BOOK REVIEW

FUNDAMENTAL ASPECTS OF ELECTROMETALLURGY by Konstantin I. Popov, Stojan S. Djokić and Brammir Grgur

Published by Kluwer Academic/ Plenum Publishers, New York, 2002, ISBN 0-306-47269-4

This book is published on 305 pages with 152 figures, 414 equations, 14 tables and 299 references. It is divided in 12 chapters: 1. What is Electrometallurgy; 2. Definitions, Principles and Concepts; 3. Surface Morphology of Metal Electrodeposits; 4. The Current Distribution in Electrochemical Cells; 5. Electrodeposition at Periodically Changing Rate; 6. Electrowinning; 7. Electrorefining; 8. Optimum Conditions for Electroplating; 9. Electroplating and Surface Finishing; 10. Metal Deposition without an External Current; 11. Electrodeposition of Metals from Molten Salts; 12. Environmental Issues.

In order to give some comments about the scientific value of this book, in spite of my experience in metal deposition. I decided to cite some parts of the foreword for this book which was written by the one of the leaders in world's electrochemistry, Professor John O'M. Bockris from Texas A&M University. In his foreword, among other comments, he said:

"The numerous technologies vary greatly in the degree to which they are intellectualized. Until the work of Popov *et al.*, electrometallurgy has been regarded as largely empirical, an activity in which there was much art and little science. This will all change with the publication of this book.

There are many figures in this splendid book of Popov *et al*. which impress me. The first is the strong, broad contents of its arrangement. There is a fine first chapter on principles of application to electrochemical kinetics – the equations being written in a form modified for use in electrometallurgical situations (*e.g.*, deposition on the tips of growing crystals of minimal radius of curvature and on corners and edges). Here, it is encouraging to find authors applying the electrochemical version of Kelvin's equation relating vapor pressure as a function of the radius of drops to the phenomena during the electrogrowth of dendrites.

I personally find the treatments of the effects of current varying regimes (*e.g.*, pulse, reverse pulse, square wave, sinusoidal, *etc.*) the most exciting for I have long thought that instead of the use of chemical additives to the solution, the type of surface finally produced – even the crystal shape – could be achieved by electrical

variations only. This book contains much toward the realization of this approach.

In the second half of the book, one finds the mathematical treatments of practical situations in electrowinning, electrorefining, electroplating and electroforming. What is the difference all this will make? It should enable to engineer to set up regimes to achieve what he wants with a minimum of prefatory experiments.

This book has no competitor. There are certainly books on electroplating. but they are largely recipes for what to do which eschew the important question of why.

Getting the intellectual side over to the practical engineer, of course, requires great lucidity, for he will not puzzle over material delivered over his head. I think the required clarity has been attained herewith, particularly in the early chapters where the concepts of exchange currents and overpotential are being added to the weary thermodynamics which covers most of what engineers are likely to know about electrochemistry.

A great strength is in the photographs of electrodeposited crystals in all their variety. Such photographs can be found in the usual journals, but I have not previously seen such a collection accompanied by textual rationalization.

Lastly, I was impressed by the application of the theory to areas which normally receive little more than a definition. I would cite electropolishing, where theory is seldom presented; electromashining; and electroless plating."

Finally, it should be emphasized here that almost 70 % of the results presented in this book has been published in the Journal of the Serbian Chemical Society, making this Journal one of the most known in the field of electrometallurgy.

Prof. Vladimir Jović
Center for Multidisciplinary Studies
University of Belgrade