



Fatigue & Fracture Mechanics:

33rd Volume

EDITORS:

Robert S. Piascik
and Walter G. Reuter



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Fatigue and Fracture Mechanics: 33rd Volume

Walter G. Reuter and Robert S. Piascik, Editors

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To make technical information available as quickly as possible, the peer-reviewed papers in this publication were prepared "camera-ready" as submitted by the authors.

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 the peer reviewers. In keeping with long-standing publication practices, ASTM International maintains the anonymity of the peer reviewers. The ASTM International Committee on Publications acknowledges with appreciation their dedication and contribution of time and effort on behalf of ASTM International.

Foreword

The Thirty-Third National Symposium on Fatigue and Fracture Mechanics was held June 25–29, 2001, at Jackson Lake Lodge in Moran, Wyoming. ASTM Committee E08 on Fatigue and Fracture was the sponsor. The symposium co-chairman and co-editors of this publication are W. G. Reuter, Idaho National Engineering and Environmental Laboratory and R. S. Piascik, NASA Langley Research Center.

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Overview



The ASTM National Symposium on Fatigue and Fracture Mechanics is sponsored by ASTM Committee E08 on Fatigue and Fracture Testing. The objective of the symposium is to promote a technical forum where researchers from the United States and worldwide can discuss recent research findings related to the fields of fatigue and fracture. The photograph above documents a portion of those who attended the symposium.

The volume opens with the paper authored by Massachusetts Institute of Technology Professor Emeritus Frank McClintock who delivered the Twelfth Annual Jerry L. Swedlow Memorial Lecture. Professor McClintock's presentation provided a description of slip-line fracture mechanics (SLFM) and its application to fracture problems. SLFM is expected to fill some of the gap for materials/conditions where J-integral no longer applies (too much ductility and/or too much crack growth) and plastic collapse.

The thirty-seven papers that follow Professor McClintock's paper are broadly grouped into four categories. These categories include Practical Applications, Constraint and/or Welds, Fatigue, and Assorted Topics.

Practical Applications

The section contains ten papers and starts with a description and discussion of the damage that occurred during the Northridge earthquake. The section includes papers that describe the use of fracture mechanics based techniques developed in Europe to predict structural integrity and papers describing the effects of hydrogen or fatigue on sub-critical crack growth. Three papers provide specific examples of structural problems and the final paper provides a discussion for selecting materials based on structural performance.

Constraint and/or Welds

The section contains nine papers and starts with four papers discussing the effects of constraint. Two papers are concerned with crack-front stress fields. The third paper provides a basis for using plane-

X OVERVIEW

strain fracture toughness/constraint to predict the applied stress-intensity factor/constraint and the location around the perimeter where crack growth initiation will occur within a surface crack. The fourth paper uses the T-stress in analyses of fracture toughness data. The following five papers are based on welds. The first paper examines the role of localized plasticity and crack-tip constraint in under matched welds. The second paper examines cleavage fracture in welds, while the third discusses the importance of fabrication history relative to weld fracture and durability. The final papers describe studies of creep-crack growth and the effects of a compressive load when applied to homogenize the residual stresses through the specimen thickness.

Fatigue

The section contains nine papers and starts with the uncertainty of fatigue crack growth rates and the applied stress-intensity factor ranges. The second paper looks at load interactions on the growth of small cracks. The following papers are concerned with mean stress effects on fatigue crack growth rates, the fatigue crack growth mechanisms in alumina at high temperatures, frequency effects, non-planar crack growth, and corrosion fatigue.

Assorted Topics

The section contains nine papers with the first two discussing aspects of crack closure. The next three papers discuss problems related to the ductile-brittle transition zone. The following papers discuss decohesion and crack initiation, crack arrest toughness in ferritic steels, cracks with multiple kinks and an innovative method for measuring fracture toughness.

The technical quality of the papers contained in this STP is due to the authors and to the excellent work provided by the peer reviews. The Symposium organizers would like to express our appreciation to all reviewers for a job well done. Because of the large number of papers, camera-ready manuscripts were used to develop the STP. The organizers of the symposium hope that it meets with your approval.

The National Symposium on Fracture Mechanics is often used to present ASTM awards to recognize the achievement of current researchers. At the Thirty-Third Symposium, the award for the Jerry L. Swedlow Memorial Lecture was presented to Professor Emeritus Frank A. McClintock, Massachusetts Institute of Technology, and the award of Merit was presented to Professor Robert Dodds, University of Illinois, Urbana. The organizing committee would like to congratulate the above award winners as considerable time, effort and hard work were put forth to win these awards.

We would like to end this overview by highlighting the fact that the symposium venue (The Teton National Park) is a special place for Prof. McClintock. Not only has Prof. McClintock climbed these mountains, but also, a mountain peak within the Teton mountain range is named after his father.

Dr. Walter G. Reuter
INEEL
Idaho Falls, Idaho

Dr. Robert S. Piascik
NASA Langley Research Center
Hampton, Virginia

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