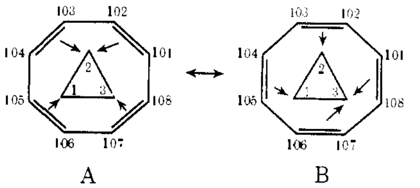
2.549(10)–2.596(11) Å, Ni(2)–C(101,104), Ni(3)–(101,106). Further, the maximum variation in C–C distances (mean 1.433(16) Å) around the ring is less than 2σ.

Thus, the C_8-ring to metal bonding is highly delocalized and in terms of valence bond theory the bonding may be represented by resonance between the cannonical forms (A) and (B) (Scheme II). This is consistent with the observed molecular parameters and allows each metal atom access to 18 electrons. Since the ^1H NMR spectrum shows only a singlet resonance even at −90°C, it is evident that an unusual fluxional process occurs in solution.

Scheme II



It is likely that in the formation of 7 from the Ni_4 cluster the cyclooctatetraene ligand becomes bonded to the relatively open Ni(1)Ni(3′)Ni(3) triangular face, suggesting that 2 might provide a template in a catalytic reaction.

Acknowledgments. We thank the U.S.A.F. Office of Scientific Research for partial support of this work under Grant AFOSR-71-2090, and I.C.I. Ltd., for the award of a postdoctoral fellowship to J.L.D.

References and Notes

(1) It has been previously reported[2] that $[Ni(CO)_4]$ and HFB react to give $[Ni_4(CO)_3(CF_3C_2CF_3)_3]$, the molecular formula being inferred from mass spectrometry. The x-ray diffraction study reveals the presence of the fourth terminal CO ligand so that the cluster as a whole obeys the "18-electron" rule.

(2) R. B. King, M. I. Bruce, J. R. Phillips, and F. G. A. Stone, *Inorg. Chem.*, **5**, 684 (1966).

(3) J. F. Blount, L. F. Dahl, C. Hoogzand, and W. Hübel, *J. Am. Chem. Soc.*, **88**, 292 (1966).

(4) V. W. Day, R. O. Day, J. S. Kristoff, F. J. Hirsekorn, and E. L. Muetterties, *J. Am. Chem. Soc.*, **97**, 2571 (1975).

(5) R. P. Dodge and V. Schomaker, *J. Organomet. Chem.*, **3**, 274 (1965).

(6) G. Ferraris and G. Gervasio, *J. Chem. Soc., Dalton Trans.*, 1933 (1973).

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Book Reviews

The Botany and Chemistry of Hallucinogens. By R. E. SCHULTES (Harvard University) and A. HOFMANN. Charles C. Thomas Publishers, Springfield, Ill. 1973. xxii + 267 pp. $14.75.

This is not only a unique and definitive volume on the botanical classification and chemical composition of hallucinogenic plants but also a fascinating history of their use by aboriginal societies and an excellent source of information of their psychoactive and toxic effects. It contains five chapters: Hallucinogenic or Psychomimetic Agents: What are they?, The Botanical Distribution of Hallucinogens, The Chemical Distribution of Hallucinogens, Plants of Hallucinogenic Use, and Plants of Possible or Suspected Hallucinogenic Use. By far the longest chapter (177 pp) gives a botanical description of each species, its history, psychoactive effects, and chemical constituents. The book is exquisitely produced and liberally sprinkled with ancient illustrations of plants and photographs of aboriginal plant collectors. For the researcher, this volume is indispensable; for the teacher of undergraduate organic classes, it will yield many anecdotes with which to spice up lectures; for the interested chemist, it will provide informative and enjoyable reading.

Victor Snieckus, *University of Waterloo*

Analysis of Water. Fifth Edition. (Translation from French). By J. RODIER and collaborators (formerly associated with the Institut d'Hygiène du Maroc and several other institutions). John Wiley & Sons, New York, N.Y. 1975. xviii + 926 pp. $82.50.

This is an encyclopedic work of reference covering *all* aspects of the analysis of water. This is a really old-fashioned book depending almost entirely on gravimetric, volumetric, colorimetric, and related classical forms of qualitative and quantitative analyses, although some sections also contain data obtained by polarography and the atomic absorption method of analysis. One of the appendixes gives a synoptic survey of some of the more recent methods of instrumental analysis, although results obtained by these methods are not quoted to any appreciable extent within the text. Almost all the references are taken from obscure French publications and governmental circulars and tend to incline heavily toward less modern publications. The book, therefore, is rather out of date and is not of much value either in research or in teaching. The volume is extremely useful, however, to technologists undertaking analysis of water in less equipped laboratories and with limited training in modern instrumental analysis. Also, it is a mine of comprehensive information on several less common, and even quite obscure, problems of water analysis. For technologists engaged in the problems of the analysis of water, the material in the book would be quite useful since established analytical procedures, however ancient, never loose their general validity.

