tween the layers, and, most importantly, high electrochemical reactivity have contributed to the practical exploitation of graphite fluorides.

To bring lithium and fluorine together as reaction partners in an electrochemical primary battery is a worthwhile objective, because of the expected high cell e.m.f., but a fluorine partner in manageable form only became a possibility with the availability of $(C_xF)_n$ compounds. Using electrolytes in organic solvents it was found possible to attain a cell e.m.f. of 3.2 to 3.3 V. *Watanabe*'s laboratory carried out pioneering work on this development. The present state of knowledge on the electrode kinetics of graphite fluoride cathodes, and the effects of the crystallinity of the carbon, the method of preparation and the nature of the solvent in the cell are treated systematically in Chapter 5.

Chapter 6 describes how graphite fluorides are used to good effect in applying a fluoride film to aluminum. By using a graphite fluoride, or alternatively by simultaneous in-situ reaction of natural graphite and fluorine, films with large contact angles (125° for water) can be produced. In Chapter 7 the potential of $(CF)_n$ as a solid lubricant is evaluated by comparing it with graphite and MoS_2. It is noteworthy that metals and $(CF)_n$ can undergo co-deposition from certain electrolytic cells, e.g. from a Watts nickel cell, if surface active agents are added to force dispersion of the $(CF)_n$.

The final chapter summarizes the state of knowledge on C_xF, an intercalate of the acceptor type with ionically bound fluorine. The high cell e.m.f. observed for the combination of C_xF with lithium (3.9 to 4.2 V) is attributed to the release of active fluorine from the intercalate. However, at high current densities the increase of overpotential with current is steeper than for graphite fluorides.

The book does not make easy reading, due to the fact that it goes into considerable experimental detail. Nevertheless, it is indispensable for anyone whishing to gain a thorough knowledge of the preparation, properties and uses of graphite fluorides. For other readers it will be valuable as a work of reference, especially as it gives a full and up-to-date coverage of the literature.

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Polymer Characterization

Polymer Microscopy. By *L. C. Sawyer* and *D. T. Grubb*. Chapman and Hall, London 1987. XIII, 303 pp., bound, £ 55.00.—ISBN 0-412-25710-6

The book "Polymer Microscopy" at least partially closes the gap between the large number of textbooks on electron and optical microscopy on the one hand and the problem oriented books about polymer morphology on the other. In general, a student of polymer science has a research problem which calls for the use of a variety of methods. It was always difficult to give him textbooks which would familiarize him with the possibilities and limits of microscopy applied to polymers, and would review what has already been done in his field of interest.

"Polymer microscopy" is not a textbook which enables the novice to avoid further reading of other books and review articles, but he (or she) will find out from the detailed reference list where additional information on a particular topic is available. An attempt has here been made to treat optical microscopy and scanning and transmission electron microscopy in one text. The result, however, is unbalanced to some extent. Whereas the treatment of electron microscopy takes most of the space, the field of optical microscopy on polymers is not sufficiently covered, even for a first introduction.

The main chapters which make the text worth reading in full, and which can also be used as a reference source, are those entitled "Specimen preparation methods" and "Polymer applications". The preparation chapter encompasses all the important stages that a sample can undergo on its way from the original state to the final specimen suitable for introducing into the microscope. Common sources of artefacts are also discussed, and some illustrations of them are reproduced. The applications chapter has to be seen in the light of a note in the authors' preface as follows: "Most of the applications come from work done by *Linda Sawyer* as a member of Celanese Research Company staff, and thus they come from the products and projects of interest to that company". Nevertheless, one does not get the impression that the idea for writing the book arose when someone had to tidy up the filling drawers in his office. The chapters are well organized, the index is very detailed, and a large number of references is listed up to 1984/85. But the statement that the text reflects the authors' experience and interests should certainly not be taken as detracting from the merit of having collected this material together.

A reader from an academic environment who has sometimes quite different problems regrets the omission of some guidance in the use of electron diffraction and dark field techniques for the investigation of polymers. These methods are very powerful when applied to semicrystalline samples to elucidate structural details or textures. The principles of these methods are explained and a few patterns are shown, but an unexperienced operator of an electron microscope who has read this text will not be able to use the instrument with the correct settings which are necessary for examining polymer specimens. And it is just this knowledge which one does not find in general textbooks on electron microscopy.

In the appendix a list of abbreviations for polymer names is given, but it does not help the reader to use the text as a reference book. For example, it is cumbersome to find out where abbreviations like LCP or NTP are introduced in the text.

The reproduction of photographs is of a high standard; some optical micrographs are even reproduced in color. The spelling of names, however, is incorrect in some cases. Obviously scientific publishing houses are not always able to reproduce special letters of foreign languages (e.g. as in Köhler, Poincaré, Michael-Lévy or the term Moiré pattern). This is irritating for a European reader. In spite of these remarks one can recommend the text to graduate students of polymer science as an introduction to the field, and to scientists as a reference book.

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Classical Light Scattering from Polymer Solutions. By *P. Kratochvíl*. Elsevier, Amsterdam 1987. xii, 334 pp., bound, Dfl 240.00.—ISBN 0-444-42890-9

The author deals exclusively with classical light scattering by polymer solutions, in 321 pages of text. The book treats the subject at a very elementary level, and it is presumably intended as an introductory text for students. The theoretical background of classical light scattering is treated in a way which verges on the superficial, whereas the applications and experimental details are dealt with very thoroughly. The book begins with an introduction to the physical principles of light scattering. In this it already becomes apparent that *Kratochvíl*, in his concern to present the subject in the simplest possible way, is prepared to forego a proper understanding of the physics; for example, the scattering vector is not introduced as such, but is instead referred to as "parameters for describing the angular dependence of the scattered light".

The second chapter deals in minute detail with methods of measurement and sample preparation. Here the reader benefits from the author's long experience in dealing with the everyday problems which arise in light scattering. There are also detailed descriptions of the main types of light scattering photometers, most of which are nowadays only of historical interest and are no longer marketed commercially. The currently used differential refractometers are also discussed. Surprisingly, however, *Kratochvíl* makes no mention of the existence of the modern laser light scattering photometers which have now been available for about five to eight years.

The third chapter deals with "basic light scattering techniques", such as fixed angle scattering, the dissymmetry method, and the well known Zimm method for analysis of light scattering. The only one of these which is still important nowadays is the Zimm method, which is discussed at some length; the other two methods have long since been consigned to history.

The next two chapters deal with light scattering by polymers in mixed solvents and scattering by copolymers, both of which are complex and many-faceted topics. The treatment in the book is limited to a qualitative description of the physical phenomena, but presents all necessary equations.

The book concludes by discussing the importance of light scattering for polymer characterization. It is first considered in relation to other methods such as viscometry and gel permeation chromatography, followed by a discussion of the characterization of branched structures and polyelectrolytes. The final chapter is very informative and useful since some light scattering curves for industrially important polymers such as PVC, polyethylene and polyamides are presented and discussed. The reader is (quite correctly) given the impression that the light scattering measurements as opposed to sample preparation are a relatively minor part of the work; aggregation or crystallization of the samples are usually found to interfere with their molecular characterization, and need to be minimized by choosing the most suitable experimental conditions (temperature and choice of solvent).

Considerable sections of the book are long-winded and tedious to read. The book could have been significantly reduced in length by stating the ideas more precisely and without the (superfluous) digressions into the history of light scattering. Despite this, the book will be useful for anyone wishing to begin work on classical light scattering, since no other comparable work exists.

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