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Book Review

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Book Review

DEVELOPMENTS IN ADHESIVES—1. William C. Wake, Ed. Applied Science Publishers, Ltd., London, 1977. 318 pp. (\$40.00)

It is the stated purpose of the Editor to provide in this volume a more balanced picture of the state of the art in adhesives technology than is generally available in existing adhesives' literature. The way he has chosen to do this, "... is to select topics which are at the present time of particular interest in the application of adhesives technology and persuade someone personally active with that topic to review it."

The list of topics, each the subject of a chapter, follows:

1. The Durability of Structural Adhesives.
2. Structural Adhesives Used in Civil Engineering.
3. Advances in Epoxy Adhesive Technology.
4. Tack and Morphology of Pressure-Sensitive Adhesives.
5. Pressure-Sensitive Adhesives—Principles of Formulation.
6. Acrylic Adhesives.
7. The Present Position of Tyre Cord Adhesives.
8. Fusible Adhesives for Textiles.
9. Thermoplastic SBS Rubbers as Adhesives and Adherends.
10. Preparing Low-Energy Surfaces for Bonding.
11. Safety and Environmental Legislation and its Effect on Adhesive Formulation.

The depth of treatment of the various topics differs quite markedly. For example, Chapter 2 on civil engineering usage (which the reviewer particularly enjoyed reading because it is outside his normal sphere of operation) contains a section on "Resin Injection for Structural Repair" which runs to approximately 13 pages. More than half of this section is devoted to the theory of crack penetration by a liquid while only very little (qualitative) treatment is given the theory of joint failure in humid environments in Chapter 1 on joint durability.

There are a few points in the book which require comment. The author of Chapter 5 states on page 134 that, "For a non-wetting system ($\theta > 90^\circ$) the equilibrium extent of contact will be small, irrespective of whether the

adhesive is a simple liquid, a viscoelastic liquid or a viscoelastic solid." This statement hardly applies to systems of organic liquids on organic substrates since, as Huntsberger has pointed out,¹ even on substrates having the lowest γ_c known, ~ 6 dyne/cm, organic liquids show intrinsic advancing contact angles less than 90° . In the chapter on acrylic adhesives there is a printing error in one of the compounds in the reaction sequence at the top of page 160. In the same chapter, on page 177, the author states that epoxy adhesives lack speed of cure without rapid (high energy) heating systems. There are, of course, commercial epoxy adhesives which harden in 3–5 minutes.

The author of Chapter 7 on Tyre Cord Adhesives omits mention of steel cords altogether. (In the U.S. the term "cord", in the context of tires, apparently includes wound structures made of steel.) The point is raised because many tires are made with steel reinforcement in Europe and the U.S. The matter is, therefore, of some importance.

Serious criticism is reserved for Chapter 10. The authors, in this reviewer's opinion, do not present either a critical or a balanced view of the mechanisms by means of which certain treatments improve the joinability of certain thermoplastics. Although the authors vacillate between whether or not the major factor involved in joint improvement is increased surface free energy (SFE), on balance they seem to feel that it is, most of the time. In the case of polyethylene (PE), they seem to feel that it is—neglecting the results of Schonhorn and Hansen² who showed that fluorination of PE markedly *decreases* its SFE (actually γ_c), contrary to the authors' statement on page 262, yet gives joint strengths comparable to PE treated with chromic acid, CASING, etc. In addition, fluorination gives an infusible "skin" on PE—as do chromic acid, CASING, etc. There are other examples of similar inconsistencies in this chapter which should be read with care.

The last chapter, on Safety and Environmental Legislation, although written in the context of British law, is useful on both sides of the Atlantic. I found one term, "tipping" (apparently a method of disposal) quite puzzling!

On balance, this is a good, useful book which can be recommended to adhesive technologists who can benefit from up-to-date reviews of the topics covered. Its price is high (\$40) but then what specialized technical book doesn't suffer from that problem these days! It is well referenced and indexed.

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1. J. R. Huntsberger, in *Treatise on Adhesion and Adhesives*, vol. 1, R. L. Patrick, Ed. (Dekker, N.Y., 1966), p. 133.
2. H. Schonhorn and R. L. Hansen, *J. Appl. Poly. Sci.* **12**, 1231 (1968).