

Book Review

'Adhesion 1'

Edited by K. W. Allen

Applied Science Publishers, 1977,
315 pp, £16

This book consists of nineteen papers presented at the 13th and 14th Annual Conferences on Adhesion and Adhesives held at the City University, London in 1975 and 1976, respectively. Previous conference proceedings have been published under the title of 'Aspects of Adhesion' (Volumes 1 to 8) and 'Adhesion 1' represents the first publication of these proceedings by Applied Science Publishers. The papers are not collected under any general heading but fall into five categories: adhesion and friction, industrial applications, structural adhesives, surface chemistry and physics, and tack of elastomers.

There are two papers in which the role of adhesive forces in the rolling or sliding friction of rubber surfaces are discussed; one is by Roberts and Thomas and the other by Roberts alone and they were undoubtedly two of the most interesting papers to this reviewer. In the first, quantitative mechanisms for the rolling and sliding friction between smooth rubber surfaces and smooth rigid bodies are identified. The theory enables the frictional forces involved to be accurately predicted, as a function of rate, from independent surface free energy measurements. In the second paper the techniques and theory developed in the first are employed to assess the relative contribution of electrostatic forces to the adhesion and friction of smooth, vulcanized rubber surfaces in contact with steel or glass substrates. The role of electrostatic forces has always been a controversial topic in adhesion science and the results obtained by Roberts support those who believe that they play a negligible part.

The papers concerned with industrial applications are of a mixed standard. One considers the adhesion of polyurethane rubbers to concrete with the aim of coating reinforced concrete bridge decks to prevent moisture ingress and subsequent deterioration. Interpretation of the results obtained would have benefited considerably by reference to the existing literature on the relations between thermodynamic work of adhesion, measured peel strengths and mode of joint failure. A second paper describes melt adhesives and their applications but concentrates almost exclusively on shoe manufacturing techniques. However, a paper on stabilization of polychloroprene dispersions in aliphatic media is interesting and considers theoretical aspects of dispersion stability which have led to the preparation of stable dispersions as a practical alternative to more costly and toxic adhesive systems based upon aromatic solvents.

Four papers are concerned with structural adhesives. They include a description of a resonant bar technique for measuring the elastic moduli of structural adhesives, evaluation of a one-component, acrylic-based adhesive polymerized by exposure to ultraviolet light, the effect of shrinkage stresses on environmental resistance and some intri-

guing work on the morphology of amine-cured epoxide resins.

Of the papers discussing aspects of surface chemistry three are concerned with treatment of the substrate's surface prior to bonding; namely, the generation of transcrystallinity in the surface of high density polyethylene, phosphating of steel and oxidation of copper surfaces. The conclusions from these papers demonstrate how surface free energy, cohesive strength of the substrate's surface regions and substrate topography may all influence the locus of joint failure and so the joint strength. The other three papers in this group discuss the measurement and interpretation of contact angles. The contribution from Université René Descartes is the most novel and explores the relationship between molecular structure, and mobility, and surface free energy.

Finally there are four papers discussing the tack of elastomers. Tack is that property of a material whereby light contact with the surface of another body results in a force being required to bring about separation. While it is generally agreed that it occurs between elastomers because of interdiffusion of polymer chain segments across the interface detailed quantitative theories have yet to be

developed. One paper attempts to rectify this by proposing a semiquantitative theory based upon the free volume available to the diffusing polymer segment. This will be governed by certain structural features such as polymer chain conformation and packing characteristics. The model does successfully rank the tack capability of various elastomers. The subsequent paper proceeds to postulate that the low tack of ethylene-propylene-diene rubbers stems from surface crystallinity developing under the low stresses generated during contact which diminishes the degree of interdiffusion that may occur across the interface. The last two papers attempt to correlate tack with the viscoelastic behaviour of the elastomer. A major problem in identifying detailed mechanisms in this field is highlighted by all these papers; there are as many different test methods for determining tack as there are papers!

Overall these diverse papers maintain a good standard and this book will be of interest to technical service departments, research and development laboratories and university research groups.

A. J. Kinloch

Conference Announcement

Toughening of Plastics

The Regent Centre Hotel, London, UK, 4-6 July 1978

The Polymer Properties Group of the Plastics and Rubber Institute is organizing a major international conference on Toughening of Plastics to take place in July 1978. The aim of the conference is to take stock of current knowledge relating to the industry, including the chemistry of toughening, manufacture of toughened polymers, structure - property relationships, rheology, melt processing and fabrication, and the economic outlook for toughened plastics. Further details and registration forms are available from Mrs Carol-Anne Alcorn, The Plastics and Rubber Institute, 11 Hobart Place, London SW1 OHL, UK.

Conference Announcement

Structure and Dynamics of Polymers: Neutron Scattering Experiments and New Theoretical Approaches

Strasbourg, France, 23-26 May 1978

The Section of Macromolecular Physics of the Condensed Matter Division of the European Physical Society together with the Groupe Français d'Etudes et d'Application des Polymères (GFP) as cosponsor are organizing the 7th EPS conference on macromolecular physics. The conference will be held in Strasbourg, France from 23-26 May 1978. The following topics will be discussed: (1) molecular conformation in amorphous and crystalline bulk polymers; (2) stretched polymers, including polymer networks; (3) macromolecules in solution; (4) chain dynamics of macromolecules. For further details write to: Professor H. Benoit - 7th EPS conference, Centre de Recherches sur les Macromolécules, 6 rue Boussingault, 67083 Strasbourg Cedex, France.