17th International ASTM/ESIS Symposium on Fatigue and Fracture Mechanics
(41st National Symposium on Fatigue and Fracture Mechanics)

Sponsored by ASTM Committee E08 on Fatigue and Fracture

May 10-12, 2017
Sheraton Centre Toronto
Toronto, ON Canada

Symposium Chairs:  Dr. Min Liao
National Research Council of Canada
Ottawa, Canada

Mr. Douglas N. Wells
NASA Marshall Space Flight Center
Alabama, USA

ABOUT THE SYMPOSIUM

Fatigue and fracture behaviors of materials and components are of interest today across an increasingly broad spectrum ranging from the aerospace, surface transportation, power generation, and petroleum communities to the semiconductor, biomedical, and micro-electro-mechanical systems (MEMS) worlds. Each of these areas presents its own particular challenges to development and application of engineering approaches to predict, optimize and manage the structural integrity and remaining life of critical systems. The required fatigue and fracture methodologies depend upon robust and accurate models of the damage formation, damage accumulation and failure mechanisms that operate within each of these domains, as well as an accurate characterization of the material response to the combined effects of loading, loading rate, environmental conditions, and engineered or naturally-occurring material heterogeneity. These challenges are further complicated by the increasing use of new materials and manufacturing technologies.

This symposium is intended to provide a forum to promote discourse and disseminate state-of-the-art advances in analysis methodologies and testing techniques in the areas of fatigue and fracture mechanics related to engineered structures, components and devices. Submittals considering either or both experimental research efforts and modeling based efforts are encouraged. Of particular interest are applications of emerging analytical tools and novel experimental techniques to assess and improve durability and damage tolerance using multi-scale or multi-physics based approaches; studies on the effects of additive manufacturing processes on fatigue and fracture properties; and implications of improved modeling and experimental capabilities on fatigue life forecasting and structural health monitoring strategies.

The language of the symposium will be English.
WEDNESDAY MAY 10, 2017

8:45 AM
**Opening Remarks**
Min Liao, Douglas N. Wells, Symposium Co-Chairs

**SESSION 1: Swedlow Memorial Lecture**

9:00 AM
**Statistical Analysis of Interface Fracture and Delamination Failure of Composites**
Leslie Banks-Sills, School of Mechanical Engineering, Tel Aviv University, Ramat Aviv, Israel

10:00 AM BREAK

**SESSION 2: Fatigue**

10:30 AM
**A New Methodology to Partition Plasticity from Roughness/Oxide Induced Crack Closure in Fatigue Crack Growth**
R. Pettit, FractureLab LLC, Fruit Heights, UT, USA; and K. Donald, Fracture Technology Associates, Bethlehem, PA, USA

11:00 AM
**Crack Size and Shape Considerations Related to Near-Threshold Fatigue Crack Rate Behavior**
K. Donald, Fracture Technology Associates, Bethlehem, PA, USA; M. James, Arconic Technology Center, New Kensington, PA, USA; and R. Pettit, FractureLab LLC, Fruit Heights, UT, USA

11:30 AM
**Bias in Linear Regression Analysis of Compliance Measurements in Fatigue Crack Growth and Fracture Toughness Test**
R. Brazill, Arconic Technology Center, New Kensington, PA, USA; and K. Donald, Fracture Technology Associates, Bethlehem, PA, USA

12:00 AM LUNCH (On Your Own)

**SESSION 3: Fatigue**

1:30 PM
**X-Ray Computed Tomography Study on the Role of Casting Defects and Surface Finish on Fatigue in Die-cast AM60B Magnesium Alloy**
H. M. Rao, J. Kang, CanmetMATERIALS, Hamilton, Canada; and D. S. Wilkinson, McMaster University, Hamilton, Canada
2:00 PM
**A Preliminary Experimental Study of Cyclic Bending of UHMWPE Fiber Composites**
Y. Zhang, R. Desnoyers, A. Johnston and Q. Yang, National Research Council Canada, Ottawa, ON, Canada

2:30 PM
**Fatigue Testing of Negative Poisson Ratio Structures for Aerospace Applications**
D. Backman, S. Yandt, T. Musclow, National Research Council, Ottawa, Ontario, Canada; M. Q. Pham, and A. Shanian, Siemens Montreal, Quebec, Canada; and K. Bertoldi, Harvard University, Boston, USA

3:00 PM       BREAK

**SESSION 4: Fracture**

3:30 PM
**ASTM E08.07.09 Analytical Round-Robin on the Use of DC Electrical Potential Difference for the Measurement of Crack Size in Ductile Fracture Testing**
E. Lucon, Applied Chemicals and Materials Division, National Institute of Standards and Technology, Boulder, CO, USA

4:00 PM
**Application of a Novel DCPD Adjustment Method for the J-R Curve Characterization: A Study Based on Interlaboratory Results**
X. Chen, M. A. Sokolov, R. K. Nanstad, Oak Ridge National Laboratory, Oak Ridge, TN, USA; and E. Lucon, National Institute of Standards and Technology, Boulder, CO, USA

4:30 PM
**J and CTOD Estimation Equations for Non-Standard Bend Specimens and Applications in Cleavage Fracture Toughness Testing of a Low Alloy Structural Steel**
C. Ruggieri and V. S. Barbosa, Polytechnic School of Engineering, University of Sao Paulo, Sao Paulo, Brazil

