which was finished in about 1973, and which deals with aralkylamines, aryl alcohols, aldehydes, and ketones, alkenylbenzenes, arylbenzenes, and di-, tri-, and tetraarylmethanes. Only one supplementary chapter discloses the period it is intended to cover (1973–1979).

The treatment of the subjects is fairly strictly reportorial, although some of the contributions have introduced some welcome interpretation. One should not expect to obtain general understanding or an overview from this work, for it is strictly a review of new work. The numerous references are incorporated into the text, a helpful feature, but some of them have peculiar orthography (e.g., *J. chem. Soc.*), and most annoyingly, "*loc. cit.*" is used too much. The chapters are reproduced from the authors' typescripts, which in some instances are jarringly non-uniform. The worst feature (or lack of it) is the absence of running headings, which makes it unnecessarily difficult to find one's way in the book.

Although the production of this book is not up to the standard of the parent work, it is a valuable supplement. It has a very thorough index,

which enhances its value as a guide to recent (but not very recent) advances in the narrowly defined areas covered.

Analysis of Pesticide Residues. Edited by H. A. Moyer (University of Florida). John Wiley, New York. 1981. vii + 468 pp. \$45.00.

This is Volume 58 in Kolthoff's Series of Monographs on Analytical Chemistry and its Applications. This book is intended as a comprehensive guide to the latest techniques and applications of pesticide trace analysis. It covers practical techniques with broad applications.

In Chapter 1, J. F. Thompson and R. R. Watts describe the bolts and nuts of gas-chromatographic columns in pesticide analysis, and give many useful hints for selecting the best possible column materials. In Chapter 2, P. T. Hollans and R. Greenhalgh help readers with the selection of gas-chromatographic detectors for pesticide residue analysis and explain their theory. In Chapter 3, J. D. MacNeil and R. W. Frei describe quantitative in-situ analysis of pesticides on thin-layer chromatograms. Chapter 4, by H. A. Moyer, covers high performance liquid chromatographic analysis of pesticide residues. Chapter 5, by W. B. Wheeler and N. P. Thompson, describes the analysis of chlorinated hydrocarbons. Chapter 6, by D. J. Jensen and R. D. Glas, covers the analysis for residues of acidic herbicides. In Chapter 7, M. C. Bowman describes the analysis of organophosphorus pesticides. Chapter 8, by J. N. Seiber, deals with carbamate insecticide residue analysis by gas-liquid chromatography. Chapter 9, by D. A. Carlson, covers residue analysis and analytical chemistry of Insect Pheromones and IGRs. Chapter 10, by M. L. Leng, deals with the status of government requirements for pesticide residue analysis and monitoring studies.

This book is useful to all practitioners and makes a valuable addition to the series of monographs in analytical chemistry.

Beat Meyer, *University of Washington*

Covalent Catalysis by Enzymes. By Leonard B. Spector. Springer-Verlag, New York, Heidelberg, and Berlin. 1982. xii + 276 pp. \$32.90.

The author started thinking about the possibility that enzymes form covalent intermediates as part of their mechanism of action while investigating acetate kinase, which catalyzes the reversible reaction between ATP and acetate to give acetylphosphate and ADP. It was originally thought that the mechanism was a direct transfer of phosphate from ATP to acetate, but a covalent phosphoenzyme intermediate was found, and the enzyme-catalyzed reaction was therefore a double displacement. Single-displacement enzyme mechanisms had never been demonstrated, while several enzymes had been shown to form covalent intermediates and have a double-displacement mechanism. A further consideration of homogeneous and heterogeneous chemical catalysis also showed that covalent intermediates were formed between catalyst and reactant.

In Chapter 1, the author develops his thesis that enzymic reactions take place by forming covalent intermediates. He considers that heterogeneous chemical catalysis has exact counterparts in enzymic catalysis. He further considers that enzyme examples, where covalent intermediates are most likely to occur, are those reactions where there is stereochemical retention of configuration and hence a double-displacement mechanism. Concerning reactions with inversion of configuration, however, it is more difficult to see how a covalent intermediate and hence a double-displacement mechanism could be involved. Nevertheless, Spector gives examples of enzymes that catalyze inversion of configuration and also form covalent enzyme intermediates. These enzymes are shown, in some cases and postulated in others, to form two covalent intermediates and to have a triple displacement mechanism.

