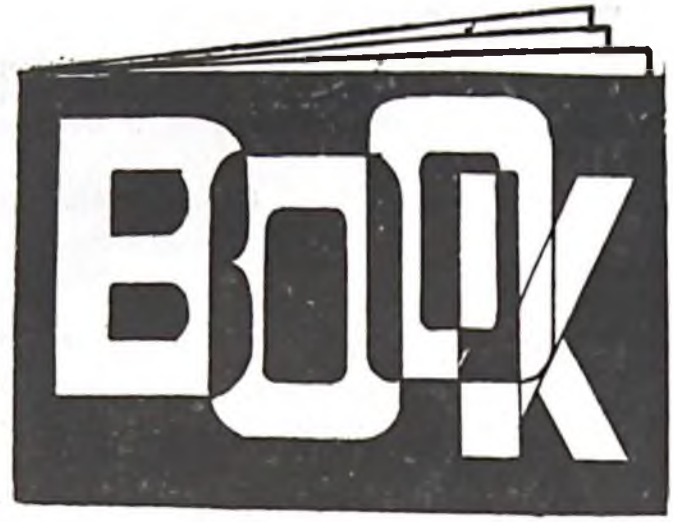


SECTION

BOOK REVIEWS

CHEMICAL KINETICS AND TRANSPORT—*by Peter C. Jordan, Plenum Press: New York and London 353 Pages*

This new text on the subject is very useful in teaching of the subject to students at the advanced undergraduate and graduate level. The author has brought to bear his vast experience in teaching in developing the subject progressively.

The unique feature of the text is a new approach to the subject begining with discussions of phenomenology and mechanism instead of the usual practice of introducing the known theories.

The text is divided into ten chapters. The first chapter on Kinetic theory of gases-equilibrium, is essentially a review chapter introducing the subject. The next two chapters on Kinetic theory of gas-Transport and Electrolytic conduction and diffusion, deal with transport in gases in solutions. The fourth chapter is devoted to to experimental techniques in determination of the rate laws with examples and the significance of the rate laws and constants. The next three chapters that follow elucidate the mechanisms involved in thermal and photochemical reaction both in stable systems and those for which explosion or oscillation is possible. In the chapter on stationary state mechanisms and photochemistry, approach based on recent research in heterogeneous catalysis, infrared laser photochemistry and oscillating chemical reactions has been introduced.

Chapter eight is on single-collision chemistry dealing with reaction cross section in relation to rate constant, the several possible systems and the model of obtaining mechanistic information from scattering data. Chapter nine contains the usual theoritical treatment of the subject on reaction rates contained in other standard texts on the subject. The last chapter introduces a dynamic model for chemical reaction in a highly simplified framework.

A set of problems and general references has been incorporated at the end of each chapter for a clear understanding of the subject matter of each chapter. The printing and get up is very elegant.

The book is a very valuable for a deligent study of the subject and should find a place in university libraries.

J. BALACHANDRA

QUANTUM ELECTROCHEMISTRY—*by J.O'M. Bockris and Shahed U. M. Khan, Published by Plenum Press, New York and London—p.p.578+ XVI $ 49.50.*

The present book titled 'Quantum Electrochemistry' describes the concept and practice of quantum mechanics vis a vis electrode kinetics.

The first two chapters (Electric Double Layers at Metals' and 'Electrode kinetics') provide a quick resume of the phenomenalogical theories of double layer and electrode-kinetics. A very brief account of various elementary excitations ('Quanta and Surfaces') follows, covering surface states and chemisorption as well. The fourth chapter is devoted to transitions aad adiabatic and nonadiabatic perturbations ('Time Dependent perturbation Theory'). This is followed by a good account of energy transfer via polaron, excition and resonance mechanisms ('Long-Range Radiationless Energy Transfer in condensed Med a') and contributions to activation process by various degrees of freedom of the particles present in the system ('Mechanisms of Activation').

