

Book Reviews

Adhesion 3

(Ed. K. W. Allen)

Applied Science Publishers, 1979,
236 pages

Adhesion 3 is a compilation of papers delivered at the 16th Conference on Adhesion and Adhesives at the City University in 1978. It contains a diversity of material which ranges from general, education oriented review papers to specialized reports of current research. The inclusion of research papers may detract from the book's general acceptance, which is unfortunate since several of the review papers are excellent and well suited to manufacturers, designers, and users of adhesives. Much of the experimental data contained in the research papers can be found elsewhere and the need to publish it here is questionable.

The first two papers are concerned with water in adhesive joints. Kinloch reviews some recent work on the effect of the oxide layer on joint durability and reaches some useful conclusions; Comyn et al. report on the work carried out at Leicester Polytechnic concerning the diffusion of water through epoxies and the connection to environmental degradation. Bulk properties of adhesives are discussed by Fischer and Schmid who seek to correlate these to adhesive joint strength and report some interesting data on the effect of temperature. Brett discusses the state of cure in epoxies and the correlation to bond strength. Other research papers discuss improvements in epoxy properties, particularly peel strength, through the incorporation of flexibilizers (Paul et al.), the fast fracture of epoxy-titanium joints including interesting results from aqueous environments (Stevenson and Andrews), design of carbon fibre reinforced plastic joints (Sage), and results of an investigation into the effects of polymerizable plasticizers on the peel strength of PVC organosol to steel joints (Harrison and Singh). Allen and Dean describe the Prot method for determining an endurance limit for adhesive joints. Three papers (Allen, Aubrey and Hodgson), including an informative review, deal with pressure sensitive adhesives. Harrison has provided an excellent review containing a great deal of information about solvent based adhesives and Cooper introduces the technology of beryllium and how it can be bonded, in a thoroughly readable paper.

Production and presentation are of a high standard.

K. W. Thomson

Ultra-high modulus polymers

A. Ciferri and I. M. Ward (Editors)

Applied Science Publishers,
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To a certain extent books like this, based on lectures from a Seminar, are out of date almost as soon as they appear because the protagonists are already preparing their papers for the next seminar. The book is based on invited lectures at a closed seminar on Ultra-High Modulus Polymers held at Santa Margherita Ligure, Italy in 1977.

In order to assess its value to polymer scientists not already belonging to the small group of participants at the seminar one must ask whether or not much of the material is already available in the journals (and was therefore subjected to the usual refereeing procedures) and how much was first communicated at the seminar. If a great deal was new then the question could well be asked: would it not better have been communicated to an open meeting or to the established scientific literature? On the other hand, if the material was not new there seems little point in republishing it except in the form of a well-prepared and researched, balanced review article.

This being said, the book comprises a number of very readable, apparently comprehensive accounts of research in the field of ultra-high modulus polymers. Great progress has been made in research on these materials over the last five or more years. The achievement of near-perfect chain orientation in a variety of polymers has meant that stiffnesses and strengths approaching those of metals are obtainable in one direction in these materials, making them suitable for fibre reinforcement and similar applications.

The book has nine chapters arranged in three main groups: flexible polymers, rigid and semi-rigid polymers and the molecular basis of mechanical properties. The three methods employed at present for the orientation of flexible

polymers are tensile drawing, solid state extrusion and continuous crystallization from solution. These methods are thoroughly reviewed in the first three chapters by the Leeds, Massachusetts and Groningen schools respectively. The fourth chapter, from Naples is theoretical and discusses elongational flow for solutions of model chains of various degrees of rigidity. Experimental work on rigid and semi-rigid polymers is discussed in Chapters 5 to 8 with contributions from industry as well as from the group at the University of Genoa. These papers tend in the main to be presentations of properties with little discussion of the molecular structure responsible for them. It is doubtless a field through which a considerable amount of industrial secrecy still pervades.

In contrast, the chapter on high modulus carbon fibres from mesophase pitch, though industrially biased contained a fair amount of information of scientific interest concerning the structure of the carbons produced in this way.

Interest in the structural arrangements within oriented polymers was also present in the two last chapters of the book from NBS, Washington and the Bristol school respectively. These papers, concerned in the main with the well researched flexible polymers such as polyethylene and polypropylene, went in some depth into discussion of the current theories of modulus and strength in oriented polymers, demolishing some and edifying others and, it is stated in the preface, causing considerable controversy at the seminar. Since there is, as yet, no canonical theory for the structure of oriented polymers this is all to the good and it is useful to have the reasoned criticisms of the theories collected in one book.

The volume is a good introduction to the subject of ultra-high modulus polymers and should be on the shelf of any laboratory active or intending to become active in this important field. It should not, however, ever be considered a treatise on the subject, for there are many aspects of it which are not dealt with and, as was stated at the outset, it must suffer from being a set of lectures from a closed seminar.

Each article is well referenced however, and each was prepared by leaders of the respective schools of research so that collectively it can be taken as the state of the art current at the time (1977) of the seminar.

R. G. C. Arridge