NEWS

Book reviews

Physical electrochemistry: principles, methods, and applications, by Israel Rubinstein (Ed), Marcel Dekker, New York, (1995), 608 pp, hardback $150, ISBN 0-8247-9452-4

This is the latest in a series of monographs in electroanalytical chemistry and electrochemistry; well-received books in this series include the classical text by Ralph Adams on 'Electrochemistry at Solid Electrodes' and the well-written undergraduate text by Peter Kissinger and William Heineman on 'Laboratory Techniques in Electroanalytical Chemistry'. This work comprises 12 chapters on specialized topics in modern, physical electrochemistry by a total of 20 contributors.

Electrochemistry has evolved rapidly as a discipline over the last two decades and this is reflected in (i) the increasing combination of electrochemistry with other disciplines, (ii) adoption of electrochemical techniques by other scientists and technologists and (iii) advances at the interface between surface science and electrochemistry. These developments are well represented in this book which provides treatments of charge transfer theory, digital simulation of current against potential data, ultramicroelectrodes, scanning electrochemical microscopy, electrochemical impedance spectroscopy, electrochemical quartz crystal microbalance measurements, *in situ* X-ray techniques, ellipsometry, analysis of well-defined surfaces, electrodeposition of II–VI semiconductors and deposition of conducting polymers. Extensive and useful bibliographies are provided at the end of each chapter (although some are biased towards the work of a few research groups only). The book provides a useful complement to recent books, such as the one edited by Abruna ('Electrochemical Interfaces', 1991) and the field of *in situ* spectroscopic and related methods is becoming established and extensively documented.

The first chapter, 'Fundamentals of Physical Electrochemistry', concerns the well-known charge transfer and mass transfer theories and might have been better written as an overview of modern electrical, microscopic and spectroscopic techniques in the field of electrochemistry. It is always tempting for a reviewer to highlight areas of personal research interest. In this respect, the chapter by James McBreen on '*In Situ* Synchrotron Techniques in Electrochemistry' is an excellent contribution and provides a good summary of X-ray absorption techniques and their role in elucidating the structure of electrode surfaces. It is pleasing to see mention of technologically important areas in this and other chapters, including fuel cells, batteries and corrosion processes. The chapter is heavily biased towards EXAFS techniques rather than diffraction methods.

I was surprised to see little mention of *in situ* infrared and Raman spectroscopy techniques. These provide valuable information on molecular adsorption processes and the increasing availability of FT versions of infrared instruments has made FTIR one of the most accessible and versatile forms of *in situ* spectroscopy.

This book provides a valuable collection of reviews on specialized aspects of modern electrochemistry and deserves to be read. It should prove useful to postgraduates and other research workers. Additionally, the emphasis on surface and materials science means that the book should be interesting to materials scientists and physicists. The 1200 literature citations and many illustrations constitute a convenient source of modern literature references to the blossoming field of modern physical electrochemistry.

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Introduction to surface chemistry and catalysis, by Gabor. A. Somorjai, John Wiley & Sons, New York (1994). £24.95, ISBN 0-471-03192-5

The title may suggest that the book deals broadly with surface chemistry and catalysis as Adamson has done with his text on the physical chemistry of surfaces. While Somorjai has devoted some attention to more general aspects of interfacial behaviour, the principal focus of this book is on chemisorption and catalysis at single crystal metal and semiconductor surfaces as studied by spectroscopic and diffraction techniques under high vacuum conditions. This field of surface science is a distinct and mature branch of surface chemistry which has revealed much about the surface molecular structures and processes which are pertinent to heterogeneous catalysis, electrocatalysis and materials chemistry. Processes such as surface reconstruction, which have been long established in UHV studies of metal surfaces, have now been recognized during *in situ* STM studies of electrode surfaces and illustrate the increasing significance of surface science studies in electrochemistry. The author has played a significant role in the development of surface science and has published two previous books in this field.

The introductory chapter gives a concise summary of some features of interfaces and concludes with a table of 58 surface science techniques and acronyms but leaving the reader to go elsewhere for details of these–beyond a few explanatory sentences. Surface structures and changes are discussed in Chapter 2 including bond-length relaxation, reconstruction and adsorbed monolayers. This chapter has extensive tables of surface structures of atoms and molecules on single crystal metal and molecular substrates.

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With associated references these tables span 183 pages and are testimony to the outcome of extensive research activity in this field over the last two decades. The subsequent chapters deal with surface thermodynamics, dynamics, electrical properties and the surface chemical bond. Chapter 7 includes a general introduction to heterogeneous catalysis and case histories of catalysis in ammonia syntheses, in the hydrogenation of carbon monoxide and in hydrocarbon conversion on platinum. The final chapter is a short survey of mechanical properties of surfaces including adhesion, friction and lubrication.

This new text is essentially a revision of Somorjai's 1981 'Chemistry in Two Dimensions: Surfaces' with a few identical sections of text as well as other common figures and tables. Hope was expressed in the 1981 book that kinetic parameters for many other catalysed reactions would become available in the near future and it is therefore surprising to see in Chapter 7 the same kinetic parameters tables, unrevised, as in the 1981 book. In view of the extent to which tabulated data and the associated reference lists dominate the earlier Chapter 2 this apparent oversight may have been a consequence of concerns about text size and balance.

Each chapter concludes with a summary, some problems and a generous list of references with paper/book titles, a useful feature. Answers are provided for most of the problems. A list of tables would have been appropriate considering the prominence of tabulated data in this book. It is nice to see the Joule appearing in a text from a US author but the calorie is still retained as well.

This book provides a very readable introduction to the study of well-defined solid–gas interfaces and should be useful for undergraduate courses in surface chemistry and surface physics. The book is also well documented with physical data about surface structures and catalytic systems and this will be valuable to surface scientists in general. Electrochemists wishing to obtain a more molecular perspective on the structure of electrode surfaces will also find much of interest in this text.

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Electrochemical engineering and energy, edited by F. Lapique, A. Storck and A. A. Wragg, Plenum Press, New York and London (1995) 273 pp, ISBN 0-306-44887-4

This book contains the papers presented at the Third European Symposium on Electrochemical Engineering held on 23–25 March 1994 in Nancy, France, which was organized by the Laboratoire des Sciences du Génie Chimique, CNRS and the Centre de Perfectionnement des Industries Chimiques in conjunction with the Groupe Francais de Génie des Procédés, the Society of Chemical Industry, Dechema and the European Federation of Chemical Engineering. There are twenty four scientific papers and two reviews together with a general review paper on 'electrochemical techniques for a cleaner environment'.

The editors have produced a reasonably uniform format for the papers and there appear to be few typographical errors; it is pleasing to see a subject index at the end of the book. The contributions are divided into sections on 'Energy Conversion', 'Transport Processes in Electrochemical Cells', Electrochemical Synthesis' and Modelling of Electrochemical Systems'. Many electrochemical engineers and applied electrochemists will find papers of interest in this book which provides a useful mix of novel contributions and review papers in the field of electrochemical technology. My research group have found at least six of the contributions to be directly relevant to their projects.

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