

Book Review

Progress in Electrochemistry

Edited by D. A. J. Rand, G. P. Power and I. M. Ritchie, Elsevier Scientific Publishing Company, 1981, Price U.S.\$ 102.50

Australia has, in recent years, become acknowledged as a centre of excellence in electrochemistry. In no small measure this may be attributed to the standing of the series of electrochemistry conferences which have been held there. The present volume reports the Proceedings of the 5th Australian Electrochemistry Conference held at Perth, Western Australia in August 1980. It is reprinted from the *Journal of Electroanalytical Chemistry and Interfacial Electrochemistry*, Vol. 118 (1981).

The Conference, which was well attended by both Australians and visitors from overseas (including the reviewer), had all the hall marks of an international symposium. The papers presented covered a wide field of electrochemistry, totalling 82 oral and 37 poster presentations. The present book, published by Elsevier as Volume 15 of their series *Studies in Physical and Theoretical Chemistry*, contains the 33 plenary lectures and keynote papers.

A feature of the conference was the award of two medals by the Electrochemistry Division of the Royal Australian Chemical Institute to distinguished electrochemists. Dr Roger Parsons, Director of the Laboratoire d'Electrochimie Interfaciale du CNRS, Meudon, France was awarded the Bruno Breyer Memorial Medal, the highest award of the Division, while Professor R. H. Stokes of the University of New England (NSW) was honoured on his retirement by being the first recipient of the newly struck R. H. Stokes medal. In his memorial lecture Dr Parsons discussed recent ideas on the electrical double layer at solid/liquid interfaces with the emphasis on precious metal (Pt) and noble metal (Ag, Au) electrodes and single crystals. Professor Stokes, by contrast, gave an interesting and witty review of his career as an electrochemist and solution chemist over the past 40 years. Most chemists know him best as co-author with R. A. Robinson of the definitive work on *Electrolyte Solutions*.

Following the medallists' lectures, the volume contains a further 31 papers, arranged in sections as follows: Energy Conversion (6 papers), Energy Storage (8 papers), Metal Conservation (4 papers), Mineral Processing and Electrometallurgy (6 papers), Advances in Electro-analytical Techniques (2 papers), General Electrochemistry (5 papers). These section headings themselves provide some indication of the breadth of application and utility of electrochemistry in society today. As space precludes mention of all the papers, and as readers of the *Journal of Power Sources* will presumably have

a particular interest in papers on electrochemical energy conversion and storage, it is proposed to focus on these sections.

The contribution which electrochemistry may make in future to the energy scene was discussed by Dr A. J. Appleby (Palo Alto, CA, USA) in his introductory lecture "The Energy Crisis: An Electrochemical Viewpoint". He began by drawing attention to the intrinsic limitation of the heat engine, the Carnot cycle, and the higher intrinsic efficiency of fuel cells for the direct conversion of environmentally acceptable fuels to electricity. A discussion of the problems of energy substitution in general leads to a consideration of the specific problem of replacing internal combustion engined vehicles by electric vehicles and the implications that this would have for electric utilities. Some recent technical advances in electrochemical power devices are discussed in the context of their possible impact on the utilities. Finally, the role of electrochemistry in utilising solar energy is reviewed.

Fuel cells were taken up by S. Srinivasen (Brookhaven, N.Y., USA) who reviewed their recent development in the USA and technical-economic factors influencing their future use in transportation applications and by electric utilities. In more specific vein, B. D. McNichol (Thornton, UK) described work carried out by Shell Research Ltd. on the direct methanol/air fuel cell, making special reference to the electrocatalytic problems involved.

The electrochemical approach to solar energy conversion was reviewed by Mary Archer (University of Cambridge, UK) who also reported some new results on the photoelectrolysis of water using various ternary and quaternary oxides. Leading on from this review, D. Hareman of the University of New South Wales described some work on the production of stable, cheap films of CdSe with an overall efficiency for sunlight conversion of >3%, while J. F. McCann (Flinders University, Adelaide) reported on an electrical method for determining the equivalent circuit components of a semi-conductor/electrolyte/counter electrode cell.

In the Energy Storage Session there were three papers on lead/acid batteries; D. Pavlov (Sofia, Bulgaria) discussed the "Semi Conductor Mechanism of the Processes during Electrochemical Oxidation of PbO to PbO₂" while D. B. Matthews (Flinders University, Melbourne) described some basic experiments on lead and lead oxide electrodes in various electrolytes. An interesting concept for a mechanically rechargeable lead slurry battery was advanced in this paper. In more immediate practical vein, D. A. J. Rand (Port Melbourne, Victoria) reported the results of laboratory tests on lead/acid traction batteries subjected to charge/discharge cycles simulating electric vehicle use. The results, in terms of cycle lives for the batteries tested, were disappointing and show the further scope which exists for developing flat plate traction batteries. Another paper concerned with traction batteries was that of L. Öjefors (Akersberga, Sweden) who reported on development work on iron/air and iron/nickel oxide batteries carried out by the Swedish National Development Company.

The remaining four papers in this Section dealt with other types of battery. K. Kordes (University of Graz, Austria) gave a comprehensive

account of the science and technology of the alkaline MnO_2 -Zn cell. R. M. Dell (Harwell, UK) reviewed recent developments in nickel oxide-hydrogen batteries. M. S. Whittingham (Exxon, N.J., USA) and J. Broadhead (Bell Telephone, N.J., USA) both presented papers on lithium cells incorporating metal chalcogenides as reversible cathodes. A number of different chalcogenides have shown interesting behaviour for the incorporation of lithium ions by an intercalation reaction. These lithium cells hold considerable promise if only the problems of the electrolyte and a fully reversible lithium anode can be solved.

The other sections of the book are equally significant for those with different electrochemical interests. It is unlikely that many individual chemists will have the breadth of interest to justify private purchase of the book, particularly having regard to its high price, but the volume should find a place in most laboratories where research in electrochemistry is carried out.

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