

Test Methods and Design Allowables for Fibrous Composites

Second Volume

Christos C. Chamis
editor



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Each paper published in this volume was evaluated by three peer reviewers. The authors addressed all of the reviewers' comments to the satisfaction of both the technical editor(s) and the ASTM Committee on Publications.

The quality of the papers in this publication reflects not only the obvious efforts of the authors and the technical editor(s), but also the work of these peer reviewers. The ASTM Committee on Publications acknowledges with appreciation their dedication and contribution of time and effort on behalf of ASTM.

Foreword

Test Methods and Design Allowables for Fiber Composites: Second Symposium was held at Phoenix, AZ, on 3–4 Nov. 1986. ASTM Committee D-30 on High Modulus Fibers and Their Composites sponsored the symposium. Christos C. Chamis, NASA Lewis Research Center, served as chairperson of the symposium and is editor of the resulting publication.

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Overview

The composites structures community recognizes that fiber composites offer a multitude of desirable properties to meet diverse and competing design requirements in a cost-effective manner. This multitude of desirable properties, however, requires special test methods to quantify material properties for design. It also requires well-defined procedures in selecting and setting design allowables for composites. Over the past 25 years researchers have continuously sought test methods to measure composite material properties with an acceptable degree of repeatability. At the same time, designers have sought well-defined procedures to select and establish design allowables that are compatible with current practice margins. Special test methods to measure composite properties and procedures for setting design allowables go through a long period of peer evaluation and critique before their adaptation on a general consensus basis.

In order to shorten the peer evaluation and critique period, a specialists symposium was organized 2 and 3 Oct. 1979, in Dearborn, MI, with the objective to provide a forum for the discussion of (1) special test methods for setting design allowables and reporting results; (2) selecting and establishing design allowables, (3) promoting an understanding of the procedures for establishing design allowables, and (4) developing new test methods streamlined for setting design allowables that will eventually lead to improved methodology for reliable composite structures design. Papers presented in that symposium are included in ASTM *STP 734, Test Methods and Design Allowables for Fibrous Composites*, which was published in 1981.

During the past ten years, new composites have emerged, especially for high-temperature and hostile environment applications. These new applications require new test methods. The evolution of new test methods and the improvement of existing ones constituted a ripe time to have a second specialist symposium on "Test Methods and Design Allowables for Fiber Composites," which was held on 3-4 Nov. 1986, Phoenix, AZ, and which focused on these recent developments. The papers presented in the second symposium are grouped into three sessions: (1) Extreme/Hostile Environment Testing, (2) Establishing Design Allowables, and (3) Property/Behavior Specific Testing. The papers presented in these sessions are included as three respective sections in this Special Technical Publication (STP). A brief description of each section follows: Section I on Extreme/Hostile Environment Testing contains six papers on testing under conditions of extreme temperatures, sand erosion, abrasive wear, and other environmental variables. Section II on Establishing Design Allowables presents five papers that review current practices and statistical methods. Section III on Property/Behavior Specific Testing contains six papers on delamination, in-plane shear, torsional failure, elastic-plastic stress, and fatigue testing.

The papers in each section provide a valuable source as to where the advances and emphasis were at the time of the second symposium with respect to special testing and procedures for selecting design allowables. In addition, the papers provide a good perspective, with suitable references, of the test methods and procedures for setting design allowables that have been proposed, or are used, including ranges of applications and limitations.

Furthermore the papers in each major area offer specific recommendations for future research, which will lead to improved test methods and procedures for establishing design allow-

ables for high-temperature composites and for the use of composites in hostile environments. Lastly, the papers collectively provide the researcher, analyst, and designer with a wealth of information and data. The papers are not, nor should they be expected to be, inclusive in any one area. However, they do constitute an integrated source of test methods and procedures for setting design allowables for a variety of composites, with vantage point, Fall 1986.

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