Ashok K. Vijh, *Hydro-Quebec Institute of Research*

Proceedings of the International Symposium on Nitrite in Meat Products. Edited by B. KROL and B. J. TINBERGEN. Centre for Agricultural Publishing and Documentation, Wageningen, The Netherlands. 1974. 268 pp. $18.00.

This book is a collection of papers presented at the International Symposium on Nitrite in Meat Products held at Zeist, The Netherlands, September 10–14, 1973. The analytical, microbiological, chemical, technological, and toxicological aspects of the problem were considered.

Six resolutions based on the symposium work were accepted by the participants. The second states: "All relevant information indicates that nitrite is currently an indispensable inhibitor of pathogenic microorganisms (*Clostridium botulinum*) in many meat products. In addition nitrite plays a key role in colour formation and flavour development. No adequate substitute is yet known." Since the date of the symposium, it has been reported that formaldehyde catalyzes the nitrosation of amines at physiological pH's. In view of the carcinogenicity of the nitroso amines, it would appear that other methods of preservation should be investigated. As a spur to such efforts, some consumers might want to avoid nitrite-preserved meats.

Emil H. White, *The Johns Hopkins University*

Microcrystalline Polymer Science. By O. A. BATTISTA (Research Services Corp.). McGraw-Hill, New York, N.Y. 1975. x + 208 pp. $18.50.

Dr. Battista explains microcrystalline polymer science in Chapter 1 (16 pp) and discusses then the preparation, properties, and application of microcrystals from cellulose (41 pp), collagen (60 pp), silicates (20 pp), amylose (11 pp), polyamides (20 pp), polyesters (13 pp), and polyolefins (11 pp). In a brief appendix the major scientific conclusion is made that: "when the mechanical energy introduced to disperse microcrystals recovered from the aforementioned polymers is intense enough, the resulting smallest measurable subunits or microcrystal particles all are uniformly of about the same size and shape with their diameters ranging from about 100 to 300 Å .... This author respectfully suggests that the most stable building block or 'brick' out of which the gross architectural morphology of high-molecular-weight natural and synthetic linear polymers is fabricated has a dimension in the 100-to-200-Å size range, a truly *limiting* microcrystal size particle."

In the brief introductory chapter the subject matter is described in general scientific terms. Crystals of colloidal dimensions can be kept in suspension and have interesting rheological properties. Crystalline linear macromolecules have now the unique structure of crystal sizes in the colloidal range. All that needs to be done is to cut (unhinge, in Battista's terminology) the tie molecules between crystals and remove perhaps some of the amorphous portion, and practically perfect single crystals of microcrystalline dimensions are produced. The cutting can be done, for example, by hydrolysis or oxidation etching. The microcrystalline state is thus conveniently reached from a large number of macromolecules, but otherwise it is not bound to macromolecules as the example of chrysotile asbestos in the book shows. Chrysotile is not a linear macromolecule. The following chapters describe mainly the application and applied problems of various examples analyzed by the author and his coworkers at Avicon during the last 25 years. Close to 50% of all references listed refer to work of the author.

This book is a convenient and well written and illustrated summary of this field of work which has been dominated by the work of the author and the industrial success of Avicon. It also suggests many new applications of this field. As expressed in the preface, it should be of great interest to scientists and engineers involved in research, development, and manufacture of high polymers and to teachers and students interested in the disciplines of polymer and colloid chemistry. I doubt, however, its usefulness as a suggested text for an introductory course. As a textbook, the treatment is too narrow, dealing only with Avicon products. The scientific introduction is too short, bringing little crystallography, morphology, colloid science, polymer science, or even references to it.

Bernhard Wunderlich, *Rensselaer Polytechnic Institute*

Thermal Methods of Analysis. By WESLEY W. WENDLANDT (University of Houston). John Wiley & Sons, Inc., New York, N.Y. 1974. xvii + 505 pp. $27.50.

Experienced thermal analysis workers are often asked by the neophyte, "What one book can I read to get a basic understanding of thermal analysis theory, instrumentation, and applications." "Thermal Methods of Analysis" meets this need.

Professor Wendlandt has updated and expanded his earlier book of the same title. While retaining its overall organization, the text and figures have been rewritten and considerably expanded to provide the reader with a broader and certainly more current understanding of this fast-moving field.

The first seven chapters, like his earlier book, deal with the theory, instruments, and applications of thermogravimetry (TG), differential thermal analysis (DTA), and differential scanning calorimetry (DSC). Chapter 8 deals with evolved gas analysis and Chapter 9 covers optical thermal techniques. Chapter 11 covers, in a cursory way, a variety of miscellaneous thermal analysis techniques including thermomechanical analysis (TMA), electrical conductivity, emanation analysis, thermoluminescence, thermomagnetic analysis, torsional braid analysis (TBA), and oxyluminescence. Full chapters are also included on the cryoscopic determination of purity (Chapter 10), the uses of computers in thermal analysis (Chapter 12), and nomenclature (Chapter 13). The presentation is well organized and easy to follow with germane and generous illustrations. The book does suffer, however, from some shortcomings which detract from its otherwise overall high quality.

