Special Applications and Advanced Techniques for

Grack Size Determination

John J. Ruschau and J. Keith Donald, editors

457) STP 1251



Special Applications and Advanced Techniques for Crack Size Determination

John J. Ruschau and J. Keith Donald, editors

ASTM Publication Code Number (PCN) 04-012510-30

ASTM 1916 Race Street Philadelphia, PA 19103 Printed in the U.S.A.

Library of Congress Cataloging-in-Publication Data

Symposium on Special Applications and Advanced Techniques for Crack Size Determination (1993: Atlanta, Ga.) Special applications and advanced techniques for crack size determination/John J. Ruschau and J. Keith Donald, editors. (STP; 1251) "ASTM publication code number (PCN) 04-012510-30." Includes bibliographical references. ISBN 0-8031-2003-6 1. Metals—Cracking—Measurement—Congresses. 2. Fracture mechanics-Congresses. 3. Measuring instruments-Congresses. I. Ruschau, John J., 1950– II. Donald, J. Keith, 1949– III. Title. IV. Series: ASTM special technical publication; 1251. TA460.S9393 1995 620.1'126-dc20 94-49349 CIP

Copyright ©1995 AMERICAN SOCIETY FOR TESTING AND MATERIALS, Philadelphia, PA. All rights reserved. This material may not be reproduced or copied, in whole or in part, in any printed, mechanical, electronic, film, or other distribution and storage media, without the written consent of the publisher.

Photocopy Rights

Authorization to photocopy items for internal or personal use, or the internal or personal use of specific clients, is granted by the AMERICAN SOCIETY FOR TESTING AND MATERIALS for users registered with the Copyright Clearance Center (CCC) Transactional Reporting Service, provided that the base fee of \$2.50 per copy, plus \$0.50 per page is paid directly to CCC, 222 Rosewood Dr., Danvers, MA 01923; Phone: (508) 750-8400; Fax: (508) 750-4744. For those organizations that have been granted a photocopy license by CCC, a separate system of payment has been arranged. The fee code for users of the Transactional Reporting Service is 0-8031-2003-6/95 \$2.50 + .50.

Peer Review Policy

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 to time and effort on behalf of ASTM.

Foreword

The symposium on Special Applications and Advanced Techniques for Crack Size Determination was held in Atlanta, Georgia, on 19 May 1993. ASTM Committee E8 on Fatigue and Fracture sponsored the symposium. J. J. Ruschau, University of Dayton Research Institute, Dayton, Ohio, and J. K. Donald, Fracture Technology Associates, Bethlehem, Pennsylvania, presided as symposium chairmen and are editors of this publication.

Contents

Overview	1
The Measurement of Regular and Irregular Surface Cracks Using the Alternating Current Potential Difference TechniqueM. P. CONNOLLY	3
Fatigue Crack Growth Measurements in TMF Testing of Titanium Alloys Using an ACPD Technique—Y. DAI, N. J. MARCHAND, AND M. HONGOH	17
Measurement of Multiple-Site Cracking in Simulated Aircraft Panels Using AC Potential Drop—D. A. JABLONSKI	33
The Influence of Crack Deflection and Bifurcation on DC Potential Drop Calibration—P. C. MCKEIGHAN, C. P. TABRETT, AND D. J. SMITH	51
Application of a Crack Length Measurement with a Laser Micrometer to <i>R</i> -Curve Tests—L. Legendre, B. JOURNET, J. DELMOTTE, G. MILLOUR, AND JM. SCHWAB	67
Improved Load Ratio Method for Predicting Crack Length—X. CHEN, P. ALBRECHT, W. WRIGHT, AND J. A. JOYCE	83
Ultrasonic Size Determination of Cracks with Large Closure Regions- D. K. REHBEIN, R. B. THOMPSON, AND O. BUCK	104
Apparatus for Ultrasonic In Situ Accurate Crack Size Measurement on Laboratory Test Specimens—D. DE VADDER, Y. PARK, AND D. FRANÇOIS	114
Nondestructive Crack Size and Interfacial Degradation Evaluation in Metal Matrix Composites Using Ultrasonic Microscopy—P. KARPUR, T. E. MATIKAS, M. P. BLODGETT, J. R. JIRA, AND D. BLATT	130
Characterization of a Crack in an Aluminum Bar Using an AC Magnetic Bridge—W. F. SCHMIDT, O. H. ZINKE, AND S. NASRAZADANI	147

I2BN 0-9037-5003-P