BOOK REVIEWS

Progress in Dielectrics. Volume 3. General Editor, J. B. BIRKS, Ph.D., D.Sc., F. Inst. P. American Editor, PROFESSOR J. HART, Ph. D., John Wiley and Sons, Inc., 440 Park Avenue South, New York 16, N. Y. 1961. vii + 292 pp. 16 × 24.5 cm. Price, $10.00.

The subject of dielectrics is a broad one, as illustrated by the fact that the present volume includes a discussion of the molecular structure of water and a summary of the latest developments in cable insulation in the United States, both of which subjects are of interest to potential readers of this volume. It must be admitted, however, that few of these readers may be expected to be equally interested in the two subjects, for the gap between those who use the methods of dielectric investigation to add to our knowledge of the structure of matter and those who employ them for the improvement of power transmission, instruments and even weapons is a wide one. The series, of which the present volume is the third, provides articles which should be of value to readers of widely divergent interests, not only by bringing them up to date in their special fields of interest but in widening their horizons beyond these fields. The present volume seems to maintain a fair balance between the theoretical and the applied aspects of the subject. It may be superfluous to point out the value of reviews like these, but it is of interest to quote from the introductory paragraphs of the article on "Theories of Dielectric Polarization and Relaxation": "dielectric properties are important and useful in a variety of fields of physics, chemistry, engineering, and biology. . . . To keep this review within bounds, a number of topics which have considerable relation to its title have had to be omitted entirely or mentioned only briefly. These include, for example, properties of semiconductors, ferro- and piezo-electricity, molecular structure in relation to dipole moments, electrical properties of biological structures, heterogeneous solids, insulation, and electric breakdown. Even within the limits set, a rough estimate indicates that fifty or more papers are currently appearing yearly which are devoted in some part to theoretical questions."

The first of the six articles is a discussion, description and theoretical treatment by D. G. Kiely of waveguides and aerials composed of dielectric materials. The second article, which has just been quoted, is a noteworthy critical evaluation by R. H. Cole of the current theories of dielectric polarization and relaxation. Professor Cole's familarity with the foundations on which these theories are based is so great and his thinking so clear that the careful reader will gain not only an understanding of the success of the theories and the accuracy of the equations expressing them, but also a proper regard for the approximations and limitations inherent in them.

The next two articles are written by experts who have done outstanding research in these fields. J. B. Hasted in "The Dielectric Properties of Water" covers not only liquid water, but also electrolytic solutions, bound water and ice, including solutions in ice. The dielectric properties of water are so intimately related to its structure and to the nature of electrolytic solutions, on which many erroneous dielectric measurements have been published, that this comprehensive account should prove valuable to many readers. As the author is a physicist, one should, perhaps, not be too critical of the omission of the sulfate from the formula for ammonium alum in a table and in the text. The article by R. J. Meakins on "Mechanisms of Dielectric Absorption in Solids," after a brief summary of fundamentals, touches on much of the work that has been done in recent years on simple solids, naturally with considerable emphasis on the extensive work of the author's laboratory. Glasses, polymers and ferroelectric compounds, which have been treated in the previous volumes of this series, are dismissed briefly with appropriate references to the literature. A 5.5-page appendix lists the values of various rate process parameters, including the logarithm of the frequency factor, but not including the more familiar relaxation time. By coincidence, the considerable number of listed references, 154, is identical with the number in the quite different reference list at the end of a review of "Dielectric Absorption in Solids and Liquids" by J. S. Dryden and the author in 1957.

The short article, "Recent Developments in Cable Insulation in the United States," by C. W. Hamilton, states "that the most significant breakthrough in the history of research on wire and cable insulation has been the utilization of discoveries in the field of synthetic polymers." The dielectric behavior and properties of such polymers are briefly described and discussed and brief but interesting discussions of "Fundamental Research" and "Future Trends" are given. The previously mentioned wide divergence of interests in the field of dielectrics is well illustrated by the topics discussed under "Fundamental Research," for example, the observation of the effect of atmospheric environment upon corona damage, as contrasted with the subject of the structure of ice in an earlier article. The article should be useful in helping to keep up-to-date the electrical engineers and chemists concerned with cable insulation. The final article by R. Stratton is a comprehensive and critical review of "The Theory of Dielectric Breakdown in Solids." Although Volume I of this series contains two articles dealing with various aspects of this problem, it is a problem of such importance in the design and use of dielectrics that this authoritative article should prove very useful.