In the chapter on differential thermal analysis, the author calls the reader's attention to the confusion over the definition of differential scanning calorimetry calling some measurements DSC and others "DSC". DSC by widespread use has come to be a generic phrase for all quantitative thermal analysis techniques for measuring heat flow into (or out of) the sample. Attempting to limit this definition to those techniques based on a temperature servo system is inconsistent with classical calorimetry and indeed with the definition of the unit of measurement from which the technique takes its name (calorie—the amount of heat necessary to raise 1 g of water at 15°C, 1°C).

A second critical comment is the rather cursory treatment of TMA. Only nine pages of text, including five pages of figures, are devoted to this technique. Such coverage is incomplete for perhaps the fastest growing of the thermal analysis techniques.

A disappointing feature, particularly for the beginner, is the somewhat dated discussions of commercial instrumentation. In several cases, discontinued or obsolete equipment is described as if it were state-of-the-art. This is a difficulty associated with any fast-moving field and does no harm since copious amounts of literature on current instrumentation are readily available from manufacturers.

Taken as a whole, the book is a high-quality treatise which is destined to be the "handbook of thermal analysis" for many years to come. It is highly recommended for beginners and experts alike.

Roger L. Blaine, *Du Pont Company*

Photochemistry. An Introduction. By D. R. ARNOLD, N. C. BAIRD, J. R. BOLTON, J. C. D. BRAND, P. W. M. JACOBS, P. DE MAYO, and W. R. WARE (University of Western Ontario). Academic Press, Inc., New York, N.Y. 1974. vii + 283 pp. $15.00.

Organic Photochemistry. By J. M. COXON (University of Canterbury, New Zealand) and B. HALTON (Victoria University of Wellington, New Zealand). Cambridge University Press, London. 1974. vii + 196 pp. Cloth, $13.00; paper, $5.95.

These two textbooks represent two different approaches to the subject of photochemistry. The first one, as its title suggests, takes a much more inclusive view, discussing inorganic as well as organic systems and putting considerable emphasis on practical aspects of photochemistry such as experimental techniques, atmospheric photochemistry, photochromism of organic and inorganic systems, and industrial applications of photochemistry. Another unusual feature of this book is an extensive chapter on the photochemistry of the solid state. The inclusion of this material has meant that some topics in traditional organic photochemistry are touched on only briefly, but enough of an overview and references are given that the curious student will know where to start looking further. About a third of the book is devoted to a discussion of the theoretical background of phenomena such as bonding, the absorption of light, the nature of the excited state, and energy transfer. The book is reproduced directly from manuscript, but this does not detract from its legibility.

The other text, by contrast, goes, after a brief introduction to the basic concepts and terms of photochemistry, to a systematic discussion of various categories of photochemical reactions observed in organic systems. The reactions have been grouped as intramolecular reactions of the olefinic bond, intramolecular reactions of the carbonyl group, intermolecular cycloaddition reactions, and oxidation, reduction, substitution, and elimination reactions. Very few compounds containing elements other than carbon, hydrogen, and oxygen are used as examples. The authors of this text set out at the beginning to use the application of the principles of conservation of orbital symmetry as a unifying concept in leading to an understanding of photochemical reactions, and they are successful in keeping this aim in mind, so that the Woodward–Hoffmann rules pervade the text, although mechanisms for nonconcerted photochemical reactions are also suggested. With the extensive references to the original literature provided in the book, it becomes a useful and coherent introduction to mechanistic organic chemistry at a qualitative level.

Seyhan N. Ege, *University of Michigan*

Topics in Current Chemistry. Volume 46. Photochemistry. Edited by F. BOSCHKE. Springer-Verlag, Berlin-Heidelberg-New York. 1974. 236 pp. $27.90.

This volume of the series contains two chapters which attempt to correlate large numbers of experimental facts in organic photochemistry by the qualitative use of molecular orbital theory: J. Michl's "Physical Basis of Qualitative MO Arguments in Organic Chemistry" and W. C. Herndon's "Substituent Effects in Photochemical Cycloaddition Reactions" in which he applies perturbational molecular orbital theory to the [2 + 2] cycloaddition reactions of olefins and of carbonyl compounds including enones. I found Michl's presentation very interesting, especially in his consciousness of singlet-triplet differences, and in his attempt to work some accounting for this into his discussion. My attention to Herndon's chapter unfortunately was distracted by references to reactions between different molecular species as dimerizations and to benzaldehyde as a ketone, and by some typographical errors as well as some errors of fact in the bibliography.

K.-D. Gundermann's chapter on "Recent Advances in Research on the Chemiluminescence of Organic Compounds" covers rather obscure as well as well-known inorganic, organic, and biological systems that exhibit the phenomenon, with emphasis on mechanistic information when it is available.

