

COMPOSITES FOR EXTREME ENVIRONMENTS

N. R. Adsit, *editor*

 **STP 768**

COMPOSITES FOR EXTREME ENVIRONMENTS

A symposium
sponsored by ASTM
Committee D-30 on
High Modulus Fibers and
Their Composites
Bal Harbour, Fla., 11 Nov. 1980

ASTM SPECIAL TECHNICAL PUBLICATION 768
N. R. Adsit, General Dynamics/Convair Division,
editor

ASTM Publication Code Number (PCN)
04-768000-33



1916 Race Street, Philadelphia, Pa. 19103

Copyright © by AMERICAN SOCIETY FOR TESTING AND MATERIALS 1982
Library of Congress Catalog Card Number: 81-69769

NOTE

The Society is not responsible, as a body,
for the statements and opinions
advanced in this publication

Printed in Baltimore, Md.
April 1982

Foreword

The symposium on Composites for Extreme Environments was held on 11 Nov. 1980 in Bal Harbour, Fla. ASTM Committee D-30 on High Modulus Fibers and Their Composites sponsored this symposium. N. R. Adsit of General Dynamics/Convair Division served as symposium chairman and edited this publication.

Related ASTM Publications

Joining of Composite Materials, STP 749 (1981), 04-749000-33

Methods and Models for Predicting Fatigue Crack Growth Under Random Loading, STP 748 (1981), 04-748000-30

Test Methods and Design Allowables for Fibrous Composites, STP 734 (1981), 04-734000-33

Fractography and Materials Science, STP 733 (1981), 04-733000-30
Fatigue of Fibrous Composite Materials, STP 723 (1981),
04-723000-33

Nondestructive Evaluation and Flaw Criticality for Composite Materials,
STP 696 (1979), 04-696000-33

Composite Materials: Testing and Design (Fifth Conference), STP 674 (1979), 04-674000-33

A Note of Appreciation to Reviewers

This publication is made possible by the authors and, also, the unheralded efforts of the reviewers. This body of technical experts whose dedication, sacrifice of time and effort, and collective wisdom in reviewing the papers must be acknowledged. The quality level of ASTM publications is a direct function of their respected opinions. On behalf of ASTM we acknowledge with appreciation their contribution.

ASTM Committee on Publications

Editorial Staff

Jane B. Wheeler, *Managing Editor*
Helen M. Hoersch, *Senior Associate Editor*
Helen P. Mahy, *Senior Assistant Editor*
Allan S. Kleinberg, *Assistant Editor*
Virginia M. Barishek, *Assistant Editor*

Contents

Introduction	1
POLYIMIDES—MATERIALS FOR HIGH-TEMPERATURE ENVIRONMENTS	
Environmental Effects on Graphite Fiber Reinforced PMR-15 Polyimide— T. T. SERAFINI AND M. P. HANSON	5
V378A Polyimide Resin—A New Composite Matrix for the 1980's— L. MCKAGUE	20
Thermomechanical Characterization of Graphite/Polyimide Composites— S. C. KUNZ	33
Thermophysical Properties Data on Graphite/Polyimide Composite Materials—M. D. CAMPBELL AND D. D. BURLEIGH	54
Elastic Properties and Fracture Behavior of Graphite/Polyimide Composites at Extreme Temperatures—D. P. GARBER, D. H. MORRIS, AND R. A. EVERETT, JR.	73
ATMOSPHERIC AND EXTROATMOSPHERIC ENVIRONMENTS	
Filament Wound Composite Thermal Isolator Structures for Cryogenic Dewars and Instruments—E. E. MORRIS	95
Space Environmental Effects on Graphite/Epoxy Composites—C. L. LEUNG	110
Effects of Extreme Aircraft Storage and Flight Environments on Graphite/ Epoxy—P. SHYPRYKEVICH AND W. WOLTER	118
MOISTURE ENVIRONMENTS	
Environmental Exposure of Carbon/Epoxy Composite Material Systems—R. C. GIVLER, J. W. GILLESPIE, JR., AND R. B. PIPES	137
Dynamic Tests of Graphite/Epoxy Composites in Hygrothermal Environments—L. W. REHFIELD, R. P. BRILEY, AND S. PUTTER	148

**Influence of Quality Control Variables on Failure of Graphite/Epoxy
Under Extreme Moisture Conditions—L. L. CLEMENTS AND
P. R. LEE**

161

SUMMARY

Summary 175

Index 177

