

This article was downloaded by:

On: 22 January 2011

Access details: *Access Details: Free Access*

Publisher *Taylor & Francis*

Informa Ltd Registered in England and Wales Registered Number: 1072954 Registered office: Mortimer House, 37-41 Mortimer Street, London W1T 3JH, UK



The Journal of Adhesion

Publication details, including instructions for authors and subscription information:

<http://www.informaworld.com/smpp/title~content=t713453635>

A review of: “DEVELOPMENTS IN ADHESIVES-2, edited by A. J. Kinloch. Applied Science Publishers, London and Englewood, N.J., 1981, 419 pp. (\$68.00).”

George F. Hardy^a

^a Celanese Research Company, Summit, N.J., U.S.A.

To cite this Article Hardy, George F.(1982) 'A review of: “DEVELOPMENTS IN ADHESIVES-2, edited by A. J. Kinloch. Applied Science Publishers, London and Englewood, N.J., 1981, 419 pp. (\$68.00).”', *The Journal of Adhesion*, 14: 2, 175 – 177

To link to this Article: DOI: 10.1080/00218468208074899

URL: <http://dx.doi.org/10.1080/00218468208074899>

PLEASE SCROLL DOWN FOR ARTICLE

Full terms and conditions of use: <http://www.informaworld.com/terms-and-conditions-of-access.pdf>

This article may be used for research, teaching and private study purposes. Any substantial or systematic reproduction, re-distribution, re-selling, loan or sub-licensing, systematic supply or distribution in any form to anyone is expressly forbidden.

The publisher does not give any warranty express or implied or make any representation that the contents will be complete or accurate or up to date. The accuracy of any instructions, formulae and drug doses should be independently verified with primary sources. The publisher shall not be liable for any loss, actions, claims, proceedings, demand or costs or damages whatsoever or howsoever caused arising directly or indirectly in connection with or arising out of the use of this material.

Book Review

DEVELOPMENTS IN ADHESIVES—2, edited by A. J. Kinloch. Applied Science Publishers, London and Englewood, N.J., 1981, 419 pp. (\$68.00).

This volume contains ten review articles dealing with various aspects of the mechanical testing of structural adhesive bonds. The editor's intention was "to present recent developments . . . which have been of significant practical and scientific interest". In general, the contributions are informative, well organized and clearly written. The book should be useful both to beginners and to advanced workers who desire a review of recent progress and a sobering glimpse of the vast areas which are still not fully understood.

The first two chapters summarize the current status of the mechanical analysis of lap shear joints by continuum analysis (L. J. Hart-Smith) and finite element methods (R. D. Adams). The discussion of continuum analysis highlights the influence of the shear stress distribution on creep accumulation and gives evidence for the use of a maximum shear strain energy criterion for failure. The chapter on finite element analysis emphasizes details of mathematical methodology and gives special attention to the behavior of the adhesive fillet (an aspect of joint performance which is especially difficult to handle by continuum methods).

Recent applications of fracture mechanics to the failure of adhesive bonds are clearly and compactly reviewed by A. J. Kinloch and S. J. Shaw. Numerous test configurations are described and compared, and there are good discussions of such topics as the effects of bond thickness and adhesive constraint on fracture toughness, and the unresolved problems associated with environmental degradation.

D. L. Hunston, W. T. Carter and J. L. Rushford describe their very extensive and careful studies of the viscoelastic behavior of a model cross-linked epoxy resin. They stress the non-equilibrium nature of the glassy state, and the "aging" effects to which it gives rise. Their thorough discussion of the meaning (or lack of meaning) of the "glass transition temperature" of such systems will

hopefully serve as a warning to some of the other workers in this field. No attempt is made in this chapter to deal with the additional complexities introduced by the presence of fillers or fabric supports.

A description of fatigue mechanisms in bonded joints, by J. Romanko and W. G. Knauss, is also based on analytical and experimental studies of a model adhesive system. The primary emphasis is placed on the site and rate of growth of the damaged zones, and on the way in which the presence of moisture changes the relative importance of interface cracking *v.* crazing in the scrim plane.

Two chapters deal specifically with test methods currently used in the aerospace industry for metal/metal and metal/composite bonds. The first, by D. B. Arnold, is a brief outline of strictly mechanical test methods: common types of specimens, their advantages and limitations, plus some thoughts on testing strategy. A few words on currently unfilled needs and likely future developments would have added to the value of this discussion. The second review, by J. C. McMillan, deals with methods for evaluating the environmental durability of adhesive bonds for aircraft applications. It contains a good blend of general principles and practical examples, together with some recommendations as to preferred test procedures and approaches for improving bond performance.

Recent studies of the effects of water on the strength of bonds between "well surface treated" metal adherends are discussed by J. Comyn. (The corrosion effects described so fully in the previous chapter are not considered in this analysis.) Changes in mechanical properties are related, with fair success, to the diffusion of water through the bulk of the adhesive layer. However, this interpretation is complicated by the fact that the effects of many important variables (such as variation in diffusion rate with water concentration, adhesive constraint, or the presence of fillers) are difficult to incorporate into the theoretical model.

A chapter by D. E. Packham deals with the measured strength of direct bonds between metals and polyolefins. The author shows how a wide variety of published work in this area can be interpreted with reference to the extent of plastic deformation in the polymer during bond failure.

The final chapter, by E. Cutts, critically compares the methods currently employed in industry to assess the quality of rubber to metal bonds such as those used in engine mounts and vibration dampers. As the author points out, the situation here is still far from satisfactory. There seems to be no test which will provide reliable data for bond strength design, and the various standard methods often disagree widely as to the predicted ranking of different bonding systems. It is then essential, as is so often the case, to consider carefully the mode of failure and the details of the curing chemistry.

This book has been carefully edited and produced. It was especially pleasing

to see the relevant symbols and notations for each chapter gathered together at the head of the text, where they can be conveniently consulted.

GEORGE F. HARDY
Celanese Research Company,
Summit, N.J. 07901, U.S.A.