BOOK SECTION

MODERN ASPECTS OF ELECTROCHEMISTRY VOL. NO.28 (Ed) B.E.Conway, J.O'M.Bockris and Ralph E.White, *Plenum Press* ISBN 0-306-45146-8 (1996) 404 pages

For both aspiring electrochemists and experts in their respective disciplines but finding the need to keep track of the explosive developments that are taking place in other areas of electrochemistry, a rather demanding exercise,it has become imperative to look for the release of another volume of the series. This volume does not disappoint either of them. In this volume, there are five chapters covering widely differing topics in Electrochemistry.

The first chapter on *Ultra high Vacuum surface analytical methods in Electrochemical studies of single crystal samples* (by M.P. Soriagha, D.A. Harrington, J.L. Stickney and A. Wieckowskii) gives a comprehensive review of the techniques such as Low Energy Electron Diffraction (LEED), Reflection High-Energy Electron Diffraction (RHEED), Auger Electron Spectroscopy (AES), X- ray Photoelectron Spectroscopy (XPS), High-Resolution Electron Energy Loss Spectroscopy (HREELS), Work Function Measurement, Temperature Programmed Desertion (TPD) or Thermal Desorption Mass spectrometry (TDMS). The section covers experimental procedures in a rather concise manner in a rather descriptive style though an uncharacteristic error such as in page 25: para 2 where it is stated that " the electropositive adsorbate such as Cs increases the work function " instead of "decreases" has crept in. On the whole this chapter is very readable and quite authoritative.

The second chapter on *Potential Modulated Reflectance Spectroscopy Studies of the Electronic Transitions of Chemisobed Carbonmonoxide* (C.Gutierrez) discusses the application of the technique and describes the experimental details and study of Carbon monoxide chemisorption on Pt, Ru, Rh, Pd and Au. In addition, the work on methanol and ethanol chemisorption on various metals such as Pt, Rh and Pd by PMR spectroscopy has been described. The advantage of the technique arises due to the fact that it is an *in-situ* technique and can distinguish between linear, bridged and multiple bonded CO.

The third chapter by W.J. Lorenze, G.S.Ischenko and M.W. Breiter is on *Low-Temperature Electrochemistry at high, T_c Super-conductor / Ionic conductor Interfaces*. While a large number of electrochemical studies are carried out at room temperature, problems involved in relatively low temperatures on metal/solid electrolyte and metal liquid electrolytes are generally not discussed widely although these systems are of practical importance in future. This chapter successfully fills this gap.

The next chapter by S.G.Christov on *Quantum Theory of Charge Transfer Process in Condensed Media* aims to present the application of the general theory of reaction rates to various types of charge transfer processes based on the author's own work.

Though this chapter contains a detailed exposition of the phenomenon, one cannot but feel the need of a more readable review - particularly on the topic discussing the works of Gurney, Marcus and Bockris.

The last chapter on *Modern Approach to Surface Roughness Applied to Electrochemical Systems* by R.C.Salvarezza and A.J. Arvia is perhaps the best and most readable of the chapters in this volume. The description of solid surfaces in terms of surface reconstruction models is well brought out. The study of such surfaces using STM is illustrated with several images; treatment of the surfaces disorder in terms of fractals approach is a delight to read. There is a discussion on the modelling of the surface roughness in terms of atomistic models and continuum models. Surface area measurements, so much sought after in electrocatalysis and fuel cell research, have been adequately discussed and there is a useful table summarising different methods of determination of real surface area with relevant references. There is a section devoted to characterization of surface roughness and in this, the recent development in STM based surface area measurements are discussed at length and the interesting method of applying fractal approach for diffusion to fractal surface and the impedance of fractal electrodes is also described. As a whole, this chapter fulfills the long awaited requirement of the electrochemical community for a comprehensive review of this topic.