Electron transfer theories based on the continuum models ('The continuum Theory') of the polar solvent and electron tunnelling through different types of barriers ('Interfacial Electron Tunneling') are then described. The next two chapters consider proten transfer both in solution and at interfaces ('Proton Transfer in Solution' and 'Proton transfer at interfaces'). Another topic that requires a treatment based on quantum mechanical theories is that of the hydrated electron. This is dealt with next, the continuum, semi-continuum and structural approaches to the problem being outlined ('The Hydrated Electron'). Finally the direct application of the above notions to photo-electrochemical and electrode kinetics is illustrated ('Photo-electrochemical kinetics' and Quantum Electrode kinetics').

As can be seen from the above listing such a study monogragh is timely and apt. Deficiencies in the content and presentation can be spotted but it must be conceded that their origins are in the inter-disciplinery nature of the theme. A more pedagogically oriented reader must seek satisfaction by supplementing his reading of this book with other reviews, notably that of P. P. Schmidt (specialist periodical Reports of the Chemical Society, U. K. 'Electrochemistry' vols. 5 and 6). Apart from the inevitable, personal bias (in chapters 1 and 2, in particular) there are a few misprints and misleading (wrong) statements sprinkled thro' the book; e. g. equations 3.6, 7.13, (also Appand x 7.1), 8.120, 4.35 (ef. 4.15), also incomplete legend for Fig. 7.3, footnotes in p. 125, p. 126,

The reviwer would have liked to see a better organisation and like-up of the salient concepts and theoretical tools in solid-state physics related to transitionprobability.

The book is-in authors' words- 'a compromise between a monograph appealing to workers in a specialised field and a text that can be understood by any physical chemist'. Indeed, a welcome compromise !

S. K. RANGARAJAN
I. I. Sc.

ELECTROCHEMISTRY AT SEMICONDUCTOR AND OXIDIZED METAL ELECTRODES — *by S Roy. Morrison, Plenum Press, New York (1980) xiv - 401 pp.*

During the last decade the subject of semiconductor electrochemistry has developed very fast. With the increased interest in this area, a text-book or monograph which could summerize the recent developments was very much desired. As the author himself has stated in the preface, this book is an attempt to develop; (i) the basic description of electrode reactions on non-metallic electrodes, and (ii) the theory and practice of non-metal electrochemistry. It is gratifying to see that the author has succeeded in his attempt. Fluctating energy level model of Marcus and Gerischer has been used to explain the electrode reactions on non-metals. Some important applications of the semiconductor electrodes such as solar energy conversion, electrocatalysis, electopolishing and other devices are briefly mentioned. The presentation of the subject is clear and lucid. This book by S. Roy. Morrison is very timely and useful to practicing electrochemists, surface chemists and physicists.

Dr. A. K. Shukla
Dr. K. C. Patil
I. I. Sc.

MOLYBDENUM CHEMISTRY OF BIOLOGICAL SCIENTIFICANCE — *by William E. Newton and Sei Otsuka, Published by Plenum New York and London*

This volume constitutes the proceedings of the International Conference on Molybdenum Chemistry of Biologycal Significance held at hotel Lake Biva, Shiga, Japan on April 10-13, 1979.

It is of significance to see a broad spectrum of interests from enzymes to coordination Chemistry being covered thus enabling a new entrant to have an overall view of the 'State-of-the-art' in this specialized and important area of research. It brings together both biological and a biological research approaches focussed on elucidating and duplicating the mechanisms of Molybdenum-containing enzymes as well as iron-molybdenum cofactor and Mo-Fe-S Cubane clusters, and reactions and properties of Molybdenum Complexes.

