

**INDUSTRIAL ELECTROCHEMISTRY,
Second Edition**

by Derek Pletcher and Frank Walsh
Chapman and Hall, New York (1990) \$115

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In their preface, the authors write that ". . . electrochemistry and electrochemical engineering as academic disciplines . . . remain insufficiently taught at both undergraduate and post graduate levels." Their perspective is shared by others. The National Association of Corrosion Engineers (NACE) is currently forming a task group to find ways to improve corrosion education in this country. In spite of the fact that electrochemical systems encompass one-ninth of the chemical process industry, most chemical engineering undergraduates receive no exposure to the field beyond a two-week stint in a physical chemistry class. The authors express their hope that "this book will encourage many more teachers to take up the challenge of teaching an integrated applied electrochemistry course."

This text provides a compelling demonstration of the importance of electrochemical processes. In ten chapters and 460 pages the authors explore:

1. Electrolytic production of chlorine and caustic
2. Electrolytic extraction, refining, and production of metals through electrowinning, cementation, electrorefining, and electro-deposition of metal powders
3. Electrolytic production of a number of low-tonnage inorganic products such as fluorine, hydrogen peroxide, ozone, and manganese dioxide
4. Organic electrosynthesis of adiponitrile (used to make nylon) and other commercial electro-synthesis processes
5. Waste-water treatment by electrochemical processes such as electrodeposition of metal ions, in-situ formation of oxidizers, and electrodialysis
6. Metal finishing including electroplating, electroless plating, and electrophoretic painting
7. Metals processing, including electroforming and electrochemical machining and etching
8. Corrosion and corrosion control
9. Batteries and fuel cells

10. Electrochemical sensors and monitoring techniques

This text provides a broad overview of electrochemical technology, and the detail with which these systems are covered is sufficient for a survey course. The review of electrochemical practice is preceded by two chapters that cover the fundamentals of electrochemistry and electrochemical engineering. The discussion of fundamental electrochemical concepts (Chapter 1) is very compressed and may be tough going for the typical undergraduate chemical engineer. It does, however, outline the key factors that distinguish electrochemical processes from traditional chemical systems. The section on electrochemical engineering (Chapter 2) emphasizes costing of electrochemical processes and introduces typical cell designs.

This text could be used for an elective survey course directed to senior undergraduate students and beginning graduate students. The strength of the book, in this application, is its comprehensive overview of the field. The authors, however, do not make it easy for the instructor. The text does not include homework problems and, while general suggestions are made for further reading, specific attributions are not given for the material presented in the chapters. Therefore it is difficult to know precisely where to look for more information on a specific topic.

The discussion of fundamentals is not integrated into the discussion of industrial processes. While the authors stress the importance of current distribution in Chapters 1 and 2, such calculations are not employed for the design of industrial processes covered in Chapters 3 through 12. For example, the authors present different battery types in Chapter 11, but do not present the manner in which one would try to optimize the battery design based on principles governing current and potential distribution. Impressed current cathodic protection is presented in Chapter 10 as a means of controlling corrosion, but the equations used to design a cathodic protection system are not presented. This level of coverage is suitable for a survey course. For an advanced graduate-level class, I would want to apply the fundamental concepts by introducing the modeling and optimal design of some sample systems. *Industrial Electrochemistry* could be a good complement to a text such as Newman's *Electrochemical Systems* in an advanced graduate course.

Industrial Electrochemistry would be an excellent textbook for an upper-level undergraduate survey course on applied electrochemical technology. □