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Sixth International Workshop on  
Environmentally-Assisted Cracking

Proceedings

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7-16-2023

## **Conference Program - SIXTH INTERNATIONAL WORKSHOP ON ENVIRONMENTALLY-ASSISTED CRACKING**

A.K. Vasudevan

Ron Latanision

Henry Holroyd

Fritz Friedersdorf

Mehdi Amiri

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## *Program*

# SIXTH INTERNATIONAL WORKSHOP ON ENVIRONMENTALLY-ASSISTED CRACKING

July 16 - 21, 2023

Sheraton Reston Hotel  
Reston, Virginia, USA

### Conference Chairs

**A.K. Vasudevan**  
Office of Naval Research (retired)

**Ron Latanision**  
Exponent, Inc

**Henry Holroyd**  
Luxfer (retired)

**Fritz Friedersdorf**  
Luna Labs USA, LLC

**Mehdi Amiri**  
George Mason University



**Engineering Conferences International**  
369 Lexington Avenue, 3<sup>rd</sup> Floor #389 - New York, NY 10017, USA  
[www.engconfintl.org](http://www.engconfintl.org) – [info@engconfintl.org](mailto:info@engconfintl.org)

**Sheraton Reston Hotel**

**11810 Sunrise Valley Drive  
Reston, Virginia 20191  
USA**

**Tel: +1 703-620-9000**

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**Previous conferences in this series:**

***Stress Corrosion Cracking in Structural Materials at Ambient Temperatures  
August 30 – September 4, 2009***

**Padova, Italy**

*Conference Chairs:*

A.K. Vasudevan, ONR, USA

Henry Holroyd, Luxfer, Inc., UK

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Neville Moody, Sandia National Laboratories, USA

***Environmental Damage in Structural Materials Under Static Cyclic Loads  
at Ambient Temperatures II***

**August 14-19, 2011**

**Krakow, Poland**

*Conference Chairs:*

A.K. Vasudevan, ONR, USA

Henry Holroyd, Luxfer, Inc., USA

Richard Ricker, NIST, USA

Neville Moody, Sandia National Laboratories, USA

***Environmental Damage in Structural Materials Under Static/Cyclic Loads  
at Ambient Temperatures III***

**June 15-20, 2014**

**Bergamo, Italy**

*Conference Chairs:*

A.K. Vasudevan, ONR, USA

Henry Holroyd, Luxfer, Inc., USA

Richard Ricker, NIST, USA

Neville Moody, Sandia National Laboratories, USA

***Environmental Damage in Structural Materials Under Static Load/Cyclic Loads  
at Ambient Temperatures IV***

**May 29-June 3, 2016**

**Cork, Ireland**

*Conference Chairs:*

A.K. Vasudevan, ONR, USA

Ronald Latanision, Exponent, Inc., USA

Henry Holroyd, Luxfer, Inc., USA

Neville Moody, Sandia National Laboratories, USA

***Environmental Damage in Structural Materials Under Static Load/Cyclic Loads  
at Ambient Temperatures V***

**July 15-20, 2018**

**Hernstein, Austria**

*Conference Chairs:*

A.K. Vasudevan, ONR, USA

Ronald Latanision, Exponent, Inc., USA

Henry Holroyd, Luxfer, Inc., USA

The conference organizers gratefully acknowledge support from the U.S. Office of Naval Research.



**Sunday, July 16, 2023**

17:30 – 18:00	Conference check-in (Magnolia Foyer)
18:00 – 18:30	Opening Reception (Magnolia Room)
18:30 – 20:00	Dinner

**NOTES**

- *Technical Sessions will be held in the Oak and Spruce Rooms.*
- *Meals will be in the Magnolia Room.*
- *Speakers – Please have your presentation loaded onto the conference computer prior to the session start (preferably the day before).*
- *Speakers – Please leave at least 3-5 minutes for questions and discussion.*
- *Please do not smoke at any conference functions.*
- *Turn your mobile telephones to vibrate or off during technical sessions.*
- *After the conference, ECI will send an updated participant list to all participants. Please check your listing now and if it needs updating, you may correct it at any time by logging into your ECI account.*
- *Audiotaping, videotaping and photography of presentations are prohibited*

## **Monday, July 17, 2023**

08:00 – 09:00 Breakfast

09:00 – 09:10 **Opening Remarks**  
Fritz Friedersdorf, Conference Co-Chair  
Ron Latanision, ECI Technical Liaison

