

Book review

Modern batteries. An introduction to electrochemical power sources

C. A. Vincent and B. Scrosati
Arnold, London, (2nd edn, (1997), 351 pp
ISBN 0 7506 7092 4, £21.99

I have been using the successful first edition of this book (1982) for several years as a contribution to source material for undergraduate and short courses on energy conversion and batteries. The second edition contains a new section on electric vehicles and has undergone a general revision. As the authors realize in their prefatory remarks, one of the most important changes in the last 15 years has been the expansion of microelectronics-based, high value consumer products requiring rechargeable cells showing high energy density and good charge retention at reasonable cost. We increasingly seem reluctant to live without the 'essential' three 'Cs': Cellular telephones, portable microComputers and Camcorders. The book contains an excellent treatment of the lithium and nickel hydride cells often used in these applications. Indeed, we have come a long way since the voltaic pile of the early nineteenth century and modern life demands that, on average, we now use 8–15 batteries per head of the population per year in developed countries.

The text, which has been written for the nonspecialist, provides a readable, fundamental treatment of batteries and is well illustrated by diagrams and

Batteries for automotive use

P. Reasebeck and J.G. Smith
Research Studies Press Ltd, Taunton, England (1997)
213 pp, ISBN 0 86380 176 5

This book aims to provide automotive electrical engineers and others with a background to the field of battery technology as it applies to road vehicle systems. As such it should be treated as an introduction only, compared to the more detailed works available on battery technology. However, it does cover a broad area, discussing topics not normally found treated together in a text on batteries, such as battery manufacturing, battery failure modes, the worldwide market, recycling and environmental issues and vehicle electrics, ending with a summary of the new power source technologies.

Because of its remit, this book largely focuses on the lead–acid battery as the ubiquitous system for cars and larger road-going vehicles. A chapter is also given over to the nickel–cadmium system, which is sometimes used in buses and other public service vehicles where the economics can be favourable.

graphical data. The fundamentals, technology and applications of batteries are described. The authors have deliberately excluded fuel cells from their treatment. This is understandable as inclusion of the fast-moving field of fuel cells would have greatly expanded the size of the text. However, the absence of fuel cells provides a problem for lecturers delivering an integrated course on electrochemical power sources and wishing to use a single text.

Following an 'Introduction' and a 'Theoretical background', chapters are provided on 'Primary aqueous electrolytic cells', 'Primary lithium cells', 'Secondary lead–acid cells', 'Secondary alkaline cells', 'Rechargeable lithium cells', 'High temperature cells' and 'Miscellaneous cells'. The authors are both well known for their contributions to the electrochemistry of battery systems and their strengths are particularly evident in the excellent chapters which concern lithium and solid state batteries.

The text is well written and deserves to be read by all electrochemists and other scientists who are involved in teaching or research in the essential area of battery technology and electrochemical energy conversion. Indeed, it is recommended reading not just for 'battery electrochemists' but for all scientists and technologists involved in development and use of efficient energy conversion devices.

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The text begins with an interesting précis of the history of the development of vehicle electrical systems, and the parallel developments in lead–acid technology. It is interesting to see how one technology has driven the other. The text then considers the standard treatment of basic electrochemical principles of the lead–acid system. This is covered clearly, with the minimum number of equations.

The battery structure and the functions of the different components are then described, as is the way that these components have been developed in order to maximize battery performance. Lead–acid battery manufacture is then covered at some depth in chapter 3, along with photographs of the manufacturing equipment. Chapter 4 reviews the worldwide market for batteries and assesses the environmental impact before concluding with a section on recycling.

Chapter 5 describes the operating characteristics and failure modes of the battery. We then move into the still uncharted areas of state-of-charge measurement and battery health monitoring, which illustrates how little the lead–acid system is understood, even after more than a century of research and development.

The essentials of the nickel–cadmium system are summarized in chapter 6, before we move into the final chapter, which deals with future developments in vehicle systems design and the future requirements for the battery. The issues of high voltage ($>12\text{ V}$) systems are discussed, as is the idea of multiple battery systems.

Not surprisingly, the authors believe that lead–acid technology can meet the future challenge, and highlight areas for future research and development. A useful summary of the challengers to lead–acid dominance in automotive applications, including nickel–alkaline and lithium–ion batteries, together with super capacitors, concludes the text.

A list of useful references are provided with each chapter. Appendices include a bibliography, a comprehensive glossary of terms and key technical data relating to the lead–acid system. The treatment of: vehicle electrics, the worldwide battery market, re-

cycling and the environment and the lead–acid battery production process all in the same volume is what makes this work unique.

Some typographical errors occur on page 9. To address this problem, the text needs to be deleted from line 2 (sentence starting ‘Later versions ...’ to line 7 (sentence ending ‘... effect of battery’).

The text will be particularly helpful to its target audience, the automotive electrical engineer, but it will also be useful to students and those working in other disciplines who require an overview of battery technology. It would also be useful as an introductory text for students of electrochemical technology and those intending to specialize in energy storage.

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