Book Reviews

Compléments au Nouveau Traité de Chimie Minérale Volume 4. Peroxide d'Hydrogène et Polyoxydes d'Hydrogène. By P. A. GIGUÈRE (Laval University). Masson et Cie, Paris. 1975. x + 181 pp. Fr 160.

This is Volume 4 of "Compléments au Nouveau Traité de Chimie Minérale". As such it represents a continuation and updating of "Noveau Traité de Chimie Minérale"; nonetheless, the book can stand by itself as a comprehensive review of hydrogen peroxide and its higher homologs. The discussion, which is written in French, is divided into two independent sections: "Peroxyde d'Hydrogene" and "Polyoxyde d'Hydrogene". Not surprisingly, the former constitutes the bulk of the book (159 pages out of 179 pages of text and references). Each is well referenced through 1972.

The major topics included in the discussion of hydrogen peroxide are its physical and chemical properties, molecular structure, and laboratory and industrial preparations, analysis, and uses. The chapter on H_2O_3 and H_2O_4 is also complete. It effectively summarizes what is known of these uncommon compounds and describes the difficulties of obtaining definitive data on them. These reviews are critical throughout and are supplemented by numerous tabulations and listings of various data.

While this book will not find a place on every bookshelf, those who need a good review article on the compounds covered will find it quite valuable. The numerous tabulations of various physical and chemical data should also make it a very useful reference source for those who are working with these compounds. It is a must for any library which holds the earlier volumes in the series.

John W. Gilje, *University of Hawaii*

Solid State Diffusion. By J. P. STARK (The University of Texas at Austin). John Wiley & Sons, Inc., New York, N.Y. 1976. xi + 237 pp. $17.50.

In this book the theory of diffusion in solids is developed in a logical, multi-approach format. The author stresses the kinetic-theory approach to diffusion, but often adopts phenomenological treatments for complex problems, such as interpreting experiments in concentrated systems.

The text consists of seven chapters. This first chapter is devoted to the mathematical manipulation of diffusion laws, and it is assumed that the reader is familiar with matrix methods and the Laplace, complex Fourier, and infinite Fourier sine transforms. The remaining chapters treat diffusion of interstitial solutes, self-diffusion of substitutional solutes by a vacancy mechanism in dilute alloys, the influence of internal and external fields upon diffusion by a vacancy mechanism, divacancies and concentration effects in dilute alloys, matrix equations for unequal jump distances, and slow and fast diffusion of substitutional solutes. These topics are discussed in considerable depth, and several detailed examples of the application of diffusion theory to dilute alloys are developed. With the exception of the first chapter, the mathematical background necessary includes partial differentiation, matrix algebra, and statistical mechanics. To supplement the book, both problems and references are included for each chapter.

The book contains numerous equations (551 numbered equations), but relatively few figures (17). In addition, the text is limited in scope in the sense that attention is restricted to dilute alloys having body-centered-cubic or face-centered-cubic structures. It is unfortunate that the text has so many typographical errors, but most of these errors are minor and do not detract from the explanations in the text.

This book should be useful to graduate-level students of engineering metallurgy and physics, as well as those engineers associated with solid-state devices.

William S. Glaunsinger, *Arizona State University*

Topics in Current Chemistry. Inorganic Biochemistry. By E. T. DEGENS (Geologisch-Paläontologisches Institut der Universität), W. A. P. LUCK (Fachbereich Physikalische Chemie, Universität Marburg), and D. D. PERRIN (Australian National University). Springer-Verlag, Berlin—Heidelberg— New York. 1976. 225 pp. $27.90.

The essays in this book, "Topics in Current Chemistry. Inorganic Biochemistry," aspire to provide a comprehensive discussion of the molecular interactions of inorganic constituents such as metal ions, water, etc., in biological systems. The book is composed of three chapters with a lengthy and exhaustive discussion of the molecular interactions underlying the deposition of carbonate, phosphate, and silica in the living cell (first chapter), and a chapter on that most important inorganic constituent, namely water, in biological systems. The third and final chapter by D. D. Perrin is the shortest of the three and takes the reader into the realm of inorganic medicinal chemistry dealing with such general topics as antiviral, antibacterial, and anticancer action of chelating agents and metal complexes.