Having once been slightly skeptical of the considerable utility of this series of volumes, the reviewer has been converted to the cause of "Progress in Dielectrics" and very much hopes that it will continue.

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X-Ray Analysis of Organic Structures. By S. C. NYBURG, Department of Chemistry, University College of North Staffordshire, Keele, England. Academic Press Inc., 111 Fifth Avenue, New York 3, N. Y. 1961. xii + 434 pp. 16 × 23.5 cm. Price, $13.00.

Of all of the physical methods which have been adapted to the service of the organic chemist, the techniques of X-ray crystallography are certainly the most powerful and are likely to be the most revolutionary in their consequences. Unfortunately they are also the most complicated and the most frightening to the uninitiated in their mathematical appearance. Dr. Nyburg's book is intended to bridge this gap of unfamiliarity and to introduce the chemist both to the tools of the crystallographer and to the results which may be obtained. It is not a "do-it-yourself" manual for the organic chemist. After reading it one would still be lost among the practical details of a structure analysis. It does, however, provide a good basic knowledge of the method, its power and some of its weaknesses, and should allow the interested student to proceed to more advanced works with relative ease.

The first chapter is devoted to a discussion of X-rays and the mechanical manipulations of obtaining diffraction photographs, while the second deals with the crystal cell and its implications. Although knowledge of experimental details is not necessary for an understanding of crystallographic results, the omission of any mention of the Weissenberg technique, the most common photographic method for obtaining intensity data, seems an oversight.

Chapter 3 introduces space groups and is rather more detailed than the earlier ones. Examples are drawn from "The International Tables for X-ray Crystallography" and the reader is shown the consequences of translational symmetry elements and the methods used for determining space groups. It is with the discussion of diffraction intensities in Chapter 4, however, that the matter of most interest to the chemist, *i.e.*, the relationship between diffraction effects and molecular structure, is introduced. The calculation of structure factors is considered in some detail, and this theme is continued with the discussion of one, two and three-

dimensional Fourier summations. Numerical examples are provided to clarify the mathematical techniques, and there is a very good discussion of the available methods for solution of the phase problem. Since, however, it is the growth of the electronic computer which has made crystallography a truly practical tool, it is unfortunate that these machines are dismissed in one paragraph and that the computational methods described are all based on hand calculations or analog devices.

The question of the accuracy of crystal structure determinations is considered next together with methods of refinement and means of estimating probable errors in bond lengths. This chapter serves as an introduction to the second half of the book, which is devoted to a very thorough discussion of organic molecules whose structures have been determined by X-ray methods. It is this part which has no parallel in the literature and which is likely to be the most valuable to workers in the field of structural analysis. Starting with simple hydrocarbons, the author proceeds through compounds of increasing chemical complexity before arriving at the results of diffraction studies on proteins and other polymeric materials. The crystallographic techniques are described when of particular interest and the implications of the results with regard to the molecular structure are discussed in detail. Particular attention is devoted to the questions of bond order in aromatic systems and of hydrogen bonding. Such a collection of results should prove of great value both to the crystallographer searching for structural analogies and to the chemist who wishes to learn more about precise molecular shapes and dimensions.

A few errors are to be found in the tables and drawings, but the body of the text is remarkably free from mistakes. The drawings are good and the discussion is highly readable.

In summary, this is a book which should be read by any chemist who has wondered what X-ray crystallography could offer for his problems, or who has considered its use and then turned away because of imagined mathematical complexities. The increasing involvement of organic chemistry with X-ray crystallography appears inescapable and the more chemists become familiar with its virtues, the sooner its benefits will be enjoyed by all.

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Radioactive Wastes. Their Treatment and Disposal. General Editor: J. C. COLLINS, B.Sc., M.S.E., A.M.I.-C.E., Lecturer in Civil Engineering, Faculty of Technology, University of Manchester, Consulting Engineer. John Wiley and Sons, Inc., 440 Park Avenue South, New York 16, N. Y. 1961. xxi + 239 pp. 14.5 × 22.5 cm. Price, $8.00.