5:00 PM
**A Review of the Proposed KIi Offset-Secant Method for Size-Insensitive Linear-Elastic Fracture Toughness Evaluation**
D. Wells and P. Allen, Marshall Space Flight Center, Huntsville, AL, USA; M. James, Arconic Technology Center, New Kensington, PA, USA; and K. Wallin, VTT Nuclear Safety, VTT, Finland

5:30 PM       SYMPOSIUM ADJOURNS FOR THE DAY

6:00 PM       Reception
THURSDAY, MAY 11, 2017

SESSION 5: Analysis of Experiments

8:30 AM
Improved Two-Parameter Fracture Criterion for Various Crack Configurations under Tension and Bending Loads
J. C. Newman, Jr. and M. J. Mahtabi, Mississippi State University, Mississippi State, MS, USA

9:00 AM
Three-Dimensional Elastic-Plastic Fracture Simulations using the Critical CTOA Fracture Criterion on Three Crack Configurations
H. Bowering, T. Lacy and J. C. Newman, Jr., Department of Aerospace Engineering, Mississippi State University, Mississippi State, MS, USA

9:30 AM
Analytical Round Robin for Elastic-Plastic Analysis of Surface Cracked Plates: Phase II Results
P. A. Allen and D. N. Wells, NASA Marshall Space Flight Center, Huntsville, AL, USA

10:00 AM  BREAK

SESSION 6: Analysis of Experiments

10:30 AM
Modeling the Effect of Hydrogen on Ductile Fracture
C. Huang, T. Luo, and X. Gao, The University of Akron, Akron, OH, USA; and S. M. Graham, United States Naval Academy, Annapolis, MD, USA

11:00 AM
Thermal-Mechanical Modeling of Welding and Galvanizing of a Steel Beam Connection Detail to Examine Susceptibility to Cracking
K. Nguyen, C. Bennett, and J. L, University of Kansas, Lawrence, Kansas, USA; and R. Nasouri, A. Matamoros and A. Montoya, University of Texas at San Antonio, San Antonio, Texas, USA

11:30 AM
Effect of Microporosity and Surface Condition on Fatigue Strength of Casted Aluminum Components
M. Leitner, and C. Garb, M. Aigner, and M. Stoschka, Christian Doppler Laboratory for Manufacturing Process based Component Design, Chair of Mechanical Engineering, Austria Montanuniversität Leoben, Austria

12:00 PM  LUNCH (On Your Own)
SESSION 7: Environmental Effects

1:30 PM
Characterization of the Effects of High Altitude Environments on Dislocation Structure Evolution during Fatigue Loading of 7075-T651
A. Thompson, and J. Burns, University of Virginia, Charlottesville, VA, USA

2:00 PM
Study of the Influence of the Friction Force in Pressurized Fatigue Testing Using Vessels with A Conventional Sealing System with Reduced Stick-Slip

2:30 PM
Effect of Pitting Corrosion on Fatigue Life of Aluminum Alloy
S. Lv, Y. Liu, W. Zhang, L. Yao, Northwestern Polytechnical University Xi’an, Shaanix, Sheng, China

3:00 PM     BREAK

SESSION 8: Fatigue

3:30 PM
Development of an Optimization Tool for Calibrating Crack Growth Material Models
Y. Bombardier, National Research Council Canada, Ottawa, ON Canada

4:00 PM
Some Recent Progress in Predicting Propagation Lives of Part-through Cracks at Cold Worked Holes
S. A. Prost-Domasky, C. L. Brooks, and T. B. Mills, APES, Inc., St. Louis, Missouri, USA

4:30 PM
Strength Based Fatigue Models: Advantages, Pitfalls and Implementation
W. Falk, Medtronic CVG, Minneapolis, MN, USA

5:00 PM
Implementation of the Fatigue-to-Fracture Methodology for Cardiovascular Medical Devices
W. Falk, Medtronic CVG, Minneapolis, MN, USA, B. Berg, Boston Scientific, Maple Grove MN, USA

5:30 PM     SYMPOSIUM ADJOURNS FOR THE DAY
FRIDAY, MAY 12, 2017

SESSION 9: Fatigue and Fracture of Additive Manufacturing

8:30 AM
**Keynote Speech: Laser Consolidation - A Novel Additive Manufacturing Process for Making Net-Shape Functional Metallic Components for Various Applications**
L. Xue, National Research Council Canada, London, Ontario, Canada

9:00 AM
**Fatigue Performance of Additive Manufactured 300M Steel**
A. Nolting, S. Farrell, Department of National Defence, Halifax, NS, Canada; L. Xue, J. Chen, S. Wang, National Research Council Canada, London, ON, Canada; M. Genest, National Research Council Canada, Ottawa, ON, Canada; C. Bescond, National Research Council Canada, Boucherville, QC, Canada

9:30 AM
**Multiaxial Fatigue Behavior of Selective Laser Melted Ti-6Al-4V**
A. Fatemi, R. Molaei, University of Toledo, Toledo, OH, USA; and N. Phan, US Naval Air Systems Command, Patuxent River, Maryland, USA

10:00 AM  BREAK

SESSION 10: Panel Discussion on Fatigue and Fracture Properties of Additive Manufactured Part/Component

10:30 AM
**Fatigue and Fracture Properties of Additive Manufactured Part/Component**
Invited Panelists

11:00 AM
**Panel discussion: Q&A**
Invited Panelists and all audience

12:00 PM
**Closing Remarks**
Douglas N. Wells, Min Liao, Symposium Co-Chairs

12:15 PM  SYMPOSIUM ADJOURNS