

## BOOK REVIEWS

**Environmental Effects on Polymeric Materials. Vol. 1. Environments.** DOMINICK V. ROSATO and R. T. SCHWARTZ, Eds. Interscience, New York, 1968. xvi + 1228 pp. \$42.00.

This volume, composed of a series of review articles by many authors, establishes itself as an encyclopedia for the effects of environments on polymers. It is very detailed in explaining the effects of environments (e.g., cavitation and rain erosion, chemical propulsion exhaust, radiation, space, corrosive, thermal, etc.) on plastics, coatings, adhesives and elastomers used in aerospace applications. Weathering of polymers by laboratory methods and outdoor exposure is presented in depth, and some in-service performance data is also given for many types of industrial applications.

The reader must realize that because of the comprehensive scope of this volume concerned with environments, some generalized sections of the book are brief. Due to brevity, some areas could be misleading. In particular, these include discussions related to the synthesis of commercial polymers, processing techniques and industrial applications for polymers. To avoid any scientific, technical and business misinterpretations, the reader is referred to the bibliographies offered by the authors. The references cover the vast amount of material presented in this encyclopedia volume.

This book is recommended as a general source and reference book covering environmental effects on polymers.

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**The Science of Adhesive Joints. 2nd Ed.** J. J. BIKERMAN. Academic Press, New York, 1968. xi + 349 pp. \$16.00.

This second edition of *The Science of Adhesive Joints* is concerned with the theoretical and experimental aspects necessary for producing a strong adhesive bond. The author, in the first volume, adopted new terms, such as adhint, hooking, proper and improper joints, rugosity and his now well-known "weak boundary layer" theory for explaining effective adhesion. The second edition, in expanded form, is well documented with recent references. Additional sections on fastening devices, classification of adhints, solid-to-solid adhesion, hooking adhints, work of fracture, bulk adhesives and *in-situ* adhesives are included in this expanded text. Experimental test methods are presented very clearly, and the author very effectively points out the limitations, as well as advantages, of the available laboratory methods. The use of schematic drawings in explaining phenomena and test methods are of great value in clarifying many points. Some of the schematic drawings serve to explain hysteresis of wetting, surface roughness, adsorption, surface hardness, hooking, and mechanical attachment.

As the author notes, this book does not offer ready-made formulations for producing adhesive joints. It does offer the science and technology involved at the layer between the adhesive and adherend. From this scientific approach, the adhesives technologist

may achieve practical results. The author's weak boundary layer theory is the general theme of this volume. That is, a proper adhesive joint is present when a weak boundary layer is absent; conversely, an improper joint indicates the presence of a weak boundary layer. The author stresses the idea that in order to account for the experimental strength of an adhesive joint, it is necessary to know the geometry of an adhint, the texture of the adherends and other macroscopical and mechanical factors associated with the adhesive bond. In line with this reasoning, it is evident to the reader why certain concepts (e.g., van der Waals forces, polarity) have not been included in the book.

This volume is very well organized, and the author is to be complimented for making such a very complex subject so clear to the reader. The text covers, in detail, solid surfaces, adhesive joints, formation of adhints, tack, setting, final strength of adhints, improper adhints, stresses in proper adhints, experimental strength of adhints, testing methods and a practical summary. This book continues to be of importance in explaining the mechanics of adhesive bonding and, therefore, must be included as a standard for the adhesives and coatings technologist.

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**Fracture in Polymers.** E. H. Andrews. American Elsevier, New York, (Oliver and Boyd Ltd., London), 1968. 204 pp. \$10.00.

Chap. 1; 36 pp.; The Nature of Polymeric Solids; long-chain molecules, crosslinks and networks, molecular flexibility, the glass transition, mechanical properties of polymers, microstructure of polymers. Chap. 2; 35 pp.; Fracture Phenomena in Polymers, I; fracture, modes of fracture, fracture under direct loading. Chap. 3; 37 pp.; Fracture Phenomena in Polymers, II; creep fracture, crack propagation, fatigue fracture, corrosion cracking, wear, fracture and the microstructure of polymers. Chap. 4; 22 pp.; Initiation of Fracture; theoretical and actual strengths, flaw theory of fracture, generalization of the flaw theory, time-dependent fracture, fracture in polymers as an initiation-controlled phenomenon. Chap. 5; 44 pp.; Propagation of Fracture; controlled fracture, characteristic fracture energy in elastomers, the distribution of stress around a crack tip, creep fracture and tensile strength in elastomers, fatigue fracture, stress-corrosion cracking in polymers. Chap. 6; 21 pp.; Fracture Surfaces; microstructural observations in fracture surfaces, fracture markings involving microstructure and the behavior of the fracture itself, markings caused by behavior of the fracture front, the study of stress-corrosion phenomena by microscopy, summary.

From the author's preface:

"Fracture is, of course, a phenomenon of great scientific interest as well as practical importance, and it is hoped that this book may be of interest and service to the purist as well as the engineering scientist. It may have some appeal even to the metallurgist since a familiarity with material as such is often expected of him today."

"My purpose in writing has been to present a comprehensive, logical and readable account of the subject. These aims are, to a certain extent, conflicting and a balance has had to be struck between exhaustiveness and clarity. If either has been sacrificed, it is the first of these and as a result some excellent research has received less attention than it deserves."

This book is neither a literature review nor a correlative view of the literature, but an attempt at an integrated delivery of the general topic. However, it is not a well-balanced delivery, since the contributions of Hsiao, Sauer, Marin, Dietz, Kolsky, Fedors, R.