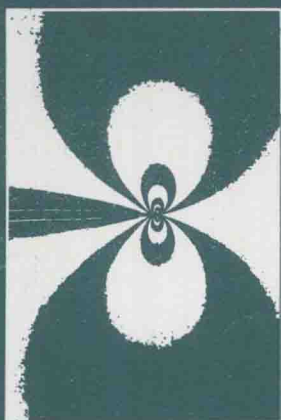


FRACTURE MECHANICS

Seventeenth Volume



Underwood/Chait/Smith/
Wilhem/Andrews/ Newman
editors

ASTM STP 905

FRACTURE MECHANICS: SEVENTEENTH VOLUME

Seventeenth National Symposium
on Fracture Mechanics
sponsored by
ASTM Committee E-24
on Fracture Testing
Albany, New York, 7-9 August 1984

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NOTE

The Society is not responsible, as a body,
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advanced in this publication.

Dedication

This publication is dedicated to the following group of individuals and their pioneering work in fracture testing:

William F. Brown, Jr.
James E. Campbell
Roy H. Chirstensen
John Hodge
George R. Irwin
Joseph M. Krafft
William T. Lankford
John R. Low, Jr.
Richard A. Rawe
John E. Srawley
Henry J. Stremba
Charles F. Tiffany

Their important contributions were central to the ASTM Special Committee on Fracture Testing of High Strength Sheet Materials, forerunner of Committee E-24 on Fracture Testing.

As a tribute to the founders of ASTM Committee E-24 and to the series of symposia which they helped to establish, the poem on the following page was offered as a special presentation at the Albany meeting.

The 17th Symposium on Fracture

At first a Committee, called E-24,
Studied aspects of fracture not known before;
And Irwin suggested the very best way
Was to write all the terms as functions of K .

This worked for bodies whilst still elastic,
But needed correction as the stresses turned plastic;
Till Rice and some others showed us the way
To express all the terms by the integral J .

And presently users were nothing loath
To use dJ for stable crack growth;
So fracture was thought to be well understood
At the Albany meeting of John Underwood.

But then the Symposium, in second day session,
Was taught a quite salutary lesson;
As the crucial question was faced by John Srawley
That sometimes J would serve us but poorly.

But if these complexities seem to confuse us,
Just follow the founders' advice on consensus
And study the problem until a year older,
Then tell us next time in the Conference at Boulder.

*Dedicated to those founding members
of the original Committee, whom
it was my good fortune to know.*

*Cerdic Renrut
9 August 1984*

Foreword

The Seventeenth National Symposium on Fracture Mechanics was held on 7-9 August 1984 in Albany, New York. ASTM Committee E-24 on Fracture Testing was the sponsor. J. H. Underwood, U.S. Army Armament Research & Development Center, served as symposium chairman and co-editor of this publication. R. Chait, U.S. Army Materials & Mechanics Research Center, C. W. Smith, Virginia Polytechnic Institute & State University, D. P. Wilhem, Northrop Aircraft, W. A. Andrews, General Electric Company, and J. C. Newman, NASA Langley Research Center, served as symposium co-chairmen and co-editors of this publication.

Related ASTM Publications

Fracture Mechanics: Sixteenth Symposium, STP 868 (1985),
04-868000-30

Fracture Mechanics: Fifteenth Symposium, STP 833 (1984),
04-833000-30

Fracture Mechanics: Fourteenth Symposium—Volume I: Theory and
Analysis, STP 791 (1983), 04-791001-30

Fracture Mechanics: Fourteenth Symposium—Volume II: Testing and
Applications, STP 791 (1983), 04-791002-30

Fracture Mechanics (Thirteenth Conference), STP 743 (1981),
04-743000-30

Fracture Mechanics (Twelfth Conference), STP 700 (1980),
04-700000-30

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

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Allan S. Kleinberg
Janet R. Schroeder
Kathleen A. Greene
Bill Benzing

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Introduction

This volume and the Seventeenth National ASTM Symposium on Fracture Mechanics on which it is based are part of a continuing series. These symposia have become clearly the most prestigious in the field of fracture. As such, they are the focus and forum for quality work in all areas of the field, and this is the important purpose of the symposium and volume.

If the field can be divided into testing and analysis, the former has been and continues to be the more emphasized in this symposium series. This is appropriate, considering the sponsor, ASTM Committee E-24 on Fracture Testing. Nevertheless, analysis is a required part of any test, and much of the work reported here is primarily analysis.

At least four general topics or categories of work frequently occur in the papers: ductile fracture, test method development, surface cracks and crack shape effects, and high temperature and loading rate effects. The prevalence of these four categories attests to the basic practical nature of the field of fracture and of those who work in it. Each of these categories defines an area of important current concern in the design and use of load-carrying components and structures. It is the hope and belief of all those involved that this symposium and volume have contributed to these and other important areas in the field of fracture.

The National Symposium on Fracture Mechanics is often the occasion at which ASTM awards are presented to recognize the achievements of current investigators. At the Seventeenth Symposium two awards were presented. The ASTM Committee E-24 Irwin Medal was presented by Dr. Irwin to Mr. John G. Merkle, Martin Marietta Energy Systems, for his outstanding work in the field of fracture mechanics. The ASTM Award of Merit and honorary title of Fellow were given to Mr. David P. Wilhem, Northrup Corporation, for his distinguished service and leadership in Committee E-24. Dr. J. Gilbert Kaufman, Arco Metals, past chairman of E-24, made the presentation to Mr. Wilhem.

We take this opportunity to thank two groups who deserve a significant share of credit for this symposium. The first is the combined support staff of all of us listed below. The administrative and clerical work of this whole group was essential to the task and is greatly appreciated. The second group is made up of those behind-the-scenes people whose work is nonetheless critical.

In particular, we thank Professor Ray Eisenstadt of Union College for his help in administering the symposium, Mr. Jim Gallivan of the Army Materials and Mechanics Research Center for financial support, the late Dr. Fred

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Schmeideshoff of the Army Research Office for his help in organizing the symposium, and Professor Jerry Swedlow for his continuing support and sound advice during the entire process.

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Applications

