

Automated Test Methods for Fracture and Fatigue Crack Growth

Cullen/Landgraf/Kaisand/Underwood
editors

ASTM STP 877

AUTOMATED TEST METHODS FOR FRACTURE AND FATIGUE CRACK GROWTH

A symposium
sponsored by
ASTM Committees E-9 on
Fatigue and E-24 on
Fracture Testing
Pittsburgh, PA, 7-8 Nov. 1983

ASTM SPECIAL TECHNICAL PUBLICATION 877
W. H. Cullen, Materials Engineering Associates,
R. W. Landgraf, Southfield, Mich.,
L. R. Kaisand, General Electric R&D Center, and
J. H. Underwood, Benet Weapons Laboratory,
editors

ASTM Publication Code Number (PCN)
04-877000-30



1916 Race Street, Philadelphia, PA 19103

Library of Congress Cataloging in Publication Data

Automated test methods for fracture and fatigue crack growth.

(ASTM special technical publication; 877)

"ASTM publication code number (PCN) 04-877000-30."

Includes bibliographies and index.

1. Materials—Fatigue—Congresses. 2. Fracture mechanics—Congresses. I. Cullen, W. H. II. Landgraf, R. W., III. Kaisand, L. R., IV. Underwood, J. H., V. American Society for Testing and Materials. Committee E-9 on Fatigue. VI. ASTM Committee E-24 on Fracture Testing. VII. Series.

TA418.38.A98 1985 620.1'123 85-15710

ISBN 0-8031-0421-9

Copyright © by AMERICAN SOCIETY FOR TESTING AND MATERIALS 1985
Library of Congress Catalog Card Number: 85-15710

NOTE

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

Foreword

The symposium on Automated Test Methods for Fracture and Fatigue Crack Growth was held in Pittsburgh, Pennsylvania, 7-8 November 1983. ASTM Committees E-9 on Fatigue and E-24 on Fracture Testing sponsored the symposium. W. H. Cullen, Materials Engineering Associates, R. W. Landgraf, Southfield, Michigan, L. R. Kaisand, General Electric R&D Center, and J. H. Underwood, Benet Weapons Laboratory, presided as symposium chairmen and are editors of this publication.

Related ASTM Publications

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

Fatigue Crack Growth Measurement and Data Analysis, STP 738 (1981), 04-738000-30

Effect of Load Variables on Fatigue Crack Initiation and Propagation, STP 714 (1980), 04-714000-30

Part-Through Crack Fatigue Life Prediction, STP 687 (1979), 04-687000-30

Flaw Growth and Fracture (10th Conference), STP 631 (1977), 04-631000-30

Fatigue Crack Growth Under Spectrum Loads, STP 595 (1976), 04-595000-30

Mechanics of Crack Growth, STP 590 (1976), 04-590000-30

Fracture Toughness and Slow-Stable Cracking (8th Conference), STP 559 (1974), 04-559000-30

Stress Analysis and Growth of Cracks, STP 513 (1973), 04-513000-30

A Note of Appreciation to Reviewers

The quality of the papers that appear in this publication reflects not only the obvious efforts of the authors but also the unheralded, though essential, work of the reviewers. On behalf of ASTM we acknowledge with appreciation their dedication to high professional standards and their sacrifice of time and effort.

ASTM Committee on Publications

ASTM Editorial Staff

**Helen M. Hoersch
Janet R. Schroeder
Kathleen A. Greene
Bill Benzing**

Contents

Overview

SYSTEMS FOR FATIGUE AND FATIGUE CRACK GROWTH TESTING

New Developments in Automated Materials Testing Systems— NORMAN R. MILLER, DENNIS F. DITTMER, AND DARRELL F. SOCIE	9
An Inexpensive, Multiple-Experiment Monitoring, Recording, and Control System— DALE A. MEYN, P. G. MOORE, R. A. BAYLES, AND P. E. DENNEY	27
Development of an Automated Fatigue Crack Propagation Test System— ROBERT S. VECCHIO, DAVID A. JABLONSKI, B. H. LEE, R. W. HERTZBERG, C. N. NEWTON, R. ROBERTS, G. CHEN, AND G. CONNELLY	44
The Reversing D-C Electrical Potential Method— WILLIAM R. CATLIN, DAVID C. LORD, THOMAS A. PRATER, AND LOUIS F. COFFIN	67
Crack Shape Monitoring Using A-C Field Measurements— DAVID A. TOPP AND W. D. DOVER	86
A Low-Cost Microprocessor-Based Data Acquisition and Control System for Fatigue Crack Growth Testing— PATRICK M. SOOLEY AND DAVID W. HOEPPNER	101
An Automatic Fatigue Crack Monitoring System and Its Application to Corrosion Fatigue— YOSHIYUKI KONDO AND TADAYOSHI ENDO	118
Experience with Automated Fatigue Crack Growth Experiments— W. ALAN VAN DER SLUYS AND ROBERT J. FUTATO	132
Potential-Drop Monitoring of Cracks in Surface-Flawed Specimens— R. H. VANSTONE AND T. L. RICHARDSON	148
A Microprocessor-Based System for Determining Near-Threshold Fatigue Crack Growth Rates— JOHN J. MCGOWAN AND J. L. KEATING	167

Krak-Gages for Automated Fatigue Crack Growth Rate Testing: A Review—PETER K. LIAW, WILLIAM A. LOGSDON, LEWIS D. ROTH, AND HANS-RUDOLF HARTMANN	177
Automated Test Methods for Fatigue Crack Growth and Fracture Tough- ness Tests on Irradiated Stainless Steels at High Temperature— GIN LAY TJOA, FRANÇOIS P. VAN DEN BROEK, AND BART A. J. SCHAAAP	197
An Automated Fatigue Crack Growth Rate Test System— YI-WEN CHENG AND DAVID T. READ	213
 SYSTEMS FOR FRACTURE TESTING	
An Automated Method of Computer-Controlled Low-Cycle Fatigue Crack Growth Testing Using the Elastic-Plastic Parameter Cyclic J—JAMES A. JOYCE AND GERALD E. SUTTON	227
Automated Technique for R-Curve Testing and Analysis— MITCHELL JOLLES	248
A Computer-Interactive System for Elastic-Plastic Fracture Toughness Testing—TIMO SAARIO, KIM WALLIN, HEIKKI SAARELMA, AKI VALKONEN, AND KARI TÖRRÖNEN	260
Computerized Single-Specimen J-R Curve Determination for Compact Tension and Three-Point Bend Specimens—DAVID A. JABLONSKI	269
Author Index	299
Subject Index	301