The last chapter, "Das sonderbare Verhalten elektronenangeregter 4-Ring Ketone (The Peculiar Behavior of Electronically Excited 4-Membered Ring Ketones)" by W.-D. Stohrer, P. Jacobs, K. H. Kaiser, G. Wiech, and G. Quinkert, is a critical review of the photochemistry of cyclobutanones with special emphasis on the formation of the ring-expanded products postulated to arise from oxacarbenes. Tables of data on irradiation conditions (including the sunlight of Paris) and products, and on low-temperature irradiations done in search of evidence for transient intermediates are given. A discussion of theoretical reasons why cyclobutanones react in ways uncommon to larger ring ketones is also included.

The volume covers the literature mostly through 1972 except for the last chapter where citations to work appearing in 1973 and in press in 1974 are given.

Seyhan N. Ege, *University of Michigan*

Spectroscopic Exercises in Organic Chemistry. By A. N. MASON, A. BHATI, and J. CAST (Liverpool Polytechnic). Halsted Press, John Wiley & Sons, Inc., New York, N.Y. 1973. 146 pp. $6.00.

This book aims at a systematic presentation of exercises in infrared, ultraviolet, and nuclear magnetic resonance spectroscopy and mass spectrometry at a level suitable for undergraduate students. There is also a final section in which spectroscopic and chemical data are combined for the determination of more complicated structures. Much of the data are presented in tabular form which saves space but does not help the student to become at home with the visual recognition of significant patterns which are so helpful in the interpretation of spectra. There are no charts or compilations of reference data for any of the spectroscopic methods. For example, on page 28, there is mention of the rules of Woodward, Fieser, and Scott, without explanation or reference to where they may be found. Therefore the book is clearly meant only as an exercise book to be used in conjunction with other textbooks.

In general, the problems start at a relatively simple level, but quickly become challenging enough for graduate students. They are chosen to bring in a sampling of the variety of factors such as substitution, stereochemistry, and solvent effects that affect spectra. Answers are supplied to the problems. The book seems to be generally free of typographical errors though there are a few mistakes either in descriptions in problems or in structures provided as answers.

Seyhan N. Ege, *University of Michigan*

Handbook of Photochemistry. By STEVEN L. MUROV (State University at Stony Brook). Marcel Dekker, Inc., New York, N.Y. 1973. xi + 272 pp. $27.00.

Anybody who has had to search the literature for spectroscopic properties of solvents, sensitizers and quenchers in setting up photochemical reactions will appreciate this handbook, where tables of just such information have been compiled. The headings of some of the sections will give an idea of the scope of the book: spectroscopic properties of sensitizers and quenchers, triplet energies of organic compounds, lifetimes and quantum yields of phosphorescence, quantum yields of fluorescence, quantum yields of intersystem crossing in solution, rates of energy transfer, rates of hydrogen abstraction, solvent properties, characteristics of light filters, spectra of glasses, spectral distribution of photochemical sources, actinometry, as well as a variety of more general topics and parameters are covered. Most of the information is in the form of tables, or specific practical directions. The book also contains a guide to the photochemical literature, part of which is arranged according to topics, references to all of the experimental data displayed in tables, an extensive subject index, and a formula index. It has been reproduced directly from typescript, but is easily legible.

Seyhan N. Ege, *University of Michigan*

Findlay's Practical Physical Chemistry. Ninth Edition. Revised by B. P. LEAVITT (Imperial College, London). John Wiley & Sons, Inc., New York, N.Y. 1972. xxi + 442 pp. $11.75.

The object of this ninth edition is, after an interval of 20 years, to modernize the material of the previous volume. The work is also broadened in scope by the inclusion of several new experiments in spectroscopy, gas chromatography, catalysis, and surface chemistry, as well as a short chapter on electrical measurements.

There is a large selection of experiments for a book of this size. Enough theory is presented to recall the main physical ideas needed for each topic without duplicating the function of a physical chemistry text. There are good sections on kinetics, colligative properties of solutions, phase equilibria, and a large choice of electrochemical experiments. As the title implies, the projects provide a good deal of practical experience in basic laboratory manipulations.

Nevertheless, the main emphasis is still on the more traditional approaches and instrumentally simple methods, and the book will probably not appeal to students with access to more sophisticated, modern techniques. An appendix lists the subjects considered outside the scope of the text; it includes infrared and ultraviolet spectroscopy, nuclear magnetic resonance, x-ray methods, and high-vacuum work among others. Ideally a physical chemistry student should have some contact with these methods, and experiments employing them can be found in other currently used laboratory texts. This book is therefore most useful in a program not involving complex equipment, or in one designed to be followed by a more advanced instrumental course.

Bret Halpern, *Yale University*

Displacement of Water and Its Control of Biochemical Reactions. By SHERRY LEWIN (North-East London Polytechnic). Academic Press, London. 1974. xiv + 367 pp. $24.00.

