68.95 MPa and 62°C. Because the modulus is higher at 62°C, the instantaneous deflection at the nominal stress level of 68.95 MPa is lower at this temperature than that at 93°C.

In all three cases, the creep deflection increases smoothly and gradually, without any "jumps" as have been seen in tensile creep tests of such composites [1]. This is perhaps due to the low stress levels used in two of these cases where microcracks are not developed in the specimen. Although it is less than 20% of the static flexural strength, 68.95 MPa corresponds to the fatigue strength of the material at 10⁶ cycles [2] and may, therefore, be used as design stress level.

Figure 3 shows the effect of a sequence of loading on the creep deflection at 62°C. When the load was increased to nearly double the stress level at t = 12,000 min, the deflection increased instantaneously, but to a lower value than it would be if the same load was applied initially. When the load was released so that the stress level fell back to 68.95 MPa, there was again an instantaneous recovery, but not quite to the value at 12,000 min.

References


Literature Reviews

Developments in Adhesives—2

Book reviewed by R. M. Christensen, Lawrence Livermore National Laboratory, Livermore, CA 94550.


No edited book on a technical subject can be expected to be both detailed and comprehensive. Typically, individual authors pursue their own areas at great length, but there remain considerable gaps, if not conflicts, between the treatments. This book is no exception; nevertheless, it is highly recommended for its interesting, relevant, and broadly useful treatment of the subject of the mechanical and physical aspects of adhesive joint design. The emphasis is on the analysis and the interpretation of the mechanical testing of adhesive joints, written by experts in the field.

The diversity of approaches is evident in the first three chapters. The first chapter concerns analytical solutions for stress analysis, the second is on the finite-element approach, and the third is on the fracture mechanics approach, written respectively by L. J. Hart-Smith, R. D. Adams, and A. J. Kinloch and S. J. Shaw. All three treatments represent distinctly different, legitimate approaches to the subject. The first two approaches explicitly include plasticity effects. The article on the fracture approach to adhesive design is very helpful, although one could wish that it had gone a little further into the time-dependent case.

The fourth chapter involves a very complete viscoelastic characterization of a model material, an epoxy resin, by D. L. Hunston, W. T. Carter, and J. L. Rushford. Although not immediately applicable to design, it is easy to agree with the authors that this is basic and important characterization information for polymeric bonding. The next chapter is on the fatigue of bonded joints by J. Romanko and W. G. Knauß. This work also involves the time-dependent properties of the polymer, and in fact relates these properties to some characteristics of the bond joints. The authors examine mechanisms of damage growth in this work.

The last five chapters concern practical mechanical tests for aerospace certification, durability testing, water uptake analysis, specific behavior of a particular polyolefin bond material and rubber-type bond materials, respectively, written by D. B. Arnold, J. C. McMillan, J. Comyn, D. E. Packham, and E. Cutts. All articles present useful assessments of the current work in the subfields.

Correction

Please note the following corrections to the review of Effect of Variances and Manufacturing Tolerances on the Design Strength and Life of Mechanically Fastened Composite Joints in the Spring 1982 issue of Composites Technology Review, pp. 26-28: The second author is J. M. Ogonowski. On page 26, the third (and last) volume of the report is titled User's Manual for the Bolted Joint Stress-Field Model (BJSFM) Computer Program. On page 26, right column, second paragraph, the fourth sentence should read: "Failure (at R_c) was defined by a predicted shear or fiber failure using a Tsai-Hill or maximum-strain criterion." On page 27, left column, second paragraph, the value of R_c used for compressive predictions should be 0.625 mm (0.025 in.).

Composite-Material Flywheels and Containment Systems

Article reviewed by P. L. Lien, Lawrence Livermore National Laboratory, Livermore, CA.


This article, a general and brief overview of the design and use of composite flywheels as energy-storage devices, deals specifically with work coordinated by the Lawrence Livermore National Laboratory. Included is an introduction to the advantages of composite materials over steel for flywheel applications and a basic discussion of the use of flywheels to store energy. Perhaps the most interesting feature of the article is a spread of photographs of ten different composite flywheel designs. There are also abbreviated discussions of testing and evaluation methods for composites, containment designs, rotor dynamics, nondestructive inspection, and processing and fabrication of composite materials. Although well written and generously illustrated, this article is directed at a rather elementary, nontechnical audience. It might, however, make an interesting introduction to the field of composite material design for a university class in engineering or materials science.