It is well known that water is perhaps one of the simplest constituents of the living cell, yet the physicochemical state of water and its function in the living cell is little understood. Thus, a chapter on water in biological systems by W. A. P. Luck is rightly justified at a time when some of the recent experiments using physical, physicochemical, and physiological experiments are beginning to unveil the nature of the physicochemical state of water and its function in the living cell. This particular essay on water in biological systems starts with an introduction to the ideas of the structure of nonpolar liquids and basic ideas of H-bonding in general and in water, in particular. The author gives a critical discussion of the calculations of the various models of liquid water structure by simulation of water interactions and stresses the importance of the bonded and unbonded OH groups in understanding some of the physical properties of water such as density, specific heat, etc. The importance of the H-bonding in understanding some of the physical properties of water as well as the structure of the electrolyte and nonelectrolyte solutions with hydrophilic and hydrophobic solutes is well brought out in this essay. Relevant to the title of the chapter is a section on water interactions with some bimolecules such as lipids, nucleic acids, and proteins and the effects of the ions on the hydration of biopolymers such as nucleic acids and proteins and a four-page account of water in biological tissues. Readers interested in the general understanding of the problems connected with the structure of liquid water in diverse environments could profit by reading this chapter, despite the fact that not much has been said about water in biological tissues and the presentation is very telegraphic. Commensurate with the title of the essay, a more detailed account of water in tissues would have been in order especially in view of the fact that considerable progress has been made in the understanding of the physical state of water in tissues using nuclear magnetic resonance techniques. The bibliography includes quite a good collection of papers up to 1976, and considering the vastness of the literature, this should be a useful source of reference on this subject.

The chapter on "Molecular Mechanisms on Carbonate, Phosphate and Silica Deposition in the Living Cell" by E. T. Degens is based on the main theme of molecular interactions between metal ions and skeletal tissues in cells and their role in the mineral deposition. Of particular interest is the importance of water in the thermal degradation of calcified tissue and in the aragonite-calcite transformation cited in the experiments outlined to show the validity of crystalline model for the deposition of minerals. The discussion includes a brief section on the specific role of the two important enzymes, carbonic anahydrase and alkaline phosphatase, in the deposition of minerals and the role of Ca^{2+} ion transport. Despite the fact that the function of these enzymes and calcium ions in the mineralization process is not clear, these sections provide a general background relevant to the understanding of the mineralization process in biological systems. The chapter concludes with three long sections dealing with the molecular mechanism of carbonate deposition, phosphate deposition, and silica deposition in skeletal material. These three sections constitute the main part of the chapter. The bibliography is quite extensive and includes citation of about 560 papers from 1930 to 1975.

Inorganic cations and anions play a vital role in maintaining the osmolarity of biological fluids in a cell and participate in other func-

tions like nerve conduction, etc. D. D. Perrin precisely deals with this aspect in the third chapter, "Inorganic Medicinal Chemistry". This chapter begins with a summary of the typical applications of some inorganic compounds in medicine. Some of the topics that are discussed in this article include discussion of the mechanism of antacid therapy, the physiology of the intake and excretion of sodium and potassium ions by certain corticosteroids, as well as the role of lithium and calcium ions in the human body, the physiological and medicinal uses of halide ions and phosphate ions and the vital role of essential metal ions in the human metabolism. The most interesting topics discussed in this chapter are the use of chelating agents as therapeutics and the use of these agents as antibacterial, antiviral, and anticancer agents by way of their action on metal ions. The therapeutics discussed, however, are actually organic molecules. One interesting example discussed by the author is the possible use of these chelating agents as prophylactics against influenza virus by the inhibition of zinc-containing enzyme, as the usual technique of vaccination may be ineffective due to frequent mutations of the virus. This chapter would serve as a very valuable resource for a reader looking for a brief introduction to the plausible diverse applications and role of the inorganic salts and complexes in medicine.

The book, in general, provides a good reading material for anyone venturing into this area of inorganic biochemistry. There are, however, many typographical errors in the second chapter of this book.

S. R. Kasturi, Carlton F. Hazlewood*
Baylor College of Medicine

Topics in Current Physics. Volume 4. Electron Spectroscopy for Surface Analysis. By. H. Ibach (Institute für Grenzflächenforschung und Vakuumphysik, Jülich). Springer-Verlag, Berlin—Heidelberg. 1977. 255 pp. $28.20.

During the past decade various types of electron spectroscopy have emerged for studying surfaces. The focus of the present book is to provide a practical orientation among the various forms of electron spectroscopy. The book places emphasis on practical aspects and instrumentation of the various techniques, rather than being a detailed theoretical treatise. The book is a collection of chapters (a total of six) each by a different author or set of authors. In general, the chapters are of good quality and are accurately written.

The introduction (H. Ibach) focuses on an overview of the variations on electron spectroscopy, as well as treating the problem of sampling depth of photoelectrons. Chapter 2 (B. Roy and J. D. Carette) is a discussion of electron spectroscopy instrumentation. This chapter views the specific requirements of the forms of electron spectroscopy and how these requirements can be met by various hardware configurations. Design principles of electron spectrometers are treated, as well as different types of analyzers. For example, electrostatic, spherical and cylindrical analyzers are discussed, including the cylindrical mirror analyzer, and the plane mirror analyzer. Magnetic spectrometers and retarding spectrometers are also treated, along with a comparison of various types.