The book explores the question of water participation in biochemical reactions and associations in terms of simple thermodynamics, molecular modeling, and various general properties of liquid water. Qualitative arguments about water structure, energetics, and entropy are applied to a wide range of problems including solute effects, denaturation, reactions, conformational transformations, precipitations, membranes, and deuterium substitution. The result can best be described as interpretive rather than predictive and, hence, is open for considerable debate and requires much further development and experimentation.

A major and interesting point discussed is the entropic involvement of water in stabilizing conformations and driving various reactions which involve water extrusion. Unfortunately, the quantitative "handles" on this problem are not fully developed (since they are not available), and much of the discussion is highly qualitative. The basic question is, however, well presented and deserves increased attention in future work.

In general, the book was well written with careful attention to clarity and detail. The numerous figures and photographs are well chosen and contribute greatly to the readability of the material. The chapters dealing with conformational changes in DNA and proteins are the most interesting and detailed and involve extensive use of correctly proportioned space-filling molecular models which indeed provide many clues to water involvement.

Chapter 7 entitled "Membranes" is disappointing. After much attention to the thermodynamics of various systems in the early part of the book, Dr. Lewin proceeds to present the chapter on membranes in a classical manner; that is, he assumes the existence of a dilute solution within cells and the existence of membrane situated pumps without reference to works which show that such assumptions can lead to thermodynamically unfeasible situations. Fortunately, this chapter is very short and does not affect the conclusions of the other chapters.

We recommend the book as a readable and plausible, though incomplete, picture of water in the biological environment. It should be read, however, in conjunction with more quantitative though less ambitious works which give proper perspective to the subtleties and complexities of the subject of water.

C. F. Hazlewood, *Baylor College of Medicine*
W. A. Seitz, *Rice University*

Diffuse Reflectance Spectroscopy in Environmental Problem-Solving. By R. W. FREI (Sandoz, Ltd., Switzerland) and J. W. MACNEIL (Canada Department of Agriculture). The Chemical Rubber Co., Cleveland, Ohio. 1973. v + 220 pp. $39.95.

The reader who expects to find an in-depth discussion of environmental problems such as pesticides, trace metal analysis, and other ecological factors is apt to be somewhat surprised at the content of this book. It deals not so much with what one ordinarily thinks of as environmental problems per se and might more appropriately be entitled "Diffuse Reflectance Spectroscopy in Analytical Chemistry". Even here the title is not completely indicative of the content of the book, as it is strongly biased toward the research interests of the authors. In particular, one-third of the book is devoted to the one topic, Applications in Chromatography.

Unfortunately, reading in several passages is rendered rather difficult by inadequate proofing of the text. One finds numerous examples of misplaced subscripts and superscripts, inconsistent notation, erroneous reference to figures, discussion of nonexisting chemical species, and inconsistent usage of symbols which represent measurement conditions. One finds, for example, a derivation of the Kubelka-Munk function where, within the space of just a few lines, distance is represented by lower case x, the greek letter χ, capital X, and then back to lower case x, and finally the greek letter χ.

The book is devoted almost exclusively to applications of the technique with virtually no coverage of the theory being given. The authors start with the assumption that the Kubelka-Munk treatment is valid. It is, of course, well known that this is only a first approximation, notwithstanding the fact that it has been used to good advantage in numerous applications. There have been numerous developments in the theory in the past few years, and we are developing a much clearer understanding of the reasons for deviations from the theory. It is this reviewer's opinion that these developments should not be neglected, as they point the way for further refinement and are much more satisfying than the ad hoc introduction of numerous empirical equations which linearize reflectance over a larger concentration range, as an analytical expedient.

The book provides discussion in depth of numerous applications of diffuse reflectance spectroscopy in analytical chemistry. The literature references are numerous, and the book will be welcomed as an important source to those who are interested in future development and application of the technique.

Harry G. Hecht, *South Dakota State University*

Metastable Liquids. by V. P. SKRIPOV (Ural Science Center of the Academy of Sciences of the USSR). John Wiley & Sons, Inc., New York, N.Y. 1974. xi + 272 pp. $30.00.

The text deals primarily with the thermodynamic and kinetic aspects of spontaneous vapor nuclei formation in superheated liquids. The central focus is on analysis of experimental data and verification of homogeneous nucleation theory. It was written to fill a gap left by the more extensive studies made on crystallization from supercooled liquids. The text is easy to read, especially if the reader has even a modest familiarity with the subject; and it should be useful as a reference text or a fairly in depth introduction to the subject of superheated liquids. The author has devoted a number of years to studying nucleation in superheated liquids and the material for the book is derived largely from his work.

