

Book Review

Structural Adhesives: Developments in Resins and Primers. Edited by A. J. Kinloch, Elsevier Applied Science Publishers Ltd, London, 1986, 328 pp. Price: £45. ISBN 1 85166 002 X.

Each of the eight chapters in this book has been written by an expert in his field. The first chapter, entitled, 'The Cure and Properties of Thermosetting Polymers', is by J. K. Gilham. This chapter includes a detailed review of the use of Time Temperature Transformation diagrams. This TTT analysis has been utilised for a number of years to aid the understanding of the various mechanisms involved when a thermosetting material cures. The various stages of cure through initial mixing to vitrification can be identified. This form of analysis is used to review the cure of rubber toughened epoxy adhesives.

Chapter two, by F. Martin, on 'Acrylic-Based Adhesives', represents a more applied approach and considers the use of various commercial acrylic type adhesives. Reference is made to cyanoacrylates, anaerobics and rubber modified acrylics. The ease of application of this class of adhesives and especially their suitability for automated application is stressed.

The third, on 'Epoxy Based Adhesives' is by E. Garnish. He emphasises the range of curing agents that are available for epoxy resins and discusses the curing mechanisms and properties of the materials.

Chapter four, by H. Stenzenberger, is devoted to 'Bismaleimide Adhesives'. Bismaleimides are a relatively new class of adhesives and offer the potential for high temperature operation. Much of the development of BMI's and indeed polyimides in general is driven by the need for high performance matrix resins from which adhesives have often been developed. This chapter is concerned with the structure and cure chemistry of bismaleimides, their thermal stability and stress retention at high temperatures. The importance of hot wet environments to the durability of joints made with bismaleimides is also discussed.

The fifth chapter, entitled 'Rubber Toughened Thermosetting Polymers' has been written by A. J. Kinloch. The introduction of a rubbery material into a resin matrix such as epoxy resin will improve the fracture resistance of adhesives without seriously affecting other mechanical properties. This chapter covers the essential chemistry whereby this toughness is facilitated, together with the mechanisms by which the fracture resistance is improved.

Chapter six, by R. J. Young and entitled 'Rigid-Particulate Reinforced Thermosetting Polymers', covers toughening by the incorporation of a rigid filler such as silica into an adhesive matrix. The toughness is increased by the particles 'pinning' the crack front and therefore dissipating energy. Further enhancement in toughness can be achieved by the particles acting as stress concentrators and causing plastic deformation in the matrix resin. These mechanisms are covered in detail together with the effect that size and distribution of the filler has upon the mechanical properties.

The seventh chapter is entitled 'Microstructure in Crosslinked Epoxy Polymers'. In this chapter, G. C. Stevens reviews the evidence for a microstructure in the bulk of cured epoxy resins. Reference is made to the use of sophisticated analytical equipment such as small angle X-ray scattering.

The final chapter, by J. Comyn, is devoted to 'Silane Coupling Agents'. The use of silanes as adhesion promoters between adhesives and substrates and also between fillers and matrix resins is covered, dealing predominantly with the interaction of silanes with glass and with metals. The interaction with other materials such as polymers is briefly addressed. The use of other primers such as zirconates and titanates is mentioned. Results are used which are derived from surface specific techniques such as Inelastic Electron Tunnelling Spectroscopy to infer the reaction of the silane molecules with the surface.

A book containing chapters written by eight different authors would not be expected to present a uniform style. As most readers will select chapters for study, rather than attempt to read the book from cover to cover, this will not be a problem. The quality of the figures in some places is a little less clear than one would have hoped. The use of computer generated figures directly from experimental equipment is perhaps a little out of place in a book rather than a journal format. This book presents a good balance between chapters on specific adhesives and more detailed aspects such as toughening mechanisms. Readers will quickly find their own most useful chapters and these will take on the well thumbed nature of a true reference book. To sum up, this is a reasonably priced book which will find a useful home on the bookshelves of many workers in the fields of adhesion, adhesives and related materials.

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