In the next six chapters, he presents a survey of the literature of the six main classes of enzymes of the Enzyme Commission of the International Union of Biochemistry: oxidoreductases, transferases, hydrolases, lyases, isomerases, and ligases. This survey shows that 465 of the 2200 enzymes (21%) listed by the Enzyme Commission form covalent intermediates as a part of their mechanism of catalysis. In each chapter, he considers the detailed mechanisms of several enzymes, the smallest being the oxidoreductases with six and the largest being the transferases with twenty-five. Each chapter terminates with a listing of the enzymes that have evidence for the formation of covalent intermediates, the type of evidence, and the literature references.

In the last chapter, the author proceeds to develop arguments to substantiate his hypothesis that all enzymes act by means of covalent intermediate(s).

Overall, the book presents detailed examples of a total of 80 enzyme mechanisms and is an interesting survey of the mechanism of enzyme action. It, therefore, would be an excellent text for a graduate course in enzyme mechanisms and a valuable reference for the practicing enzymologist and biochemist. Further, it provides logical and clear explanations as to exactly how enzymes go about their job of catalyzing reactions, and it dispels some of the "mystery" that sometimes surrounds the action of enzymes. Although there will undoubtedly still be those

proponents of the noncovalent, single-displacement, carbonium ion stabilized mechanisms, Spector has provided ample ammunition against such hypotheses.

John F. Robyt, *Iowa State University*

Pyrolysis Mass Spectrometry of Recent and Fossil Biomaterials. By Henk L. C. Meuzelaar (University of Utah), Johan Haverkamp (F. O. M. Institute for Atomic and Molecular Physics, Amsterdam, The Netherlands), and Fred D. Hileman (Monsanto Corporation, Dayton, Ohio). Elsevier Scientific Publishing Company, Amsterdam, The Netherlands. 1982. xiv + 293 pp. \$67.50.

Pyrolysis is one of the oldest techniques for characterizing organic substances. After a long period of neglect, it has again become a valued technique, though in a much more sophisticated form.

The form of the technique chiefly covered by this book is specially applicable to substances that cannot volatilize without decomposition. The method of heating preferred by the authors depends on the fact that the Q of a coil in an inductive field drops drastically when the magnetic properties of the alloy change at the Curie point. The sample, placed in the coil, is heated very rapidly to a fixed temperature (the Curie point of the alloy selected, commonly 510 °C), and then held there. Pyrolysis products are either bled directly into a mass spectrometer or fractionated by gas chromatography with mass spectrometry detection and a dedicated computer for data acquisition. The mass spectral data can be analyzed by such statistical procedures as principal components and discriminant analysis. In this way, series of peaks due to different structural components of a complex molecule, or to structures in the components of a complex mixture, can be sorted out and interpreted.

The literature on this type of pyrolysis system only goes back a very few years, and the authors have been major contributors to this literature. It is pleasing that they have produced this monograph so early.

The book starts with a useful review of experimental techniques for pyrolysis and product analysis. The pyrolysis behavior of a number of biological polymers is discussed, and this discussion is by no means limited to Curie-point pyrolysis. It is shown that there are indeed common features in the product distribution from all polymers of any given type, so that class recognition as well as individual identifications can be achieved. I found the review of statistical methods of interpreting complex mass spectra rather disappointing. All of the principal procedures are covered, but I should rather have seen a fuller exposition of these extremely powerful means of data handling, little known to chemists.

Over half of the book consists of an atlas of Curie-point pyrolysis/mass spectra, which naturally reflects the authors' own interests and illustrates some of the classes of substances to which the technique can usefully be applied. These include a number of biological polymers, humic acids, kerogens from petroleum source rocks, a few coals, and manmade polymers. Experimental conditions are specified and principal features of the spectra are discussed. There are copious literature references scattered through the text and a single alphabetical list of citations is placed at the end of the book—a very useful feature.

Obviously this is a book of rather narrow scope, and perhaps only those active in the field will want to own a personal copy. However, the book deserves a wider readership. It demonstrates that pyrolysis/mass spectrometry can now take its place beside NMR, GC/MS, FT-IR, etc., as part of the armory of analytical techniques now available to the organic chemist, and to those in such related fields as biochemistry, organic geochemistry, and polymer science. This book is clear, well written, and organized, and will give the reader a very fair appraisal of what the technique can and cannot do.