The first two chapters are introductory and serve to review the thermodynamics of metastable states and the theory of homogeneous nucleation. The next five chapters are the most important in the book. Here the author has collected and summarized experimental data on superheated liquids from a number of sources and obtained with a variety of methods. Experimental techniques described in the book include measurements with bubble chambers, superheating liquids in open capillaries, superheating droplets in other liquid mediums, and pulse heating methods. The data from all the methods, taken over a wide range of pressures generally agree well with the predictions of homogeneous nucleation theory. The author believes (and is probably correct) that the lifetime of the superheated liquid, defined as the reciprocal of the nucleation rate, is of more use and supplies more information than the more commonly measured limit of superheat temperature. Techniques for measuring this lifetime are discussed and experimental data are presented. A chapter entitled "Initiated Nucleation" is devoted entirely to the effects of high-energy radiation on superheated liquids. Nucleation in superheated liquid mixtures is not discussed at all. The remaining chapters are devoted to measurements of thermodynamic properties of metastable liquids, thermodynamics of the spinodal, and light scattering measurements in metastable and near critical states.

Richard H. Heist, *University of Rochester*

Man Made Fibres. Sixth Edition. By R. W. MONCRIEFF. John Wiley & Sons, Inc., New York, N.Y. ix + 1094 pp. $37.50.

This book is the 6th edition of a comprehensive and standard reference work covering all aspects of world commercial synthetic fibers. It is divided into four parts comprising the structure and properties of fibers, fibers made from natural polymers, synthetic fibers, and processing. Included in the synthetic fibers section are such fairly recent developments as the high-strength and high-temperature fibers, carbon fibers, and metallic yarns. It is hard to imagine that anyone will ever produce a work on fibers which contains more useful information than the author has achieved. The book is in the nature of required reading for anyone concerned with the technical aspects of man-made fibers.

William J. MacKnight *University of Massachusetts*

Molecular Behaviour and the Development of Polymeric Materials. Edited by A. LEDWITH (University of Liverpool) and A. M. NORTH (University of Strathclyde). John Wiley & Sons, Inc., New York, N.Y. 1974. ix + 553 pp. $37.50.

This volume is in the nature of a festschrift on the occasion of the retirement of Professor C. E. H. Bawn from the University of Liverpool in 1973. The 17 contributors are friends and associates of Professor Bawn and are all well recognized as experts in their particular fields. The topics covered which range from polymerization mechanisms, through chemical modification of polymers to basic polymer physics, reflect the breadth of interest for which Professor Bawn was known throughout his distinguished career. Each of the 14 chapters is authoritatively written and achieves considerable depth. The editors state that the objective of this book is to show how an understanding of molecular behavior can lead to an explanation of polymerization reactions and the structures of the resulting polymers. This knowledge is then expected to lead further to the development and application of new polymeric materials. Such an objective is ambitious indeed, and, had it been achieved, would leave little more for the research scientist in polymers to do. It is a tribute to this volume that much of the currently available information is well summarized, and relationships between properties and structure are pointed out to the extent that they are understood. The editors deserve high marks for effective integration of the rather diverse contributions of many people, and the book reads in a very logical manner with reasonable unity of style. As is unfortunately common in these days, the price of the book is sufficiently high so that it is unlikely to find its way into individual libraries. It will undoubtedly be of great value as a reference to those already acquainted with the field as well as serving as a good introduction to those initiating research in the area of polymer science.

William J. MacKnight, *University of Massachusetts*

Polymer Handbook. Second Edition. Edited by J. BRANDRUP and E. H. IMMERGUT. Wiley-Interscience, New York, N.Y. 1975. xvi + 1364 pp. $34.50.

This handbook provides a comprehensive collection of data of particular interest to chemists, physicists, and engineers working with polymers or teaching courses in polymer science.

The information and data presented have been grouped into eight sections entitled "Nomenclature Rules-Units", "Polymerization and Depolymerization", "Solid State Properties", "Solution Properties", "Physical Constants of Some Important Polymers", "Physical Data of Oligomers", "Physical Properties of Monomers and Solvents", and "Contemporary Thermoplastic Materials".

There is also a Subject Index which covers the entire book. This second edition of the Handbook is approximately twice the size of the first edition, which was published in 1966. All of the tables of data have apparently been extensively revised, and many new ones have been added. The material is presented in a very attractive format, on convenient $8\frac{1}{2} \times 11''$ pages. The price of the book is relatively low, considering the wealth of information provided.

There is no other collection of data on polymers and related materials which even approaches the present volume in utility and completeness. It is simply unique and absolutely indispensable to anyone interested in polymer science. The editors and the many contributors to this handbook are certainly to be commended for this extraordinarily useful contribution to the polymer literature.

J. E. Mark, *University of Michigan*

Natural and Synthetic Polymers: An Introduction. By HENRY I. BOLKER. Marcel Dekker, Inc., New York, N.Y. 1974. ix + 688 pp. $29.75 ($19.75 textbook).

