TIME DEPENDENT AND NONLINEAR EFFECTS IN

POLYMERS AND COMPOSITES

RICHARD A. SCHAPERY
AND C. T. SUN
EDITORS

STP 1357

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STP 1357

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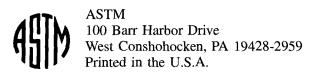*Richard A. Schapery and C. T. Sun, editors*

ASTM Stock Number: STP 1357

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on Publications acknowledges with appreciation their dedication and contribution of time and effort
on behalf of ASTM.

Foreword

The Symposium on *Time Dependent and Nonlinear Effects in Polymers and Composites* was held on May 4–5, 1998 in Atlanta, Georgia. ASTM Committee D-30 on Composite Materials sponsored the Symposium. Richard Schapery, the University of Texas at Austin, and C. T. Sun, Purdue University, presided as symposium co-chairmen and are editors of this publication.

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Overview

Polymeric composites exhibit appreciable time-dependent and nonlinear mechanical behavior in many structural applications. Improved fundamental understanding of and predictive models for this behavior over service lifetimes in realistic environments are needed for composites to gain wider acceptance and to achieve a significantly increased level of structural efficiency and reliability in commercial and military applications.

In advanced fibrous composites, the fiber phase is basically linearly elastic and shows little nonlinear and time-dependent behavior, if any. Thus, the nonelastic properties originate primarily from the matrix phase, including the polymer-fiber interphase zone. It is evident that to understand and to model the nonelastic behavior of composites, one must understand and be able to model this behavior in polymers.

Understanding the in situ behavior of the polymeric matrix and its interaction with fibers is an important part of developing improved predictive models. Because there is now a considerable amount of research activity worldwide on time-dependent and nonlinear effects in polymers and composites, it is desirable to describe and assess recent developments and their practical significance as well as to identify important unsolved fundamental problems. For these reasons, the two related disciplines, polymers and composites, were brought together at the *Symposium on Time-dependent and Nonlinear Effects in Polymers and Composites*. One of the main objectives of this symposium was to join the effort of specialists in these two disciplines to advance research in this important area of polymeric composites.

This volume contains eighteen papers presented at the Symposium. They are grouped under two subheadings, *Polymers* and *Composites*. Under *Polymers*, the primary topics are chemical and physical aging, nonlinear viscoelasticity and viscoplasticity. A number of topics are addressed by the papers under *Composites*, including the effect of physical aging on time-dependent behavior of composites, multiaxial nonlinear effects, compressive behavior, nonlinear viscoelasticity and viscoplasticity, failure and failure mechanisms, hygrothermal effects, durability, and accelerated strength testing.

We want to express our sincere thanks to all those who made the symposium and this STP possible. The excellent contributions of the authors, reviewers, presenters, session chairs, ASTM staff, and sponsoring technical committee are deeply appreciated.

Richard A. Schapery

The University of Texas, Austin, Texas;
symposium cochairman and editor

C. T. Sun

Purdue University, West Lafayette, Indiana;
symposium cochairman and coeditor