The first twelve research contribution sequenced are on Molybdoenzymes. Electrochemical and Kinetic Studies of Nitrogenase : Brief Review and Recent Developments-Electron Partitioning from Dinitrogenase to Substrate and the Kinetics of ATP Utilization-Active Site Probes of Nitrogenase-Studies on the Subunits of Clostridial Molybdenum-Iron Protein-HD Formation by Nitrogenase : A Probe for N_2 Reduction Intermediates-Spectrocopic and Chemical Evidence for the nature and Role of Metal Centres in Nitrogenase and Nitrate Reductase C_2H_2 Reduction and $^{15}N_2$ Fixation in Blue-Green Algae-Common Antigenic Sites for Nitrogenase from *Azotobacter* and Bacterial Nitrate Reductases. - E.P.R. and the active Centres ot Xanthine Oxidase and of other Molybdenum-Containing Enzymes-Formate Dehydrogenase from *Clostridium Thermoacetricum*-Structural Chemistry of Molybdenum in Metalloenzymes as Elucidated by EXAFS – EXAFS and other Studies of sulfite Oxidase Molybdenum.

This is followed by six contributions covering the iron-Molybdenum cofactor and Mo-Fe-S cubane Clusters. Metabolism of Molybdenum by nitrogen fixing Bacteria-Studies on the Iron-Molybdenum Cofactor from the nitrogenenase Mo-Fe Protein of Llebsiella Pneumoniae-Chemical Properties of the Fe-Mo Cofactor from Nitrogenase Synthesis and Characterization of Iron-Molybdenum-Sulfur Clusters-Chemical and Physical Studies of Polynuclear Mo-Fe-S and Mononuclear Mo (III) Complexes-Molybdo-Iron Mixed Cluster as a Fe-Mo Cofactor Model.

A group of 14 papers comprise the reactions and properties of Molybdenum Complexes :- Formation of Ammonia from Ligating Dinitrogen at a Single Metal Site and its posssible Relevance to the Nitrogenase Reaction-Reactions of Hydrazido (2) Complexes Derived from Molybdenum and Tungsten Dinitrogen Complexes-Model Studies for Molybdenum Enzymes : Structures, Spectra, Electrochemistry and Reactions of Oxo Mo (IV), (V) and (IV) Complexes-Mo (VI) Complexes of N,S-Donor Ligands : Relevance to Molybdenum Enzymes-New Molybdenum Complexes with Sulfur Donor Ligands-Structural Studies of Molybdenum Complexes-Some Oxygen-Bridged Complexes of Molybdenum (VI)-Electrochemical and Spectroscpic Studies of Molybdenum-Cathdchol Complexes: Models for Molybdoenzymes and Biological Transport–Electrochemistry of Molybdenum Complexes-Effect of Structure and Solution Environment on Redox Properties–Kinetic Study on the Disproportionation Equilibrium of μ-Oxo-Bis [Oxobis (dithio Chelaie) Molybdenum (V)] and related Compounds-Oxoxmolybdenum Complexes of Cysteine-Containing Peptides : Solution Structures and Oxidation Catalysis-Structure and Circular Dichroism of Binuclear Molybdenum (V) Complexes with Optically Active Ligands-Molybdenum Catalyzed Reductions of small Molecules : Requirements of the Activated State-Aueous solution Properties of Sulfido Complexes of Molybdenum (VI).

From the forgoing titles one can note that a vast and varied biological aspects of Molybdenum Chemistry have been presented. The presentations are lucid, informative and authors have taken adequate care to relate their findings in the light of the status of the available knowledge, in their respective areas. Good use has been made of the new structural tool extended x-ray absorption fine structure (EXAFS) for getting structural information about the metals immediate coordination environment. Every papel carries a list of pertinent references which helps an interested researcher on this vitally important subject with specific information.

This volume will be an invaluable source of information for any scientist active in macrocyclic compound chemistry as well as for those working in related fields.

Dr. (Mrs) D. K. PADMA
I. I. Sc.

MATERIALS FOR ADVANCED BATTERIES *—Edited by D. W. Murphy, J. Broadhead and B. C. H. Steele* **Nato Conference Series Service VI : Materials Science Vol. 2** *359 pp + Index* $ *39.50.*

The publication is a record of the proceeding of a NATO Symposium on Materials for Advanced Batteries held in Aussols France, Sept. 1979. The conference has been sponsored by the NATO special conference panel on Materials Science. Forty six. experts in the field of research and development of Advanced Batteries participated in the symposium.