This is a good news/bad news sort of reaction to a competently prepared but wide-of-target volume. When a title is broader than the contents of a volume, it is a simple matter to criticize the superficial treatment accorded the reviewer's favorite topic such as MWD, physical methods which lead to the knowledge being purveyed, polymerization kinetics, and techniques indigenous to polymer chemistry as distinct from functional group chemistry. Yet, despite the validity of these criticisms in the present instance, the author has communicated a message. The reader must complete the transfer of knowledge, but he is given plenty of references.

No clues are given why the reader should go to such effort. The book certainly is not a text, the ten dollar differential notwithstanding. "Natural and Synthetic Polymers" is as good as some of the standard works, but its organization, emphasis, and lack of a glossary prevent it from winning student acclaim.

Bolker writes with fascination in isolated areas: the historical insertions, projections on the use of natural polymers for fuel, and gene synthesis. A book which describes DNA on page 3 (later in Chapter 8) and devotes the entire second chapter to cellulose (with starch components distributed among Chapters 2 and 6) cannot be dismissed as a trivial work; but one gets the idea that rationality gave way to the desire to organize a different kind of polymer text.

The molecular structure and morphology of the polysaccharides are covered in a competent manner; light is shed on condensation and addition polymerization, and the historical insertions provide a change of pace. The proofreading is careless (Eq. 16 is missing on p 21, Eq. 1.13 half a page away from its reference on p 27, a missing antecedent on p 29 and elsewhere, typos on pp 44, 157, 170, 234, 261, 274, 276, 279, 375, 389, 415, 422, 427, etc; incorrect formulas on pp 99, 130, 260, 271, 272, 277, etc.). One questions whether it is worthwhile to compensate for these irritants simply to get a different slant on the subject of polymers.

Raymond R. Myers, *Kent State University*

Gmelin/Handbook of Inorganic Chemistry. Volume 17. Organo Nickel Compounds. Part 2. Springer-Verlag, New York, N.Y. 1974. viii + 402 pp. $252.20.

Every chemist who has searched the literature for the preparation of a specific inorganic compound is familiar with Gmelin. The Gmelin series has recently embarked upon a new endeavor, that being to cover the interface between inorganic and organic compounds. This volume is part of the "New Supplements Series" and covers in detail nickel-carbon bonded complexes. It is subdivided into categories according to the formal denticity of the carbon ligand. Beginning with π-allyl or three carbon ligands, it describes in succession mononuclear species with four, five, and six carbon ligands. Subsequently, it treats in turn dinuclear and trinuclear species with these same ligand types. It is richly illustrated with 90 figures. The literature has been surveyed through 1973, and some 1974 references are included. It contains discussions not only of preparations but also physical and spectral properties, reactions, and crystal structures as well. A compilation of the review literature which describes the ensuing compounds is given at the beginning of each section.

This volume is one part of three. Ironically, parts one and three have not yet appeared. One of these is to be an index. This volume, as with all current volumes of Gmelin, has an English table of contents and English marginal notes. What is truly unfortunate, in this reviewer's opinion, is that it is still published only in German. At the cost of this volume, an English translation should be available. With the current trend in American higher education toward elimination of foreign languages, books such as this lose the effectiveness of their intrinsically high utility. At $0.63/page this book is still indispensable to all modern university libraries but certainly beyond the budget of all individuals. It is prices such as these which force the enactment of unenforceable copyright laws covering such duplication processes as xerography.

John H. Nelson, *University of Nevada—Reno*

Gmelin/Handbook of Inorganic Chemistry. Silver/Part B. Section 5. Organic Silver Compounds. Springer-Verlag, New York, N.Y. 1975. vi + 187 pp. $132.10.

This volume of Gmelin's extensive series contains references to and short descriptions of the preparations, properties, and structures of alkyl, alkenyl, aryl, and alkynyl σ-bonded compounds. It also treats π-bonded unsaturated ligands including functionalized olefins. Complete discussions of silver acetate, formate, and oxylate are included. Useful synthetic organic reactions using these reagents such as for the generation of free radicals are discussed. This volume continues to uphold the high standards expected of this series.

John H. Nelson, *University of Nevada—Reno*

Water and Aqueous Solutions. Introduction to a Molecular Theory. By ARIEH BEN-NAIM (The Hebrew University of Jerusalem). Plenum Press, New York, N.Y. 1974. xvi + 474 pp. $29.50.

The purpose of this book is, in the words of the author, "to present the molecular theory of aqueous fluids based on a framework of the general theory of liquids." The first half of the book is used to construct this framework. It consists of a general treatment of the molecular theory of liquids in which specific references to water are rare. In the first chapter pertinent aspects of statistical mechanics are reviewed, and the notation for the rest of the book is established. (It is assumed that the reader has a basic knowledge of statistical thermodynamics.) The general molecular theory for liquids and liquid mixtures is developed in the next three chapters. Emphasis is given to approaches that can be utilized in describing aqueous systems.