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ELECTROCHEMICAL PROCESSES FOR CLEAN TECHNOLOGY, Keith Scott, *The Royal Society of Chemistry,* Thomas Graham House, Science Park, Milton Road, CAMBRIDGE CB4 4WF. UK ISBN 0 - 85404 - 506 - 6 (1995) 59.50 pages xiv + 308.

If man has to servive and enjoy the fruits of technology, clean technology is a must. This means that processes should operate with minimal waste generation; the stress is also on clean up by recyling and effluent treatment. Electrochemical science, engineering and technology marched forward and has provided much to this discipline. Electrochemistry - based industrial applications include sensors, monitors, control analysis, corrosion (and its protection), surface technologies, energy generation, materials and chemical manufacture, recycling and effluent treatment. The overall objective of this book is to describe the wide range of applications, give basic electrochemical science relevent to rate processes in electrochemical cells and to integrate these concepts with basic engineering and technology. Since electrochemical cells, reactors etc. can now be purchased as off-the shelf modules (in a range of sizes - from small laboratory units to plant scale reactors), commercial applications of this technology has been boosted world wide. In addition, they can be set up at the site for manufacture of chemicals and intermediates for fine chemical, pharmaceutical & agrochemical industries. In addition, electrowinning of metals and effluent treatment can be effected with modern automation. Thus, bulk storage and transport of treatment chemicals like Cl_2 can be avoided.

The potential for clean technology is immense. This book provides a basis for understanding and designing such technologies. **The introductory chapter** highlights the areas of application of electrochemistry, the bulk and fine chemical production, effluent treatment and recycling technologies used for recovery of materials, treatment of dilute wastes and solutions and also touches on some recovery/recycling technologies under development. The second chapter on **The electrochemical cell and reactor** highlights the processes and the basic reactions of the electrochemical cell; the various factors that contribute to its efficient functioning, energy requirements, temperature control, hydrodynamics & mass transport, cell components & materials, ion-exchange membranes, its function and manufacturers, criterea for material selection, chemical stability and engineering suitability in synthesis and effluent treatment processes. All this has been discussed in a fluent, understandable style. Chapter 3, deals in detail with **electrode processes and membrance transport** giving some specific examples. Chapter 4, is a well illustrated chapter on **Electrochemical cell design and Engineering** which encompasses a wide range of details in design of reactions and reactors along with specific examples. Chapter 5, deals with **electrochemical membrane separation processes**. It discusses use of ion-exchange membrances in electrolysis and also other related uses of ionic transfer through ion-exchange membrances. The other areas discussed in this chapter include electroosmosis, electrophoresis, micro and ultra filtration. Commercial applications has been in food and dairy industry, pharmaceutical industries, metal plating industry for effluent treatment, pulp and paper industries and chemical regeneration from salt solution. This chapter is highly informative and well classified. The same comment holds good for the exposition in chapter 6 and 7 **The treatment of industrial process streams and effluents Part I Metal recovery by electrodeposition and Part II Organic and Inorganic species.** Treatment of general procedures followed by specific species is particularly very useful in understanding and appreciating the treatment processes. The versatality of the **synthetic applications of electrochemistry** has been well brought out by providing details for several organic and inorganic chemicals manufacture and synthesis in the last chapter. This is followed by an Appendix which lists all the notations used in the text with proper units for each parameter, dimentionless groups, Greek symbols and subscripts. General references used in the area of electrochemistry, environmental electrochemistry and electrochemical engineering, in addition to the references at the end of each chapter, is an aid for further reading.

Much care has been taken for publication of this informative hard - bound book to suit the needs of a broad spectrum of scientists and engineers (at both undergraduate, graduate levels), industrialists and academics who wish to persue in the area of electrochemcial technology and processes or their design.

I recommend this book to all libraries, academic institutions where chemistry is taught and process industries where envirnometally friendly clean and alternative technologies are emphasised and practiced for synthesis of organic and inorganic compounds in bulk, fine chemicals, pharmaceutical and electronic industries. It is also a must for effluent and recycling chemical and engineering consultants.

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