The engineers' guide is clearly aimed at the North American market; the list of consultants and suppliers and the mixed use of imperial and metric units quickly confirms this view. The introductory sections would have been better with a more discursive treatment of thermomechanical properties. While the approach adopted by Chamis is all-encompassing and he includes useful step by step examples it would have been better to include other approaches, especially for failure criteria, and to have demonstrated the accuracy of the models used. An account of fracture mechanics as applied to laminates would have been helpful.

The bulk of the book, on property data, is a tremendous compilation. I was a little uneasy, especially with the sections on metal and ceramic matrix composites, because far too many of the references refer to work of the 70s rather than the mid 80s. I question the usefulness of quoting so much data on MMC and CMC simply because it is there. It might have been better to back up the much more limited, but newer, data with some general observations on the reinforcement efficiency of fibres in metals and ceramics.

The bibliography is rather limited; why, for instance refer to ICCM/2 (not Z as printed) but not the earlier or later conferences in this series? The book finishes with a very good glossary of technical terms and an excellent index. At £85 this volume may not get as widespread distribution as it ought to. A solution would be a cheaper, international, revised or amended, paperback version.

Instrumental Impact Testing of Plastics and Composite Materials

ASTM STP 936

Edited by: S. L. Kessler, G. C. Adams, S. B. Driscoll and D. R. Ireland

American Society for Testing and Materials, USA, 1987 (£59.50)

The nineteen papers range over all aspects of instrumented impact testing including methodology, end use, materials characterisation, partial penetration testing and fatigue response and fracture toughness. The materials studied include various carbon and aramid fibre composites with epoxy and bismaleimide resin matrices, RRIM, SMC, and commodity thermoplastics with and without toughening additions.

The most interesting papers are the most general ones on methodology. There are many parameters to be considered in instrumented impact testing including time/load range, triggering, filtering, inertial loads, harmonic oscillations, whether the controlling parameter is deflection, energy or force or if failure should be defined by yielding, cracking, a total break or penetration. Above all, however, is the, surely well known, but, alas often disregarded message; think very carefully first, then test! The point is made that the user should consider, in given circumstances, whether to rank materials by carrying out coupon testing or if impact behaviour should be judged by simulating as nearly as possible the real life situation.

It is emphasised that a particular test can be misleading because, for instance, the falling dart is penetrating the specimen, the samples my not be from a single representative population etc. It was found in comparison tests on SMC, RRIM, nylon RIM, ABS and PP that notched Izod, tensile and standard Gardener (in which the specimen is sheared) tests differentiated well among the materials, while anvil and flexural impact tests did not. Generally results tended to correlate provided the material stress state, controlling variable and failure limit were similar.

These themes, together with many more specific observations on given materials, are to be found throughout this volume. As is usually the case with ASTM STP's the book is very well edited and produced and is a must for anyone seriously working with polymers or composites in an impact environment.

Reinforced Plastics for Commercial Composites: Source Book

Compiled by: G. D. Shook

American Society for Metals, 1986 (£62.00)

This book, which is one of a series of a dozen or so on ceramics and metallurgy, is a collection of articles from American plastics and adhesives magazines, the Society of Plastics Industry conferences, etc. All the articles have appeared in the last 10 years. The style is mainly that of a popular newspaper with a minimum of mathematics.

No doubt, for someone without access to the various periodicals, it is helpful to have these contributions in one book. While perusing this would give the reader some idea of commercial developments in resins, fillers, reinforcements, curing agents, moulding and fabrication processes and automotive and other applications, I think that the treatment is too sketchy to be worthwhile.

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Friction and Wear of Polymer Composites

Edited by: K. Friedrich

Elsevier Science Publishers, 1986 (US $85.25, Dfl 230.00)

The text reports 12 monographic works of a distinguished group of researchers from Germany, Great Britain, New Zealand, Japan, USA, Sweden, and is the first volume of a series which the Editor,
already well-known for other publications on composite materials, has launched in response to the great interest in these new materials in all industrialized countries.

The work is divided into three parts: fundamental aspects of tribology in general and polymer composites in particular (Chapters 1–3); effects of microstructure of composites on their friction and wear behaviour, and wear behaviour under different external loading conditions (Chapters 4–9); and finally problems of the control of friction and wear behaviour in practical situations (Chapters 10–12). Part of the volume is also devoted to the friction and wear of metal-based composites and rubber compounds.

The introductory chapter presents definitions and terminology used in friction and wear, describing mechanisms and explaining why friction and wear must be considered as system properties. In Chapter 2, the fundamental principles of interfacial friction of polymers and polymer composites are described giving a special consideration to friction in lubricated systems, to frictional coefficients under abrasive and non-abrasive dry-sliding conditions and to other wear models.

In the final chapter of the first part a new approach to more systematically describing the tribological behaviour of anisotropic materials is considered, helping in a better understanding of the effects of individual components and their geometrical arrangement in a composite on its tribological properties.

The second section is the most important part of the whole volume and constitutes 260 of the total 430 pages. In this section the tribological properties of selected polymers matrices with a special trip-on-disc tribometer and against abrasive counterparts, the effects of various fillers on friction and wear and properties of PTFE-based composites, and the friction and wear of metal matrix/graphite fibre composites are analysed respectively in Chapters 4, 5 and 6. In Chapter 7, performances of unidirectionally oriented glass, carbon, aramid and stainless steel fibre-reinforced-plastics against smooth steel counterparts are described. In particular, a law of mixtures for calculating the friction coefficient and a model wear equation for fibre-reinforced plastics are proposed. The differences in wear behaviour of short fibre-reinforced thermoplastics and continuous-fibre woven-fabric-reinforced thermosets against various abrasive counterparts (steel, severe abrasive paper) are discussed as a function of fibre volume fraction by Friedrich in Chapter 8.

In the last chapter of second section, mild wear processes of rubber-based compounds and micro-mechanical detachment event are elucidated, with particular reference to modified surface layers, ageing, fatigue, crack formation and growth.

Finally, in the third part, specific friction and wear problems encountered in various practical applications of polymer composites are pointed out. In particular in Chapter 10, the classification of commercially available polymer composites into several categories is carried out as a function of their structural composition, their performance attributes and other characteristics. In Chapters 11 and 12 load-carrying capacity of polymer composites for aerospace dry bearing application and typical compositions of self-lubricating composites used for extreme environmental conditions are highlighted.

This work is intended essentially for those who are interested in research on similar aspects of polymer composite tribology, for those who often meet practical friction of wear problems and wish to learn more methods to solve them.

In conclusion, the volume not only represents a frame of reference about polymer composites behaviour in friction and wear, but also tends to catalyse further studies in this important field.

I. Crivelli-Visconti
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