This book fulfills its stated objective—to be of value and interest to a wide range of professional people—engineers, biologists, chemists concerned with water supply and with the disposal of domestic and industrial wastes, industrial executives, health officers, factory inspectors, and students of these professions.

The disposal of radioactive wastes is one of the more troublesome problems in the development and use of atomic energy. In an admirable preface, the general editor states, "Just how the nuclear age ultimately will affect our present way of living is a question present in everybody's mind, but uppermost, perhaps, is the doubt and fear that somehow man may be affecting adversely not only his own health but, worse still, the health of his children and grandchildren. . .Environmental pollution in non-radioactive forms is all too familiar. With the growth of industry and the concentration of population that have taken place in the past half century, it is now a National problem. Only in recent years at the cost of much time and money has a start been made to bring this pollution under control. Radioactive pollution must *never* be allowed to reach such proportions and no amount of energy or expense must be spared to keep it within bounds."

The ten chapters of this book cover a wide range of topics. Three chapters are devoted to fundamental background material—the nature of radioactivity, the hazards of radiation, the measurement of radioactivity. Another chapter outlines the sources of radioactive wastes (*e.g.*, uranium production, reactor operation, fuel element processing, the radium industry, research establishments, hospitals, etc.). There is a short chapter on the law of radioactive wastes in Great Britain. The last five chapters deal specifically with radioactive waste treatment and disposal (including the biological concentration of radioactivity and its application to the treatment of liquid effluents). There is a 10-page glossary of terms.

In general the book is well written, and reflects a recognition that few readers will be expert in more than one or two of the disciplines which are brought together. Two minor weaknesses: in some chapters the bibliographies are skimpy and the index is not as useful as one might expect in a book of generally high quality.

Since the editor and all of the contributors to this book reside in Great Britain there is naturally emphasis on problems encountered in that country, but problems and practices in the United States receive some attention.

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Telomerization and New Synthetic Materials. By R. KH. FREIDLINA AND SH. A. KARAPETYAN. Translated from the Russian by Margaret F. Mullins. Translation edited by B. P. Mullins, Senior Principal Scientific Officer, Ministry of Aviation, Farnborough, Hampshire. Pergamon Press Ltd., Headington Hill Hall, Oxford, England. 1961. x + 102 pp. 14 × 22 cm. Price, $4.50.

The title of this short work may be misleading to many since at first glance it implies a broader scope than it actually covers. It describes in a semitechnical fashion Russian work on the telomerization of ethylene and carbon tetrachloride and the conversion of the telomers into polyamide fibers, nylons 7, 9 and 11. The authors point out in their preface that only a limited knowledge of chemistry and physics is necessary, and consequently much space is given to a brief development of the fundamentals of organic chemistry, polymers, polymerization, fiber technology and fiber physics. The book is not a review as is apparent from its style and lack of documenting references, but those who want review-type information on this subject can find it easily and as up-to-date in the literature.

The translation is readable, and the book is reasonably free from typographical errors. However, the translator is not sufficiently familiar with organic chemical nomenclature or polymer chemistry to have used in many cases the accepted names and spellings for compounds and polymers.

There is little reason for the research scientist or research library to purchase this book, for the information it contains can be found elsewhere in better form for their purposes.

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Fortschritte der Physikalischen Chemie. Band 6. Fortschritte in der Kinetik der Homogenen Gasreaktionen. By Prof. DR. Z. G. SZABÓ, Direktor des Institutes für Anorganische und Analytische Chemie der Universität Szeged (Ungarn). Dr. Dietrich Steinkopff Verlag, Darmstadt, Germany. 1961. xii + 239 pp. 15.5 × 23 cm. Price, DM. 40.

This slender volume was prepared with a somewhat limited objective. It is intended to provide for German-speaking readers a supplement to Schumacher's "Chemische Gasreaktionen" which was published some twenty years ago. The author disclaims any desire to provide a complete treatment such as is attempted in a number of recent books in English and in Russian. In a further effort to reduce the volume of material to manageable size, oxidation reactions, photochemical and radiochemical processes and isotope studies are excluded except when they are pertinent to a reaction under discussion.

Within these limits, a huge volume of literature is summarized competently in a small space. The discussion is