### **Session 1**

Chair: Dave Rusk, Naval Air Warfare Center Aircraft Division, USA

09:10 – 10:00 **Keynote**  
**Environment-induced crack initiation in metals - experimental studies**  
Henry Holroyd, Consultant, USA

10:00 – 10:30 **Characterizing environmentally assisted crack initiation and short crack growth**  
Tim L. Burnett, The University of Manchester, United Kingdom

10:30 – 11:00 Coffee Break

11:00 – 11:30 **Effect of laser surface treatment on the corrosion and fatigue performance of aa5456-h116 alloys**  
Rajaguru Jeyamohan, University of Virginia, USA

11:30 – 12:00 **Evaluation of chloride stress corrosion susceptibility of stainless steels**  
Earl Johns, Naval Nuclear Laboratory; Fluor Marine Propulsion, USA

12:00 – 13:30 Lunch

### **Session 2**

Chair: Siddiq Qidwai, National Science Foundation, USA

13:30 – 14:20 **Keynote**  
**Modeling electrochemically assisted hydrogen adsorption on alloy surfaces**  
Chris Taylor, DNV GL and Ohio State University, USA

14:20 – 14:50 **Advances in peridynamic modeling of environmentally- assisted cracking**  
Florin Bobaru, University of Nebraska-Lincoln, USA

14:50 – 15:30 Coffee Break

15:30 – 16:00 **Combined damage-fracture model for corrosion fatigue crack growth in 3D parts**  
Alexander Staroselsky, Raytheon Technologies Research Center, USA

16:00 – 16:30 **Electrochemical-mechanical phase field model for electroplating process**  
Jung Ho Yang, Technical Data Analysis, Inc., USA

*Dinner on your own*



**Tuesday, July 18, 2023**

08:00 – 09:00 Breakfast

**Session 3**

Chair: Rick Ricker, University of Maryland, USA

09:00 – 09:30 **A computational framework for prediction of atmospheric**  
Mehdi Amiri, George Mason University, USA

09:30 – 10:00 **Correlating nature of precipitates with environmental degradation in**  
**aluminum alloys**  
Ramasis Goswami, US Naval Research Laboratory, USA

10:00 – 10:30 Coffee Break

10:30 – 11:00 **Unusual behavior of long cracks at low dk: Marci effect**  
Daniel Kujawski, Western Michigan University, USA

11:00 – 11:30 **New aluminum alloy design**  
Asuri Vasudevan, Office of Naval Research (Retired), USA

11:30 – 13:00 Lunch

13:15 Board bus for excursion

13:30 – 16:30 Excursion - National Air and Space Museum - The Steven F. Udvar-Hazy  
Center VA  
**Note: The bus will depart from the hotel promptly at 13:30**

**Wednesday, July 19, 2023**

08:00 – 09:00

Breakfast

**Session 4**

Chairs: Victor Rodriguez-Santiago, NAWCAD, USA

09:00 – 09:50

**Keynote**

**Quantification of environmentally-assisted cracking mechanisms with high-resolution characterisation**

Sergio Lozano-Perez, University of Oxford, United Kingdom

09:50 – 10:20

**Preferred EAC initiation sites in 7xxx aluminum**

Matthew Curd, University of Manchester, UK

10:20 – 11:00

Coffee Break

11:00 – 11:30

**Atomic mechanism of near threshold fatigue crack growth in vacuum as a basis for understanding environmental effects**

Mingjie Zhao, Exponent, Inc., USA

11:30 – 12:00

**Microstructural crack path prediction using graph theory**

Veera Sundararaghavan, University of Michigan, USA

12:00 – 13:30

Lunch

**Session 5**

Chairs: Nagaraja Iyyer, Technical Data Analysis, Inc., USA

13:30 – 14:20

**Keynote**

**Dynamic fracture in dealloying induced stress-corrosion cracking**

Karl Sieradzki, Arizona State University, USA

14:20 – 14:50

**Surface stress in metals induced by organic monolayer films**

Srinivasan Chandrasekar, Purdue University, USA

14:50 – 15:20

**Modeling hydrogen diffusion in precipitation hardened nickel alloy**

Attilio Arcari, Naval Research Laboratory, USA

15:20 – 15:50

Coffee Break

15:50 – 16:20

**Development of a lifetime prediction model for evaluating the sensitivities of aisc susceptibility in stainless-steel nuclear waste storage canisters**