P. H. Given, *The Pennsylvania State University*

Denitrification. By W. J. Payne (University of Georgia). John Wiley & Sons, New York. 1981. xiv + 214 pp. \$35.00.

The author has published a comprehensive review of the history, microbiology, and biochemistry of microbial denitrification, including 466 cited references. Denitrification in the agricultural scenario has been clearly outlined from the viewpoint of indicating the nutrient losses associated with the process and of seeking methods of minimization through a better understanding of the process.

After an appropriate historical introduction, which include many asides and comments from the author (and which in fact persist throughout the entire book), the text deals extensively, in the following eight chapters, with the microbiology, biochemistry, and genetics associated with the denitrification process. This section is clearly the major emphasis of the book. While only a brief section on assay techniques is included in these chapters, this is subsequently supplemented by a chapter on the techniques developed to identify nitrogen transformation in the field of Soil Science.

The chapter on aqueous denitrification in either marine or fresh water environments emphasizes the estimation of the total nitrogen flux losses

to the atmosphere. Unfortunately the author did not address the immediate concerns of environmental ecologists who are attempting to control excess nutrients contributed by urban and rural drainage from adjacent watersheds. In these instances natural denitrification is welcomed to reduce unwanted eutrophication and its associated problems. As with any attempt to combine data from numerous sources, the reader often lacks assurance that the data presented are for comparable conditions; i.e., are the denitrification rates at different temperatures quoted for similar substrate redox and diffusion conditions?

The chapter on Nitrate Removal from Waste Waters serves to do little more than introduce a non-specialist into this important area of nutrient control. While the use of methanol has been promulgated for denitrification of domestic waste water (sewage), there has been little recent application owing to the cost involved. Rather modern technology is utilizing organic compounds in the sewage itself to achieve nitrogen removal through a process sequence referred to as predenitrification. Some minor errors are included in the process descriptions by the author.

The future areas for research described by the author are those for minimizing denitrification losses. On the contrary, much research is required to maximize denitrification to achieve nutrient control. For example: adequate information on nitrogen transformations in "artificial marshes" is not available to provide for nitrogen control by this process. There is considerable variance in the estimates of the quantity of organics required in the denitrification process. Considerable additional research is required to eliminate the paucity of data and enable effective nutrient control to be practiced and thus minimize impacts on our environment.

K. L. Murphy, *McMaster University*

Reagents for Organic Synthesis. Volume 10. By Mary Fieser (Harvard University). John Wiley & Sons, New York. 1982. 528 pp. \$39.50.

The tenth volume marks the fifteenth anniversary of this popular and useful series. The period covered is 1980 and the first half of 1981. The format follows the successful style of the original work, with short (commonly one paragraph) entries arranged in alphabetical order giving concise descriptions of the function of reagents, with equations and references. The reagents may be organic or inorganic, and may be long-known ones, such as aluminum chloride, having new applications, or completely novel ones, such as "phenylthiophenyl(trimethylsilyl)methane", from which phenyl ketones can be prepared. The latter example illustrates one of the difficulties in using this work: the names are not in all cases unambiguous or systematic in the IUPAC sense. Access to desired information is more readily obtained by the indexes, one of which is Reagents According to Types, containing such entries as "amination", "oxidative coupling", "Marschalk reaction", etc. There are also author and subject indexes. This work continues to have value for both reference purposes and current awareness.

Coal Science. Volume 1. Edited by M. L. Gorbaty, J. W. Larsen, and I. Wender. Academic Press, New York. 1982. ix + 293 pp. \$32.50.

The term "coal science" has become justified because the full complexity of the subject has emerged in recent years as a matrix of chemistry in all its subdivisions, paleobotany, geology, materials science, and engineering. Because of this diversity, it has been difficult not only to acquire a unified picture of this subject of great current importance, but even to keep abreast of a particular aspect of it. The series of which this volume is the start is intended to meet this problem by presenting critical reviews in which interpretation and evaluation are regarded as important as raw information.

This volume contains five chapters: Coal Plasticity Mechanism: Inferences from Liquefaction Studies (R. C. Neavel); The Physical Structure of Coal (W. R. Grimes); Magnetic Resonance Studies of Coal (H. L. Retcofsky); Molecular Structure of Coal (R. M. Davidson); and The Reductive Alkylation Reaction (L. M. Stock). In the range of these subjects, a good introduction is provided, with valuable data in tabular and graphic form, and essential references. It thus constitutes one step beyond one-volume introductory works such as "An Introduction to Coal Technology" by Berkowitz. Its value is augmented by a thorough index.

