

trial laboratories as well as those from other institutions. Reaction mechanisms are discussed whenever they appear useful in understanding the chemistry involved but no attempt is made to make this work an approach to the theory of reactions."

The above quotation from Professor Astle's Preface explains quite well the purpose and scope of this ACS Monograph. Generally speaking, perusal of the book indicates that the author has done an excellent job within the framework he has set for himself.

The book should find wide value as a quick reference tool, not only in industrial research organizations but in academic institutions as well. It probably will be of greatest use to persons not expert in the chemistry and technology of organic nitrogen compounds who from time to time need authoritative and up-to-date answers to specific questions. By the same token, it will surely be a worthwhile addition to the bookshelf of the research chemist who has frequent occasion to work with nitrogen derivatives yet is not a primary investigator in the field.

As one might expect, the author has organized his subject matter according to functional classes. Chapter headings are as follows: 1, Aliphatic Amines, 2, Arylamines, 3, Heterocyclic Amines, 4, Hydrazines, Azo Compounds, Diazonium Salts, and Oximes, 5, Nitriles, Amides and Amino Acids, 6, Isocyanates, Ureas, Thioureas, 7, Aromatic Nitro and Nitroso Compounds, 8, Aliphatic Nitro Compounds. For each class of compound, the discussion covers (a) general properties and characteristics, (b) methods of preparation, (c) reactions and (d) industrial utilization. A list of references to literature and patents is appended to each chapter.

Emphasis is on the chemistry of organic nitrogen compounds rather than on commercial aspects. This is as it should be, nevertheless trade names and approximate production figures for important products are mentioned, and the references, which appear to have been carefully selected, include many patents. Most of the references carry dates within the past two decades up to and including 1958.

In discussing methods of preparation and reactions of a given class, the author gives a good deal of moderately detailed information, e.g., yields, melting and boiling points, reaction conditions, work-up procedures, and so on. On occasion, brief discussions of reaction mechanisms are presented. The result is a good compromise between breadth and depth, both from the standpoint of the laboratory chemist and from that of the research director.

"Industrial Organic Nitrogen Compounds" is not a book one can sit and read comfortably from cover to cover. It is rather a ready reference volume packed with well chosen information which will provide partial, if not complete, answers to the questions most likely to be asked in this area of science and technology.

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Chemical Crystallography. An Introduction to Optical and X-Ray Methods. Second Edition. By C. W. BUNN. Oxford University Press, 417 Fifth Avenue, New York 16, N. Y. 1961. xiii + 509 pp. 16.5 × 24 cm. Price, \$12.00.

When the first edition of this book appeared in 1945, the field of X-ray crystallography was expanding rapidly both in this country and abroad. Textbooks were needed to link the ancient subjects of crystal morphology, lattice geometry and crystal chemistry with the theory and techniques of X-ray diffraction and crystal structure analysis. Treatises were needed to develop systematically the formal theory and the experimental state of X-ray crystallography in order to prepare the way for the rapid advances to come. In time even additional compendia would be required to encompass the ever-growing literature.

Among the many books written in the past twenty years to meet these needs, "Chemical Crystallography" has occupied a unique position. Neither a textbook nor a treatise, the book has nevertheless maintained a substantial following over the years because it merits so well its subtitle, "An Introduction to Optical and X-Ray Methods." The author undertook the difficult task of writing a descrip-

tive survey integrating a variety of crystallographic fields. He succeeded in providing an interesting and intelligent introduction suitable for readers with diverse backgrounds. The organization was such that he was able to bring the work up to date in the recent Second Edition by making minor revisions and modest additions.

The most striking feature of this book is the lack of the formal mathematical development so characteristic of other books in this field. Indeed, one is led to feel that those few mathematical formulas which do appear were recorded reluctantly for the want of a better mode of expression. The burden of each argument therefore falls upon exposition and, fortunately, this is the strong point of the book. The author writes with charm and style and, in an unhurried way, carefully builds each argument with the aid of numerous examples and excellent illustrations. For this reason, many students encountering crystallography for the first time have found this book a useful adjunct to more formal presentations.

The first part of the book is concerned with the identification of crystalline substances. Crystal morphology and symmetry are treated at length to provide the basis for later discussions of identification procedures involving crystal optics and X-ray powder diffraction analysis.

The second, and larger, part of the book deals with crystal structure analysis. The geometric principles involved in the determination of unit cells are treated in terms of the reciprocal lattice for a variety of experimental methods. This is followed by a short treatment of the relationship of structure to diffraction intensities and the determination and use of space group symmetry. A number of well chosen examples of structure determinations are then discussed in detail to illustrate the principles involved in trial and error methods.

The last two chapters have been considerably expanded in this new edition. The first of these provides an introduction to modern methods of structure determination and refinement. A variety of Fourier syntheses, vector syntheses, Fourier transforms and statistical intensity relationships are qualitatively discussed and illustrated with examples. The last chapter briefly notes the effects of crystal size, texture and disorder on diffraction intensities.

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Reference Electrodes. Theory and Practice. Edited by DAVID J. G. IVES, Birkbeck College, London, and GEORGE J. JANZ, Rensselaer Polytechnic Institute, Troy, New York. Academic Press Inc., 111 Fifth Avenue, New York 3, N. Y. 1961. xi + 651 pp. 16 × 23.5 cm. Price, \$20.00.

The title covers only a part of the contents of this book. It is really a summary, in unsystematic form, of a large part of electrochemistry. It will probably be of most use in directing research workers to the literature of the subject. In this respect it is admirable, as the authors have searched out even obscure references to the use and preparation of the most utilized electrodes. However, the text will serve in many cases without resort to the original papers.

One criticism that can be made is that the authors are not clear as to what they mean by the term "electrode." It appears as metal-electrolyte, as in most galvanic cells; as semiconductor-electrolyte when utilizing glass surfaces; as membrane surface-electrolyte; and as liquid-liquid junctions in most of the biological applications. It is probably only in the last case that real misunderstandings can arise in the interpretation of measurements, but such false interpretations can occur particularly with data on colloidal materials.

The book should be especially useful to active workers in electrochemistry and in fields utilizing electrochemical methods. The care that is necessary if precision is to be obtained is emphasized and illustrated by excellent diagrams and illustrative data. It should prevent novices from plunging into research involving electrodes without realizing their limitations, but this is probably too much to expect.

The reviewer is pleased to observe the rather belated recognition in this volume of the utility of simple galvanic cells with one type of electrode as sources of precision

activity coefficients. This is important as cases in which adequate electrodes are available for both constituents of a binary electrolyte are comparatively rare.

The authors are to be commended for producing a book which will be of service in a wide range of research, including much of physical chemistry and of biology.

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