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-