experiments is of obvious interest to rubber tyred vehicles where considerable deformation of the rubber occurs. Chapter 16, 'A Modified Thermoplastic Adhesive Layer in Laminates' by R.J. Ashley, deals with the chemical modification of inert polymers such as polyolefins to improve their adhesive properties. Such modified materials could have applications in the packaging industry as adhesives for laminates. The last chapter is 'The Use of Electron Microscopy for the Analysis of the Adhesive-Adherend Interface in the Aluminium–Aluminium Bonded Joint' by J.A. Bishop *et al.* This paper shows how SEM analysis can be coupled with TEM analysis of ultramicrotomed sections to give information on surfaces. This is illustrated by the analysis of a clad aluminium, Alcad 2024-T3, treated with various surface pretreatments.

This book is best summarized by a direct quote from Dr Lees, chapter, 'To most, if not all engineers adhesives are unfamiliar materials — hardly surprising given the lack of training in the subject.' This book is just the sort of broad approach that is necessary for this education programme. The conference brings together people with widely different backgrounds. Academics, adhesives users, and adhesive manufacturers all come together to present papers. Any person who has an interest in the joining of materials by adhesive bonding will find some papers within this book of direct interest to them.

D. Tod
RARDE, Waltham Abbey, UK

Epoxy Resins Chemistry and Technology, 2nd edition

Edited by: Clayton A. May

Marcel Dekker Inc., 1988 ($234.00 outside North America)

The first edition of this book appeared in 1973, and in the introductory chapter the author shows that the US consumption of bisphenol-type epoxy resins has doubled since then. Also although adhesives currently account for only 4.8% of epoxy resins, adhesion is clearly involved in most of the other applications, of which coatings is the biggest.

In the preface to the second edition the author accurately states that the volume has a 'high degree of chemical orientation', and this is very evident in Chapters 2-4. Chapter 2 (Synthesis and Characteristics of Epoxides by Y. Tanaka) is a detailed review of the organic chemistry of epoxides. There is a vast amount of information taken from 1544 references, and much of it is given in 49 Tables. Curing reactions is the topic of Chapter 3 by Y. Tanaka and R.S. Bauer, and it is similar in style to Chapter 3 in placing a fair emphasis on understanding the mechanisms of chemical reactions. Throughout the volume there are many issues of potential use to adhesive bonding in the future, and which may well initiate lateral thinking. One example is the hardening of epoxides with polyurethanes, polyamides and polyphenols, all of which are potential substrates for epoxide adhesives. Chapter 3 also includes a review of the polymerisation of epoxides and the statistics of crosslinking. Practical curing systems are reviewed in Chapter 4 (Curing Agents and Modifiers by T.F. Mika and R.S. Bauer), which includes tables of cured physical properties for some common systems.

Chapter 5 (Elastomer-Modified Epoxy Resins by T.Y. Ting) has no parallel in the first edition. There is a slight error in verbal continuity at the end of page 551 and the start of page 552 in what is otherwise an excellent chapter which is particularly well illustrated. One important issue for adhesive bonding which is discussed is the effect of bondline thickness. Two further key issues are critical surface tension and moisture degradation, these appear in Chapter 6 (Physical and Mechanical Properties of Cured Resins by D.H. Kaelble, J. Maocanin and A. Gupta).

Chapters 7-12 deal with the applications of epoxides. There is inevitably some repetition from earlier on, but this is never excessive and it helps to make each chapter self-contained. Of these Chapter 7 (Epoxy Resin Adhesives by A. Lewis) could have dealt in more detail with the key problem of the durability of joints in wet surroundings and Chapter 8 by R.W. Tess is entitled Epoxy Resin Coatings.

A well illustrated Chapter 9 (Electrical and Electronic Applications by S.M. Lee) shows that here there is a problem shared with the adhesive bonding of structures by stating 'the entry of moisture ... is probably the most deleterious single factor in causing electrical or electronic failure in components'. Whilst plasma chemistry is now a promising method of surface treatment for adhesive bonding, a use in the electrical area is epoxy decapsulation by plasma ashing.

The 10th Chapter (Fiber-Reinforced Epoxy Composites by J. Delmonte, J.T. Hoggatt and C.A. May) concentrates of reinforcement with glass fibres, and a particular topic of interest for adhesion is finishes for glass.