NEWS

Book reviews

High-energy non-aqueous batteries
by Andrezej Cisak and Lidia Werblan,
607 pp, Ellis-Horwood series in Physical Chemistry, 1993, £65, ISBN 0 13 388596 8

It has become almost a cliché to emphasize the need of our modern society for improved means of storing electricity. Electrochemistry–thus batteries–remains the most studied approach, as seen by the increasing number of publications, symposia and monographs addressing this subject. Clearly, this domain is vast enough, with different schools of thinking, to allow a multiplicity of contributions each possibly bringing some enlightenment to the reader. As suggested by the title, the focus is on systems using electrolytes rather than water solutions. For high-energy systems, the choice is that of the majority of the scientific and engineering community, as estimated from the relative volume of publications.

The book is comprised of 8 chapters:

1. Historical outline.
2. Theoretical principles of action of galvanic cells.
3. Basic kinetics of electrode processes.
4. Transport processes in cells.
5. Anode materials.
6. Cathode materials.
7. Solvents and electrolyte solutions.
8. Non-aqueous cells and storage batteries.

The introduction is an excellent reminder of the two-centuries old strive for improvement of the original results of Volta who himself took inspiration from Galvani's work and the then unexplained observations of physiologists.

The three following chapters feature the thermodynamics and kinetics of cells and parallel the generality of advanced electrochemistry textbooks, but mainly without addressing the specificity of non-aqueous cells. Molten salts and solid electrolytes like β-alumina or polymers are left aside, a lacuna if we consider their specificity in terms of charge transport mechanisms and the numerous examples taken from high-temperature electrochemistry in the last chapter. Also, we miss a section devoted to the definition and role of transport (transference) numbers. A description of an hypothetical reaction mechanism for the Li/CuS cell appears quite out of place in the chapter devoted to charge transport in electrolyte solutions; besides, it is now generally agreed the displacement type reaction chosen as an example proceeds via an intermediate insertion compound which eventually disproportionates. Along the same line, chapter 6 on cathode materials (positive electrode would have been preferable) lacks a presentation and discussion of the generality of insertion reactions, a special case of which is intercalation and is specific to layer compounds like disulfides (TiS_2). Again, the far more studied insertion compounds found among oxides (MnO_2, V_2O_5...) appear as impromptu references in the last chapter. Nevertheless, the classification for electrode reaction has been the subject of a specialized conference series and is unanimously accepted [Electrode Materials for Advanced Batteries, D.W. Murphy, J. Broadland & B.C.H. Steele eds., NATO Advanced Studies, Plenum Press, New York, page 343, (1980)].

The quasi-absence of references to lithium-carbon compounds as negative electrode materials is excusable considering the novelty of the field, but a regret for the reader eager to follow recent trends.

Finally, chapter 8 gives pell-mell the results on both laboratory or commercial cells but some information appears outdated.

There are, unfortunately, traces of a hasty translation/editing of the book, as for 'glaze' (...glassy solid electrolytes), the repeated mention of hyposulfite for dithionite $S_2O_4^{2-}$ or the reference to nonexistent CuF (...CuF_2) or $LiAlF_6$ (...$LiAsF_6$)...etcetera... Moreover several of the formulas for solvents in Table 7.1 page 165 are wrong. Such errors should be corrected in a future edition.

As it is, this book could be useful for the expert in the field who is able to find specific information despite dissimilar views or analysis. As it lacks clarity and precision on many points, it may be questionable as an introduction to the field for newcomers.

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