ADHESION AND ADHESIVES

Adhesion

Edited by Prof. D. D. Eley. Pp. x+290+11 plates. (London: Oxford University Press, 1961.) 55*s*. net.

THE subject of adhesion, like so many subjects of technical importance, does not fall within the boundaries of any one branch of science, but draws on the activities of chemists, physicists, engineers and others. This renders the need for a good systematic text-book both more desirable and more difficult to satisfy. If the book is to be anything like comprehensive, it is almost inevitable that it should be a co-operative venture.

The book under review, of which Prof. Eley is the editor and part author, is the outcome of the discussions of a committee on the subject of adhesion. Its outlook is fundamental in the sense that it is concerned primarily with scientific principles rather than with detailed applications. The subjects included have been chosen with care so as to cover all the principal lines of development.

The introductory chapter, on the fundamentals of adhesive joints (D. D. Eley and D. Tabor), sets out the main phenomena to be examined. Chapter 2, "Molecular Theories of Physical and Chemical Adsorption" (C. Kemball), gives an excellent account of the types of molecular forces operating between surfaces of dissimilar materials. Chapter 3, "Thermodynamic Adhesion" (D. D. Eley), and Chapter 4, "Thermodynamics and Imperfections of Solid Surfaces" (W. J. Dunning), deal with the fundamentals of adsorption phenomena, with particular emphasis on the adsorption of liquids on solids. Experimental data on surface free energy, enthalpy and entropy, and their interpretation, are discussed. Chapter 5, "Friction and Adhesion between Metals and Other Solids" (D. Tabor), discusses in a very illuminating manner the information which has been obtained on the nature of the actual surfaces of contact in the case of clean metals and metals covered with surface films.

These five chapters are concerned with 'adhesion' in general rather than with 'adhesives', and it is only in later chapters that the chemical and physical properties of adhesive materials, which are usually high polymers, are considered. Thus in Chapter 6 (by A. Baker) the principal types of adhesive materials are classified in relation to the chemical reactions involved in the setting process, and their general fields of application are indicated. Chapter 7 (by H. Warburton Hall) gives a general account of the mechanical properties of thermosetting polymers, which emphasizes particularly the phenomena of visco-elasticity and fracture, while Chapter 8 (by W. C. Wake) discusses the closely related subject of the rheology of adhesives, but with more particular emphasis on soft or rubbery materials in which the ability to flow and wet a surface is a primary consideration. This leads on to "The Distribution of Stress in Adhesive Joints" (I. N. Sneddon), which to the engineer will appear as the central and most informative chapter in the book. This chapter gives an extremely clear account of the remarkable theoretical and experimental work which has been carried out on the analysis of stresses in joints, and has perhaps a more direct bearing on practical design than any of the earlier chapters. After this, a short chapter on the physical testing of adhesives and adhesive joints, which is not free from technical jargon, and the editor's "Concluding Remarks" come rather as an anti-climax.

While the presentation is generally clear, there are a few places in which difficulty may be encountered. Thus, for example, Plate 1, which shows nothing at all clearly, is without value—at least the position (and form ?) of the solid surface, and the specific atoms in the molecules, should have been indicated. On p. 123 it is not the 'softness' of the metal (which to me means "low modulus of elasticity") but its low yield stress which is relevant to the argument. The formula for the elastic energy of a rubber (p. 173) is incorrectly given; the 'strains' should be replaced by 'extension ratios'. The argument (p. 202) concerning the effect of strain energy on the force required to rupture an adhesive bond fails to define the problem clearly. In the same chapter 'Griffiths' is used repeatedly for 'Griffith'. On p. 207 it is difficult to see how a 'stress concentration' factor can have a value less than unity.

These, however, are minor defects. Bearing in mind the inherent difficulties of the subject, already referred to, and the inevitable additional difficulties arising from multiple authorship, the book as a whole is successful in achieving its purpose, which is to bring together the most important basic facts and theories of adhesion and related phenomena. It is a notable addition to the not too extensive scientific literature on the subject, and it can be confidently recommended. The comparatively low price should encourage its purchase by individuals as well as by libraries.

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BIOLOGY OF MAMMALS

Systematic Dictionary of Mammals of the World

By Dr. Maurice Burton. Pp. 307. (London: Museum Press, Ltd., 1962.) 35*s*. net.

FACTUAL information concerning the many genera and species of mammals is scattered through a wide and diverse literature often to be found only in specialized libraries. The author of this work, perhaps better known in other fields of natural history, has attempted to remedy this situation and has largely fulfilled his aim of providing a source of easy reference to facts not readily available elsewhere in one book. The book, not a dictionary in the alphabetical sense of the word, is a compilation of basic biological information for many of the more important species of mammals, and follows the usual systematic arrangement, with species listed in their appropriate orders, suborders and families. Any disadvantage to those unfamiliar with detailed mammalian classification is overcome by the provision of an excellent index. The author supplies brief but useful notes on the more important features of the higher systematic categories while presenting the distinguishing characteristics, ecology and life-history of individual species in considerable detail, with statistical and other information wherever possible. The text is enlivened throughout with small but attractive scraper-board drawings.

It is facile to criticize such a book as this, the more so since varying levels of knowledge of its raw material render inevitable some degree of uneven treatment and for reasons of space much has had to be omitted. These features are emphasized by the arrangement of the book at the lower levels of classification with related genera and species or those