The volume is divided into three sections. The first section consists of eight plenary review papers. The papers cover the requirements of battery systems for applications such load levelling, electric vehicles, and wind and solar energy storage systems. Several of the systems, their components, performance limitations and future outlook are critically examined and future anticipated developments discussed. Aqueous electrochemical storage systems, high temperature batteries, solid electrolytes, molten salt electrolytes, intercalation electrodes and interfacial phenomena are topics reviewed.

The second section is devoted to short communications. Sixteen papers are presented in here. These papers cover a wide range of investigations that have been in progress to improve the performance of existing cells, and to understand the problems associated with their performance, be it short recycles, poor shelf life or low energy capacity compared to the theoritical anticipated values. Newer types of electrolytes, electrode systems like the intercalation electrodes, considerations in design of some of the battery systems are discussed in several of the communications.

The last section covers the study group reports. In these reports all the aspects of advanced batteries have been presented. The reports are based on the combined discussion and effort of several of the workers in the area. The unique feature of these reports. which cover topics such as state of the art and new systems, high temperature systems, solid electrolytes, electrode materials, and interface problems, is that after an appraisal of the current status and problems, valuable suggestions have been incorporated for further study and investigation to understand both the theoritical and materials aspects with a view to further the goal of obtaining viable economical battery or batteries, perhaps in the next decade.

The publication contains a wealth of information for researchers in the field with a certain amount of guidance for further line of research and development. The book will be a valuable addition to any scientific library.

J. BALACHANDRA

THEORY AND PRACTICE OF DIRECT METHODS IN CRYSTALLOGRAPHY—*Eds. M. F. C. Ladd and R. A. Palmer. Plenum Press New York and London*

Direct methods of structure determination have become very popular among the crystallographers in the recent years because of their easy adoptability on high speed computers. However, this has led to a very mechine dependent attitude that the routines are taken for granted. It is only when the structure solution is not at an easy reach that the user looks into the workings of these routines. This book will prove invaluable on such occasions. All the chapters are written by experts who are actively involved in the development of the methods described in the book. The alignment of these chapters is highly convincing.

The first three chapters cover the fundamentals. The so-called "Phase Problem" is defined and its solution is dealt with in a chronological fashion by defining the Sayre equation, Karle-Hauptman determinants and unitary and normalized structure factors. The rules for choosing origin defining reflections and enantiomorph have been dealt with extreme care. The symbolic addition method and the multi-solution approach are developed with a description of MULTAN 78. A short but very useful section on tackling problem structures is also given. The examples are illustrative.

Chapter 4 develops the theory of structure invarients and semi-invarients. This chapter is writtan beautifully. Apart from developing the $\in_1$ and $\in_2$ relations, the quarters and quintets are discussed. The "Neighbourhood Principles" is described in great detail. Chapter 5 deals with the calculation of cosine invarients. The importance of strong

enantiomorph selection is stressed. The authors point out that a loose base enantiomorph in practice would lead to an E map that contains fragments of both enantiomorphy and presented great difficulties of interpretation. The use of NQEST as a figure of merit in deciding the best set in a multisolution approach is demonstrated.

Chapter 6 describes the socalled "phase correlation procedure". It is essentially a symbolic addition approach with a large number of reflections represented as symbols: Relationships between symbols are encountered as the phase propogation proceeds. The authors employ the cosine invarients to avoid Incorrect triples in the initial steps.

The next chapter deals with a slightly different aspect viz, when a part of the structure is already known. This leads to the use of difference structure factors in the direct method routines.

The last three chapters involve the description of modified direct method routines to solution of large structures like proteins. Chapter 8 has a discussion on the convolution principle and its computer adaptability to phase extension and refinement. The chapter on molecular replacement method, eventhough strictly not a direct method routine, is very useful to crystallographers starting on large structures. This chapter as a concluding chapter adds a great deal to the quality of this book.

This book, in general, is highly useful to practicing crystallographers. It will also serve as an excellent course book on direct methods.

T. N. GURU ROW
I. I. Sc.

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