Volumes of Proceedings

Ion-Selective Electrodes. Volume 3. Edited by E. Pungor and I. Buzas. Elsevier Scientific Publishing Company, Amsterdam and New York. 1981. xi + 428 pp. \$100.00.

Contains lectures and discussions held at a symposium held in Hungary in 1980. Subject index.

Fundamental Research in Organometallic Chemistry. Edited by Minoru Tsutsui, Yoshio Ishii, and Huang Yaozeng. Van Nostrand Reinhold Company, New York; and Science Press, People's Republic of China. 1982. xxix + 975 pp. \$65.00.

Proceedings of the China-Japan-United States Trilateral Seminar held in Peking in 1980. Subject index.

Genotoxic Effects of Airborne Agents. Edited by Raymond R. Tice, Daniel L. Costa, and Karen M. Schaich. Plenum Press, New York and London. 1982. xiii + 658 pp. \$75.00.

Proceedings of a symposium held at Brookhaven National Laboratory in 1980. Contains "agent" and subject indexes.

Data Processing in Chemistry. Edited by Z. Hippe. Elsevier Scientific Publishing Company, New York and Amsterdam. 1981. x + 288 pp. \$73.25.

Contains papers presented at an International Summer School held in Poland in 1980. No index.

Biological Reactive Intermediates. Volume II. Parts A and B: Chemical Mechanisms and Biological Effects. Edited by Robert Snyder, Dennis V. Parke, James J. Kocsis, David J. Jollow, C. Gordon Gibson, and Charlotte M. Witmer. Plenum Press, New York and London. 1982. xx + 1476 pp. \$125.00.

These two parts contain the presentations at the International Symposium on Biological Reactive Intermediates, held at the University of Surrey in 1980. Reproduced from the authors' variable typescripts. Subject index.

Physicochemical Methods for Water and Wastewater Treatment. Edited by L. Pawlowski. Elsevier Scientific Publishing Company, New York and Amsterdam. 1982. viii + 394 pp. \$97.95.

Contains the papers presented at the Third International Conference on the title subject, held in Poland in 1981. Subject index.

Development of Iron Chelators for Clinical Use. Edited by Arthur E. Martell, W. French Anderson, and David G. Badman. Elsevier North-Holland, New York, Amsterdam, and Oxford. 1981. xviii + 311 pp. \$55.00.

Proceedings of the Second Symposium on the title subject, held in San Francisco in 1980. No index.

Chemical Approaches to Understanding Enzyme Catalysis: Biomimetic Chemistry and Transition-State Analogs. Edited by B. S. Green, Y. Ashani, and D. Chipman. Elsevier Scientific Publishing Company, New York, Amsterdam, and Oxford. 1982. xvi + 356 pp. \$100.00.

Proceedings of the 26th OHOLO Conference held in Israel in 1981. Subject index.

Structural and Functional Aspects of Enzyme Catalysis. Edited by H. Eggerer and R. Huber. Springer-Verlag, Berlin, Heidelberg, and New York. 1981. ix + 216 pp. \$27.00.

This volume is dedicated to the late Feodor Lynen and contains the papers given at the 32nd Colloquium der Gesellschaft für Biologische Chemie, held in Baden in 1981. Subject index.

High-Energy Ion-Atoms Collisions. Nuclear Methods Monograph Series. Volume 2. Edited by D. Berenyi and G. Hock. Elsevier Scientific Publishing Company, New York and Amsterdam. 1982. 276 pp. \$69.75.

Proceedings of an international seminar held in Hungary in 1981. The papers are reproduced from the authors' varied typescripts. No index.

Macromolecules. Edited by H. Benoit and P. Rempp. Pergamon Press, New York. 1982. x + 335 pp. \$75.00.

Contains the main lectures presented at the 27th International Symposium, held at Strasbourg in 1981, reproduced from the authors' variable typescripts. No index.

Recent Advances in Analytical Spectroscopy. Edited by K. Fuwa. Pergamon Press, New York. 1982. ix + 325 pp. \$75.00.

Proceedings of the 9th International Conference on Atomic Spectroscopy and the 22nd Colloquium Spectroscopicum Internationale, held in Tokyo in 1981, reproduced from the authors' variable typescripts. No index.

