

BOOK REVIEW

Theoretical electrochemistry

L. Antropov, published by MIR, Moscow, 1972. \$25.00.

Until Sputnik, Russian Science and Technology was badly underestimated in America. More recently, an increasingly realistic attitude has developed. In no field has there been a more confident and long term exhibition of leadership than in Electrochemical Science. Although that leadership is generally associated in the West with the names of Frumkin and his colleagues (e.g., Baggetsky and Levich), there are eleven Chairs of Fundamental Electrochemistry in the Soviet Union, and the best-known name in the West, outside those from the Frumkin school, is the author of the present book.

The volume is divided into six parts: equilibrium properties of solutions; irreversible properties of solutions; equilibria at electrodes; the double layer; irreversible phenomena at electrodes; the kinetics of electrode processes. The fifth section deals with general aspects of electrode kinetics, and the last section with those of specific systems. The standard of presentation is elementary. The volume would be suitable for, say, a 24 lecture course on Basic Electrochemistry to third or fourth year chemistry students. The lack of deep development (particularly the absence of Quantum Mechanical treatments) and the microtreatment of the broader-line phenomena (e.g., fuel cells) allows the author to round off a good sketch of fundamental electrochemistry in a rather short space.

Among general characteristics which catch the attention of the reader is the modernity of the material. The orientation is that of a physical chemist, and some connection to solid state science is never far off from the discussion. The style is clear, natural, unhurried, thorough and historical. Occasionally, one wonders if the author could have given up some of the classical material: do students need to learn, nowadays, about Nernst's osmotic pressure?

Some aspects of the book are outstandingly good: the discussion of potentials in cells; the treatment of reduction reactions and their relationship to adsorption; the hydrogen evolution reaction. The breadth of knowledge shown and the manifestation of the relation of the phenomena to other branches of chemistry, is impressive. It contrasts markedly with the restricted character of the electrochemistry presented by those who see largely the hydra-headed solutions of Fick's Law as the centre of the field.

Most books contain some misrepresentations. It is surprising to find Delahay charged principally with the application of the rate theory to electrode kinetics; and the Tafel-line approach towards the evaluation of the exchange current density. To present Pourbaix's diagrams without the kinetic warning that they may deceive does not help the student. The Born equation is often used far outside its realm of applicability. Bernal and Fowler are not credited with the distinction between cation and anion heats, but Miscenko is said to be the author who allowed electrochemists to calculate single heats of solvation, by assuming that those of cesium and iodide ions were equal. Proton migration is short-changed at about half a page, and this has to be contrasted with five pages taken to describe the very classical diffusion potential material. The treatment of metal deposition is erudite and far above the very out of date sketch often given. But one must question the great space given to Budiewski's work. This is of course delightful and sophisticated; but metal deposition does not in practice occur at dislocation-free surfaces.

In respect to priorities, one meets some names which surprise. Thus, the person who is supposed to have discovered electroplating is Yakobi (1837), although Faraday's Laws are dated 1834. Lomonosov (1738) as originator of the concepts of passivation is perhaps more acceptable. On the whole, however, a strict accounting of priorities is attempted and succeeds quite well. Russian authors, particularly in respect to modern work, are not given unduly favourable treatment.

To whom should this book be recommended? Only three years ago, the recommendation could

have been very wide. However, there is perhaps more appropriate material elsewhere for the engineering-oriented electrochemist, and certainly for the electroanalytical chemist. The students who could well use this excellent compendium of the essentials of electrochemical theory, are the middle-of-the-roaders, the chemists themselves, who can here find the essentials of modern Electrochemistry, lightly sketched, in 550 pages.

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