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Book reviews

Chlor-Alkali Technology Volume 4
N. M. Prout and J. S. Moorhouse (Eds)
Elsevier Science for the Society of Chemical Industry, 1990
ISBN 1-85166-392-4 £55.00

The volume represents those papers presented at the 5th chlorine symposium organized in 1988 by the Electrochemical Technology Group of the Society of Chemical Industry. It has some advantages not normally present in conference proceedings and its coherence is due to the fact that all the papers deal with aspects of chlorine production. Also, the great majority of papers are presented by industrialists and in consequence deal with recent aspects of chlorine production of direct concern to other industrial producers and to those interested in electrochemical engineering.

In spite of the well-defined subject of the volume topics range over wide limits. Thus the first paper, entitled 'The World Chlor-Alkali Industry Past–Present–Future', explores past and present trends and provides reasonably up-to-date statistics. Considerable emphasis is placed on safety and environmental aspects as evidenced by general papers: 'The Increasing Regulatory Controls and their Effects on Business' and 'The Safety of Liquid Chlorine Storage, Transportation and Environmental Protection in China's Chlor-Alkali Industry', as well as technical papers on membrane technology. Other papers deal with practical aspects of design and performance of electrolysers. The remainder of the 29 papers are concerned with electrode materials for chlorine cells. Only one author discusses the production of sodium chlorate. Of all the presentations only one, entitled 'An Electrochemist's View of Chlorine Manufacture', could be called academic and the reviewer is not sure whether this should be regarded as a recommendation or not.

In summary this is a worthwhile publication keeping up to the high standard of its predecessors. It covers the latest developments in chlor-alkali technology and should be of interest not only to people directly involved in the industry but also to those concerned in general electrochemical engineering. As to the price of the volume the reviewer has long given up commenting on the price of technical books.

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Quality and reliability methods for primary batteries
P. Bro and S. C. Levy, John Wiley & Sons, New York
Hardback, 302 pp. ISBN 0 471 52427 1. £63.10.

This is another book in the series sponsored by The Electrochemistry Society which maintains the same high standards as the previous publications. Both authors are known throughout the primary battery industry for their research and publications and their present work is a very readable and valuable contribution.

In an industry that is not particularly known for compliance and maintenance of specification, this book shows how standard quality procedures are systematically carried out with only basic knowledge of statistics. It can be used to predict both battery performance and reliability and as a diagnostic tool for the analysis of battery inefficiencies. Particular attention is paid to the changing behaviour of primary batteries with time. Indeed, as the authors state, primary batteries have the unavoidable characteristic of wearing out even when they are not used and conventional reliability techniques have been extended to take into account these kinetic effects.

Part 1 offers a short introduction to some basic battery concepts and definitions. It provides an elementary approach to primary batteries and introduces the difficulties caused by the unavoidable deterioration of batteries with time and shows how reliability and confidence levels can be estimated from capacity distributions after allowing for the kinetics of their deterioration.

Part 2 is of particular interest to engineers and users for its quantitative forecasts of long term battery reliability. There are seven chapters dealing with reliability patterns, various distribution functions and the kinetics of battery deterioration and its effect on capacity distribution. These changes are described using linear or exponential kinetic models, with consideration of situations where the kinetic parameters are constant (deterministic) and variable (stochastic). The final chapter is a basic statistical exercise on the importance of sample selection. Nevertheless, it illustrates the uncertainties that arise where the sample behaviour differs from that of the main population.

Practical aspects are considered in some detail in Part 3. Conventionally, reliability can be defined as the probability of the cell or battery performing within the required voltage/current range for a specific period of time: In practical terms, however, the cell or battery fails when it cannot deliver the required current above some threshold value, prior to reaching the expected operating life. This failure may be due to some inherent fault in the design, materials, fabrication, or due to errors in handling or connecting to the device, or due to a faulty device which drains the cell or battery at a higher rate than expected. Consequently the authors consider the interactions between the battery and the system it is powering and include the influence of multicell series and parallel arrangements on reliability. This section also describes the use of fault trees to provide an understanding of the relationship between various deficiencies and system reliability and as a useful tool for the systematic improvement in quality and reliability.

In addition to sections which describe a range of nondestructive methods of examination, Part 3 also contains chapters on how design and manufacturing approaches can be used to improve reliability. The final chapter deals – all too briefly – with examples and case histories explaining how the use of these techniques have been used to improve products and overcome defects. Regrettably, only three examples are given, namely improvements in zinc–mercuric oxide batteries for implanted pacemakers which extended the service life from eighteen months to ten years and reduced the self discharge rate to less than 2% per month; the design of lithium iodine cells having very high reliability, also for pacemakers; and the development of high energy density lithium–sulphur dioxide cells to power electronic measurements for five years or more with high reliability. Further examples of this kind would have been of value.

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