Strategy in Drug Research. Edited by J. A. Keverling Buisman. Elsevier Scientific Publishing Company, New York and Amsterdam. 1982. viii + 420 pp. \$76.75.

Contains 21 papers given at a symposium held in the Netherlands in 1981. Subject index of titles.

Organometallic Chemistry Reviews. Journal of Organometallic Chemistry Library. Volume 12. Edited by D. Seyferth, A. G. Davies, E. O. Fischer, J. F. Normant, and O. A. Reutov. Elsevier Scientific Publishing Com-

pany, New York and Amsterdam. 1981. viii + 376 pp. \$117.00.

Contains the plenary lectures from the Third International Conference on Organometallic Chemistry of Germanium, Tin, and Lead, held in Dortmund in 1980. No index.

Surface Treatments for Improved Performance and Properties. Edited by John J. Burke and Volker Weiss. Plenum Press, New York and London. 1982. x + 224 pp. \$35.00.

Proceedings of the Annual Sagamore Army Materials Research Conference, held at Lake George in 1979. Subject index.

The Resource Potential in Phytochemistry. Edited by Tony Swain and Robert Kleiman. Plenum Press, New York and London. 1980. xiii + 215 pp. \$29.50.

This volume of "Recent Advances in Phytochemistry" is the proceedings of the 1979 Annual Meeting of the Phytochemical Society of North America. It is dedicated to the late Theodore A. Geissman. Subject index.

Photochemical, Photoelectrochemical, and Photobiological Processes. Edited by D. O. Hall and W. Palz. D. Reidel Publishing Company, Holland, Boston, and London. x + 226 pp. \$75.00.

Contains the papers, reproduced from the authors' variable typescripts, that comprised a "contractors meeting" held in France in 1981. No index.

Stable Isotopes. Edited by H.-L. Schmidt, H. Förstel, and K. Heinzinger. Elsevier Scientific Publishing Company, New York and Amsterdam. xvii + 758 pp. \$127.75.

Proceedings of the 4th International Conference on Stable Isotopes held in the Federal Republic of Germany in 1981. The topics range from geochemistry to biomedical applications and synthesis. There are author and subject indexes.

Frontiers of Chemistry. Edited by K. J. Laidler. Pergamon Press, New York. 1982. x + 369 pp. \$42.50.

Contains the plenary and keynote lectures given at the 28th IUPAC Congress, held in Vancouver in 1981. The subjects range from considerations of energy and the environment to computers in chemistry, with sections on Organic, Inorganic, Analytical, and Physical Chemistry. No index.

Nature, Aim, and Methods of Microchemistry. Edited by H. Malissa, M. Grasserbauer, and R. Belcher. Springer-Verlag, Wien and New York. 1981. 340 pp. \$57.60.

The softbound proceedings of the 8th International Microchemical Symposium held in Austria in 1980, containing papers on microchemistry in arts and archaeology, life sciences, environmental sciences, and material sciences and on instrumentation and automation. No index.

Computational Crystallography. Edited by David Sayre. Oxford University Press, Oxford and New York. 1982. 539 pp.

Contains the papers presented at the International Summer School on Crystallographic Computing, held in Ottawa in 1981. The papers are reproduced from the authors' typescripts; a subject index is included.

Particulate Carbon Atmospheric Life Cycle. Edited by George T. Wolff and Richard L. Klimisch. Plenum Press, New York and London. 1982. x + 411 pp. \$49.50.

Contains the papers and discussions given at a symposium held at the General Motors Research Laboratories in 1980. Contains author and subject indexes.

Carotenoid Chemistry and Biochemistry. Edited by G. Britton and T. W. Goodwin. Pergamon Press, New York. 1982. ix + 399 pp. \$95.00.

Contains 25 papers, reproduced from the authors' variable typescripts, given at the 6th International Symposium on Carotenoids, held in Liverpool in 1981. An Index of Organisms is included.

Actinides in Perspective. Edited by Norman M. Edelstein. Pergamon Press, New York. 1982. ix + 610 pp. \$75.00.

Contains 24 papers given at the conference Actinides—1981 held in California in September. Includes subject index.

Microemulsions. Edited by J. D. Robb. Plenum Press, New York, and London. 1982. viii + 259 pp. \$35.00.

Proceedings of a conference on the physical chemistry of microemulsions held in Cambridge in 1981.