

NEWS

Book review**Electrochemical reactors: their science and technology
Part A: Fundamentals, electrolyzers, batteries and fuel cells**

Edited by M. I. Ismail

Elsevier, Amsterdam and New York, 1989, 548 pages, \$139.5, Dfl 265 (ISBN 0-444-87139-X)

This book is intended as "a guide for professionals interested in energy transfer and electrochemical technology". From the editor's preface and the publisher's advertising, a reader would expect to find the 15 chapters split into Part A (covering the fundamentals of electrochemical reactors, batteries and fuel cells, various aspects of design, construction, materials, operation and control systems), Part B (covering water electrolysis, organic and inorganic electro-synthesis, electrochemical polymerization, molten salt electrolysis, electrochemical machining, metal finishing, reactor performance, failure mechanisms, corrosion control, material selection), and Part C: (covering surface treatment of commercial reactor materials, fastenings and mathematical modelling of various reactor processes). However, the chapter contents indicate that this is the first (Part A) of three volumes, in agreement with the book's title. This unfortunate error reflects the general level of editorial care in harmonising the content, depth of coverage and quality of presentation in the various chapters. For example, irrespective of the merits of chapter 5 on heat and mass transfer, the editor could have subsumed it in the more extensive chapter 11 on fluid transport, thereby avoiding some duplication.

The characteristic features of the content and structure of the text are the component-based descriptions of electrochemical reactors and the more practical approach adopted in many of the chapters, than found in previous monographs on the subject. This is complementary with the reactor theory approach taken by Elsevier monographs on electrochemical engineering by Pickett and Fahidy. However, it means that a reader will not find explicit information, for example on reactor modelling.

To avoid any further confusion about the actual coverage, the chapter contents are listed below. These are written mostly by well-known electrochemists or electrochemical engineers, and reproduced from camera-ready manuscripts, with extensive references.

1. *Introduction to Electrochemical Reactors* (8 pages) – presaging some of the subsequent chapters.
2. *Fundamentals of Electrochemical Reactors* (19 pages) – electrochemical thermodynamics and transport processes.
3. *Fundamentals of Electrode Kinetics* (23 pages).
4. *Design concepts in Electrochemical Processes and Engineering* (33 pages) – design concepts, energy saving, reactor selection, scale-up pitfalls, industrial cell designs, health and safety.
5. *Heat and Mass Transfer* (22 pages) – with extensive listing of correlations.
6. *Traditional Problems with Electrochemical Reactors* (26 pages) – selectivity, electrode failure mechanisms, gas evolution.
7. *Electrodes* (44 pages) – electrocatalysis, current density distribution, bubble effects, mass transfer, 2-D and 3-D electrodes.
8. *Electrolytes* (16 pages) – liquid, molten, solid and polymer electrolytes.
9. *Separators* (37 pages) – hydrodynamics of diaphragms, transport, membranes, composite structures, including electrodes, separator selection.
10. *Commercially Available Materials for Electrolyser Construction* (27 pages) – metallic and electrode materials, corrosion, diaphragms and membranes, polymers, gaskets.
11. *Fluid transport in Electrochemical Reactors Systems* (66 pages) – an extensive treatment including pump selection, flow through porous media and gas/liquid flow.
12. *Control Systems* (21 pages) – automatic control, process dynamics, controller design, reactor control.
13. *Process Control Systems in Electrochemical Engineering* (21 pages) – reactor, chemicals and safety control.
14. *Batteries* (60 pages) – primary cells (MnO₂-Zn, Ag₂O-Zn, HgO-Zn, Li cells, Zn-air), rechargeable cells (Pb acid, Ni-Cd, Ag₂O-Zn), new battery materials.
15. *Fuel Cells* (56 pages) – low, middle and high (solid oxide) temperature systems.

The Appendix contains information on recent patents, on organizations involved with reactors, on power supplies and a glossary.

In spite of the editorial shortcomings, the book can be recommended as a useful contribution to the subject area, in terms of bringing together otherwise widely dispersed material, to inform chemical engineers and chemists of the present level of understanding, scope, and some applications, of electrochemical reactors.

G. H. KELSALL
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