The formalism established in the first half of the book is applied in the second half to three kinds of systems: (i) pure water, (ii) aqueous solutions with nonpolar solutes in the limit of infinite dilution, and (iii) aqueous solutions of nonpolar solutes at concentrations where first-order deviations from infinite-dilution behavior become important. Various models are considered with the mixture-model approach receiving the most emphasis. The solute-solute interactions encountered in the less dilute solutions (case iii) are described in terms of hydrophobic interactions. An appendix includes several derivations that have been appropriately left out of the main body of the text. Ionic solutions have not been included in this work.

The book has been written with unusual clarity. The derivations are easy to follow and are accompanied by lucid explanations. Over 300 references are cited, the most recent being 1974. The author has been successful in writing a well-organized, up-to-date summary of the molecular theory of aqueous fluids.

Robert A. Orwoll, *College of William and Mary*

Treatise on Solid State Chemistry. Volume 1. The Chemical Structure of Solids. Edited by N. BRUCE HANNAY (Bell Laboratories). Plenum Press, New York, N.Y. 1974. xv + 540 pp. $35.00.

This is the first volume of a six-volume treatise intended for advanced workers in the field of solid state chemistry. Study of the chemical aspects of solids has played an integral role in developing solid-state sciences during their rapid growth over the past 25 years. The interdisciplinary nature of the overall area, however, has frequently precluded treatments which clearly show the chemical insights and contributions which have been associated with these solid-state studies. This treatise is designed with the goal of emphasizing these features, and one of the important purposes as stated in the introduction is to help define the field.

Other good books on various aspects of the field have appeared recently, including the fine, comprehensive introductory volume of Rao reviewed in the April 30 issue of this journal, but this treatise promises to be the most comprehensive and complete treatment to date. The first volume furnishes a fundamental basis for later volumes by addressing the bonding behavior and interatomic bonding forces in solids. There are eight chapters in this volume covering the following areas: general aspects of chemical bonding in solids, energy bands, control of phases, defects and defect equilibria, and characterization of chemical and structural composition and the relationship of composition to properties. The introductory chapter on bonding is clear and lively, setting the tone for the entire volume. It is emphasized from the onset that current bonding models for solids remain limited in their range of application and that many of the questions associated with properties of solids do not yet have satisfactory theoretical answers. Experimental techniques for measuring properties have been well developed, however, and a very fine summary of currently used procedures is presented and evaluated.

The material in this volume is very readable and should be useful to interested individuals with an introductory exposure to the solid state while serving at the same time as a standard reference for workers in the field. Particularly attractive is the integration of basic science with application-oriented aspects of solid-state chemistry. There is a well-balanced mix of theoretical concepts and experimental methodology with an overall tendency toward a descriptive approach without sacrificing rigor. Theoretical sections are straightforward and brief. Coverage of experimental techniques is extensive, giving good insight into capabilities and weaknesses of various methods.

As in most multiauthor, edited volumes, continuity among chapters is not emphasized although the editor has been careful to minimize redundancies. The book as a whole is well indexed, and most chapters contain extensive references. A reasonably large amount of useful data is presented as are graphical representations of numerous properties in solid systems. If this volume is an indication of the quality of the completed treatise, the editor will have succeeded in providing the definitive reference work on this rapidly growing and important field of study.

Leonard D. Spicer, *University of Utah*

Synthetic Production and Utilization of Amino Acids. Edited by T. KANEKO (Shiseido Co.), Y. IZUMI (Osaka University), I. CHIBOTA (Tanabe Seiyaku Co.), and T. ITOH (Ajinomoto Co.). Halsted Press, New York, N.Y. 1974. xi + 312 pp. $22.50.

This book is a translated version, with some revisions, of the Japanese book, "Amino-san Kogyo" (T. Kaniko et al., Ed.) Kodansha, 1973. Part 1, dealing with synthesis, is the major portion of the book. After short chapters dealing with general methods of synthesis, optical resolution, and asymmetric synthesis, the remainder of this section consists of individual treatments of synthetic procedures for 26 amino acids. The authors present concise reviews of the literature with many references to the patent literature, particularly Japanese and to a lesser extent U.S. It was somewhat disappointing, however, to find that, in most cases, the latest reference is 1967 and sometimes 1965. Almost all of the post-1967 references are to Japanese work.

The major portion of Part II consists of reviews on amino acid utilization in (1) food, (2) animal feed, (3) medicines and cosmetics, and (4) the chemical industry. Although very brief, the literature references are more recent than in Part 1. In considering the commercial utilization of amino acids, the relative merits of chemical and fermentation production are very important. Although the authors have specifically restricted themselves in this book to chemical synthesis, it would have been of value to include some comparions with fermentation. The final chapter on Future Prospects for the Amino Acid Industry is too brief to be of any significant value.

In a book of this size, it would be unrealistic to expect a more comprehensive coverage of such a complex subject. The brevity of the treatment, however, does restrict its usefulness. The book probably is of most value to industrial chemists for its references to the Japanese literature including patents.

Halbert C. White, *Dow Lepetit USA*