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NEWS

Book reviews

Graphite Fluorides (Studies in Inorganic Chemistry, Volume 8)
N. Watanabe, T. Nakajima and H. Touhara
264 pages, Elsevier, Amsterdam, 1988, US$ 107.25, Dfl. 220.00, ISBN 0-444-42885-2 (Vol. 8)

This volume reviews the preparation, characterization methods for, and end uses of graphite fluorides. The book is an invaluable source of data on physical, chemical, electrochemical, and surface properties of graphite fluorides. Almost all the data presented was gathered through the authors' own exhaustive work beginning as far back as 1959, however, extensive references to further literature are given at the end of each chapter.

Structures of graphite fluorides are discussed and it is shown that two distinct forms may be prepared having different properties. Fluorination of other forms of carbon, including fibres, is reviewed and kinetic data are given.

Electrochemists will find of interest the chapter discussing the "anode effect" in the electrolysis of fluoride-containing molten salt electrolytes and the chapter on lithium/graphite fluoride batteries.

The "anode effect" is attributed to the formation of a type of fluoride film which the authors separately prepared via non-electrochemical means and characterized. The hydrophobicity resulting from progressive fluorination is shown to play a role in the sudden and very large increase in anode potential observed during the "effect". Adherent fluorocarbon gases are also a factor. Both the roles of trace water and electrolyte constituent concentrations are characterized.

The properties of graphite fluoride as a cathode for batteries are discussed and its discharge characteristics are presented. The effects of the form of carbon used and the extent of fluorination are shown to be especially important. Data obtained in different solvents are presented. Extensive full-cell and half-cell data are presented, along with interpretive theory and electroanalytical experimentation.

A further application of graphite fluoride, as a solid lubricant, is discussed following a chapter on surface properties. Circumstances in which graphite fluoride has been shown to be of practical advantage are illustrated (these tend to be in high-temperature or high-load conditions).

All in all the book is very well organized, which is very much to the authors' credit, considering the topics selected, which range from the academic to the technological. It fills the wide gap on most library shelves between comprehensive texts on the fluorination of organic compounds by such authors as Chambers, Banks, and Hudlicky, and Ubbelohde's dated (1960) "Graphite and its Crystalline Compounds". Until this publication, there was no alternative to laborious networking through the primary literature.

Use of the English language has proved no barrier to the authors in achieving clarity, and in light of this electrochemically-oriented readers will forgive the single reference to a "Ruggin Capillary".

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3rd Meeting on Lithium Batteries
Journal of Power Sources **20**, 1–4 (1987)

With the growing demand for portable energy sources, lithium batteries are commercially more important and generate substantial scientific activity. Their main advantages are a high energy density, high voltages (up to 3 V) and very low self-discharge rates, a significant asset when compared to classical aqueous systems.

The scientific community in this field has felt the need for an exchange of information, by a meeting held every two years. The Third International Meeting on Lithium Batteries (3rd IMLB) held 27–30 May in Kyoto, Japan, had attracted some 240 scientists from 20 countries. A total of 50 papers have been compiled in a special issue of the *Journal of Power Sources* out of 90 presentations, either as lectures or posters.

All pertinent aspects of lithium batteries, both primary and secondary (rechargeable) have been addressed:

Solid Electrode materials have received the maximum attention (22 papers); they include inorganic, crystalline or glassy, cation (Li^+) intercalation compounds. Conjugated polymers should indeed be considered as anion intercalates in their doped state and are tentatively proposed as the positive electrode component.

Electrolytes (12 papers) fall mainly into three categories: (i) organic solutions, with emphasis on mixed solvents whose kinetic inertness and dissociation ability are needed for long shelf life and possible rechargeability. (ii) Inorganic electrolytes, like sulphur dioxide or oxyhalides which are used both as a dissociating medium and depolarizer. (iii) Solid electrolytes with a perceptible interest in ion-conducting polymers that can be processed into thin films.

Interfacial studies and system characterization (8 papers). The cyclability of the lithium electrode is a major challenge, and the characterization of passi vating films inevitably formed at the surface in con-

tact with the electrolyte is needed to understand the dissolution–nucleation processes.

A salient feature of this meeting is the importance that was given to secondary lithium batteries. Recent progress in the field has made such systems feasible, and the number of scientific contributions (34) reflects this historic trend. While a choice of high-performance intercalation compounds is now available, difficulties reside in the selection of electrolytes allowing the lithium plating process with good efficiency, also avoiding the growth of dendrites.

Primary cells are already commercial. Miniature, low drain button cells with solid intercalation cathodes and used in electronic equipments are actively studied in countries like Japan where the electronic industry is the most productive. High rate systems using liquid depolarizers are mainly for military applications and represent the major research effort in the USA.

Interestingly, the book includes the minutes of a round table discussion at which the future of lithium batteries was debated. If a consensus appears for a growing share of such energy sources, no system is accepted unanimously as covering all the needs in the field. The safety aspects, however draw a definite attention: toxicology, fire or explosion hazards have to be studied carefully if large scale lithium batteries production is to replace conventional systems (lead-acid, Ni/Cd) which themselves constitute a potential heavy metal pollution problem.

This book reflects quite well the research activity and trends in this field. The proceedings of the subsequent Meeting, held in Vancouver in May 1988, will be published similarly in the *Journal of Power Sources*.

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Studies in Physical and Theoretical Chemistry, Volume 50, Photoelectrochemical cells
Edited by K. S. V. Santhanam and M. Sharon.
xii + 372 pages, Elsevier, Amsterdam, 1988,
US$ 144.75, Dfl. 275.00 ISBN 0-444-42910-7

Multi-author volumes of conference or workshop proceedings are frequently disappointing. This is perhaps not surprising since the material is generally aimed at the lecture and discussion group presentation with the publication of the material an afterthought.

Volume 50 in the series "Studies in Physical and Theoretical Chemistry", is an offshoot of a UNESCO workshop held at the Indian Institute of Technology, Bombay in 1986 on the electrochemistry of the semiconductor–electrolyte interface and photoelectrochemical solar cells. The various authors cover a fair span of topics from the introductory overview and physical background, through to details of semiconductor fabrication, thin film deposition and electrode characterization. Also included are details of the laboratory practicals including a description of the construction of a rudimentary potentiostat and triangular wave generator.

A particular criticism of the book is the type-setting, or rather lack of it. The text was evidently supplied camera ready and has been produced on a dot matrix printer of rather poor quality. As a consequence it is, at best, unpleasant to read and in the theoretical sections (where Greek, superscripts and subscripts are encountered) practically impossible. On the whole the book is disappointing.

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