Sarah Blust, University of Virginia, USA

16:20 – 17:00

**Use of an inverse life plot for fatigue endurance/limit estimation**

Daniel Kujawski, Western Michigan University, USA

17:00 – 18:00

Reception

*Dinner on your own*

**Thursday, July 20, 2023**

- 08:00 – 09:00 Breakfast
- Session 6**  
Chairs: Earl Johns, Naval Nuclear Laboratory, USA
- 09:00 – 09:50 **Keynote**  
**Is laboratory testing of SCC susceptibility fit for purpose?**  
Alan Turnbull, NPL, United Kingdom
- 09:50 – 10:20 **Assessing the loading rate dependence of hydrogen environment-assisted cracking behavior in a wide-range of engineering alloys**  
James Burns, University of Virginia, USA
- 10:20 – 10:50 **Environment-assisted fracture, my friend: The cutting of gummy metals**  
Ronald M. Latanision, Exponent Inc.; Massachusetts Institute of Technology, USA
- 10:50 – 11:30 Coffee Break
- 11:30 – 12:00 **The influence of additive manufacturing (3D printing) on susceptibility to environmentally induced fracture**  
Rick Ricker, University of Maryland, USA
- 12:00 – 12:30 **Electrochemical activities at the crack tip: A localized approach**  
Leila Saberi, George Mason University, USA
- 12:30 – 14:00 Lunch
- Session 7**  
Chairs: Alexander Staroselsky, Raytheon Technologies Research Center, USA
- 14:00 – 14:30 **Environmentally-assisted degradation and erosion of polymers for attritable metamaterials**  
Nicole Apetre, U.S. Naval Research Laboratory, USA
- 14:30 – 15:00 **Fracture toughness  $K_{1c}$  affecting static threshold  $K_{1scc}$**   
Asuri Vasudevan, TDA, Inc., USA
- 15:00 – 15:30 **Fatigue threshold  $K_{max,th}$  affected by static threshold  $K_{1scc}$**   
Asuri Vasudevan, TDA, Inc, USA
- 15:30 – 16:00 **Atmospheric laboratory and outdoor testing of aluminum alloy environment assisted cracking**  
Fritz Friedersdorf, Luna Labs USA, LLC, USA
- 16:00 – 16:30 Coffee Break
- 19:00 – 21:00 Conference Banquet

## **Friday, July 21, 2023**

- 07:30 – 08:30 Breakfast
- 08:30 – 09:00 **Needs and path forward for EAC**  
William Nickerson, Office of Naval Research, USA
- 09:00 – 09:20 **Needs and path forward for EAC**  
Dave Rusk, Siddiq Qidwai, Earl Johns
- 09:20 – 09:35 Coffee Break
- 09:35 – 12:00 **Panel Discussion: The path forward: The convergence of modeling and experiment in EAC**  
Moderator: Ron Latanision, Exponent Inc, USA.
- Panelists: Alan Turnbull, Chris Taylor, Henry Holroyd, Karl Sieradzki, Sergio Lozano-Perez
- 12:00 – 12:10 **Workshop Closing**
- 12:10 – 13:30 Lunch

### **Panel Discussion: The path forward: The convergence of modeling and experiment in EAC**

Engineering systems of all kinds are constructed from materials that meet design specifications. Those engineering systems are assembled and then operated, inspected and maintained during performance in service environments. The environmental degradation of materials is well known phenomenologically. Mechanistic understanding is often the subject of intense research and concurrent debate. This is true of Environmentally Assisted Cracking, EAC. Debate is in part a reflection of the complexity of EAC. In order to develop an understanding of any EAC phenomenon researchers must take into account the microstructural characteristics of the materials, chemical interactions with the service environment and mechanical forces that are imposed as the system performs. This ongoing series of conferences has assembled researchers who have experience in all of these areas. Our goal is to develop a core of understanding in which appreciation of materials, chemistry and mechanics essentials are common to all EAC researchers. Looking to the future, the convergence of experimental tools which allow atom scale observations and simulation and modeling tools for characterizing materials as well as chemical and mechanical interactions provides room for optimism that mechanistic fundamentals will become elucidated and with such advances EAC will become better understood and better managed.