Chapter 3 begins the treatment of various types of electron spectroscopy. This chapter (J. Kirschner) is concerned with core level spectroscopy using electron excitation. This chapter briefly discusses secondary electron phenomena as related to x-ray transitions and, various forms of threshold spectroscopy such as appearance potential spectroscopy. Other topics include energy loss spectroscopy as applied to solids and Auger electron spectroscopy. For the latter topic, quantitative aspects are stressed, along with the Auger microprobe.

Chapter 4 (M. Henzler) deals with electron diffraction and surface defect structure. The major focus of this chapter, of course, is on low-energy electron diffraction and its application to defect structure of surfaces. Of particular interest is a section on the application of electron diffraction to atomic steps and how irregular arrays of steps can affect diffraction patterns.

Chapter 5 (D. Foyerbacher and B. Fitton) is titled "Photoemission Spectroscopy" and deals with photon-induced electron emission. This chapter briefly discusses principles of photoemission both from the core and the valence band, along with other topics such as surface sensitivity, chemical shifts, emission from adsorbed species, and angle-resolved photoemission. Examples of the application of both x-ray and UV photoelectron spectroscopy to surfaces and adsorbed species are given.

Chapter 6 is on energy loss spectroscopy (H. Soritzheim) as applied to solids. The authors discuss inelastic scattering, along with a treatment of vibrational modes of molecules on gas-covered surfaces. The application of energy loss spectroscopy to determination of electronic transitions is also discussed.

In the opinion of this reviewer the book will serve as an excellent introduction to each of the topics. Although the authors have succeeded in providing a treatment at an introductory level, the examples selected are largely drawn from clean surface physics, rather than from real world chemistry. A discussion of the application of these techniques to "dirty" surfaces would greatly enhance the value of the book.

David M. Hercules, *University of Pittsburgh*

Molecular Scattering: Physical and Chemical Applications (Advances in Chemical Physics. Volume XXX). Edited by K. P. Lawley (Edinburgh University). John Wiley & Sons, Inc., New York, N.Y. 1975. viii + 541 pp. $49.50.

This monograph follows by 10 years and 20 volumes its predecessor (in the same well-known series) edited by John Ross and entitled "Molecular Beams". The tremendous growth and expansion of the field of molecular scattering is immediately evident, and many of the topics discussed are essentially new. The size and scope of the present monograph are impressive, especially since it primarily reviews work that has been reported since the appearance of some review articles that have been published in the intervening years.

After a brief introduction by K. P. Lawley entitled "New Directions in Molecular Beams", there are nine theoretical and experimental articles which describe many of the recent developments in the field of molecular scattering. D. A. Micha is the author of a chapter summarizing work in the area of formal quantal scattering theory entitled "Quantum Theory of Reactive Molecular Collisions". This is followed by "The Classical S-Matrix in Molecular Collisions" by W. H. Miller, which presents an extensive review of semiclassical mechanics, a subject the author was so instrumental in developing, and includes discussions of examples for both classically allowed and forbidden processes. The chapter by G. G. Balint-Kurti on "Potential Energy Surfaces for Chemical Reactions" provides an excellent review of the calculation of potential energy surfaces which includes a broad range of computational techniques ranging from ab initio calculations to entirely empirical methods. In the next two chapters, W. S. Koski reviews elastic, inelastic, and reactive "Scattering of Positive Ions by Molecules", while R. Grice reviews "Reactive Scattering" in neutral systems. The former provides a rather extensive review of ion molecule collisions and the latter provides a more personal view of reactive scattering by including much of the author's contributions to the field. "Elastic Scattering" in neutral systems is discussed in a chapter by U. Buck who not only describes the experiments and their results but also includes a nice discussion of inversion procedures used to obtain intermolecular potentials from scattering data. J. Reuss describes recent work on the "Scattering of Oriented Molecules" with sections on state selection of molecules in beams and determinations of angular dependent potentials. The monograph concludes with two chapters on nonadiabatic processes in high-energy collisions: one on "Electronic Excitation in Collisions Between Neutrals" by V. Kempter and the other on "Charge Transfer Between Neutrals at Hyperthermal Energies" by A. P. M. Baede. The article by Kempter provides a discussion of fast beam techniques, optical detection of the chemiluminescence, and the interpretation of the emission data in terms of potential curve crossings. The article by Baede provides an excellent review of both theoretical and experimental work on collisional ionization processes.

The only reservation this reviewer has is the omission of several subject areas that have played an extremely important role in molecular scattering in recent years. These include laser-induced fluorescence and chemiluminescence detection of final states (with the exception of the brief reference by Grice and the description of chemiluminescence in hyperthermal collisions given by Kempter), collisions of atoms and molecules in excited internal states, energy transfer in collisions of neutral collision partners, and classical trajectory studies of energy transfer and chemical reactions. However, given the range of topics chosen, both editor and authors should be complimented on producing an excellent monograph that will be very useful to workers in this exciting field and to newcomers who wish to become better acquainted.

George H. Kwei
University of California, Los Alamos Scientific Laboratory