Book Reviews

Diffusion in Polymers

Edited by J. CRANK and G. S. PARK. Academic Press: London and New York, 1968. 5¼ in. ×9 in. 454 *pp.* 105*s* or $18.00

WHEN R. M. BARRER'S book entitled *Diffusion in and through Solids* appeared in 1941 it included two chapters providing, between them, a comprehensive review of diffusion and solution of gases and vapours in polymers. The ever-increasing number of published papers devoted to these topics is indicative of the vigorous growth and development which has taken place in the last twenty five years and therefore a present-day review of any consequence would be expected to merit a complete monograph.

The appearance of the present volume is not only timely but welcome, forming as it does (at least to the reviewer's knowledge) the only available monograph devoted to diffusion in polymers. It has been written by a panel of authors each of whom has made important contributions to development in the subject. The chapter headings [with the author(s)] are as follows: Methods of measurement (CRANK and PARK), Simple gases (STANNETT), Organic vapours above the glass transition temperature (FUJITA), Free volume and other theories (KUMINS and KWEI), The glassy state and slow process anomalies (PARK), Diffusion and permeation in heterogeneous media (BARRER), The solution process (UEBERREITER), Water in polymers (BARRIE), Kinetics of dyeing (PETERS) and Transport in ion-exchange polymers (MEARES).

The editors state in their preface that the emphasis throughout is on basic scientific investigations rather than on technological applications and that individual chapters are largely self-contained. This is certainly the case and should commend itself to those seeking a review article on a particular aspect of the subject. In allowing each author maximum freedom some repetition has been deemed reasonable especially if it makes for easier reading. No attempt has been made to standardize nomenclature and, of rather less importance, the American counterpart of British spelling has been tolerated!

Each article has a summary of its content at the beginning and individual references to 1966. There are separate indices devoted, respectively, to authors, materials and subjects.

Although effectively two years old this volume should be a reference work for many years. It is eminently readable. Misprints are present but do not appear excessive. At five guineas it represents good value for money—always a refreshing experience in our present-day world!

R. ASH

Kinetics and Mechanisms of Polymerization, Volume I — Vinyl Polymerization (Part I)

Edited by G. E. HAM. Arnold: London; Marcel Dekker: New York, 1967. 6¼ in. × 9¼ in. *xi* + 546 *pp.* Illustrated. 235*s*

THE 'Kinetics and Mechanisms of Polymerization' series is not an addition to the recent flush of 'Progress in—' and 'Advances in—' series. Rather, it is intended to 'deal with significant recent findings as well as with important contributions from the past' over the whole field of polymerization kinetics and mechanisms in three volumes. The first volume (in two parts) is to cover vinyl polymerization, and the second and third volumes are to be devoted to ring-opening and condensation polymerizations respectively. Presumably the series is planned to be comprehensive.

This first part of Volume I contains a chapter entitled 'General aspects of free-radical polymerization' (G. E. HAM), followed by articles on special topics by other authors. Chapter 1 does not give a general background to polymerization by free radicals, but skips rather lightly over the basic features and concentrates on copolymerization kinetics and a discussion of radical reactivities, largely according to one scheme. Retardation, degrees of polymerization, etc., are hardly mentioned. Many of the general features are covered,

however, in a subsequent article 'Styrene' (M. H. GEORGE), in which mechanisms of initiation, primary radical termination, retardation and inhibition, and stereoregularity are discussed in rather more detail.

Specific aspects of free-radical polymerization mechanisms are treated in detail in those chapters where they have particular relevance. Transfer processes and emulsion polymerization occupy a large portion of the article on vinyl acetate polymerization (M. K. LINDEMANN) which contains many references to the Japanese literature (this article has almost 600 references). The chapter on vinyl and vinylidene chlorides (G. TALAMINI and E. PEGGION) is largely devoted to a consideration of the effects of polymer precipitation on the kinetics of the bulk polymerization of vinyl chloride. This topic is also covered briefly in an article on occlusion phenomena in general (A. D. JENKINS), which concentrates on the polymerization of acrylonitrile, but also discusses polymerization in the presence of precipitants. Two articles are concerned with monomers having more than one polymerizable group, namely cyclopolymerization of non-conjugated diolefins (W. G. GIBBS and J. M. BARTON) and acrolein (R. C. SCHULZ). Finally, the book contains an extensive account of heats of polymerization (R. M. JOSHI and B. J. ZWOLINSKI) which includes discussions of bond-energy schemes, experimental methods and the implications of the results.

On the basis of one half of the vinyl polymerization section it is difficult to judge how comprehensive the whole series will be, but at least there is a considerable amount of useful information and references on particular aspects. The series will undoubtedly be a useful addition to the library shelves but the price may preclude private purchase.

G. C. EASTMOND

Water-Soluble Resins, 2nd Edition

Edited by ROBERT L. DAVIDSON and MARSHALL SITTIG. Reinhold: London, 1968. 6 in. × 9 in. 234 *pp.* 140*s*

THE second edition of this book is an enlarged, up to date and compact review of water-soluble polymers which find increasingly wide application in many diverse industries as product improvers and essential processing aids.

The introduction clearly defines the types and functions of these various compounds which may be classified as natural, modified natural or synthetic in origin, and it goes on to mention briefly some properties related to electrochemical and rheological behaviour. In view of the practical importance of these characteristics a more detailed treatment would not have been out of place even though these aspects as they relate to certain specific polymers, are given more prominence in some of the later chapters.

Each of the following chapters covers a different class of water-soluble polymer and is self-contained, often presenting much new information. The authors would always appear to be associated with particular manufacturing companies which, in a work of this type, can have obvious advantages. The text which stresses practical applications, is presented objectively and without competitive commercial bias.

Starch is unfortunately the only representative in the book of the natural gums. The important basic properties of native starches are described in some detail and chemically modified starches are dealt with clearly but more briefly. This chapter includes a large number of useful references for those interested in further reading.

The growing importance of water-soluble cellulose ethers is reflected in the increased space allotted to this subject and now covered by three chapters describing methyl (including hydroxy propyl methyl) cellulose, hydroxyethyl cellulose and carboxymethyl cellulose. These represent the principal commercially available varieties and for each there is some description of the preparation, properties and uses. Much useful data are given on rheological behaviour such as the viscosity/shear relationships to be found in high viscosity non-Newtonian solutions. In dealing with the various applications an attempt has been made to detail the different properties which make the cellulose ethers particularly suitable. This pattern is maintained to a large degree in the remaining chapters which cover the true synthetic water-soluble resins. These are polyvinyl alcohol, polyvinyl pyrrolidone polyacrylic acid and its homologues, polyacrylamide, ethylene oxide polymer and polyethylene imine.