

***Program***  
***International Workshop***  
***on***  
***Environmental Damage***  
***under Static and Cyclic Loads in***  
***Structural Metallic Materials***  
***at Ambient Temperatures III***

**June 15 – 20, 2014**  
**Bergamo, Italy**

**Conference Chairs**

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

**Richard Ricker**  
NIST

**Henry Holroyd**  
Luxfer, Inc. (retired)

**Neville Moody**  
Sandia National Laboratories



**Engineering Conferences International**  
32 Broadway, Suite 314 - New York, NY 10004, USA  
Phone: 1 - 212 - 514 - 6760, Fax: 1 - 212 - 514 - 6030  
[www.engconfintl.org](http://www.engconfintl.org) – [info@engconfintl.org](mailto:info@engconfintl.org)

**University of Bergamo  
Via Salvecchio, 19  
24129 Bergamo, Italy  
Phone: +39 035 205 2111**

Engineering Conferences International (ECI) is a not-for-profit global engineering conferences program, originally established in 1962, that provides opportunities for the exploration of problems and issues of concern to engineers and scientists from many disciplines.

#### ECI BOARD MEMBERS

Barry C. Buckland, President  
Mike Betenbaugh  
Peter Gray  
Michael King  
Raymond McCabe  
David Robinson  
William Sachs  
Eugene Schaefer  
P. Somasundaran

Chair of ECI Conferences Committee: William Sachs

ECI Technical Liaison for this conference: Dean Miller

ECI Executive Director: Barbara K. Hickernell

ECI Associate Director: Kevin M. Korpics

## **Advisory Committee**

S. Baragetti, University of Bergamo, Italy  
J. T. Castro, Pontifical Catholic University, Brazil  
N. Chawla, Arizona State University, USA  
E. Glickman, Telaviv University, Israel  
G. Glinka, University of Waterloo, Canada  
R. Goswami, U.S. Naval Research Laboratory  
M. Hall, Westinghouse (retired), USA  
K. V. Jata, Wright-Patterson Air Force Base, USA  
R. L. Kolar, US Office of Naval Research Global, Singapore  
R. Latanision, Massachusetts Institute of Technology (retired), USA  
Stan Lynch, Monash University, Australia  
W. Nickerson, US Office of Naval Research  
Peter Pao, U.S. Naval Research Laboratory  
S. Wiederhorn, NIST (retired), USA

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



## **Sunday, June 15, 2014**

18:30 – 20:00      Conference Check-in and Reception  
(Il Gourmet Restaurant, via S. Vigilio 1)

Welcome address:

**Prof. Stefano Paleari**, Provost, University of Bergamo

### **Notes**

- Technical sessions will be held at the University of Bergamo in Room 3 (First Floor).
- All oral presentations are for 40 minutes, including 25 minutes for a talk and 15 minutes for discussions. We suggest the authors prepare their number of slides to fit within 25 minutes & not go over their time limit.
- Lunches will take place at Mimmo's Restaurant and Franco's Restaurant. Refer to the program for details. The conference banquet will be held at Mimmo's Restaurant.
- Audiotaping, videotaping and photography of presentations are prohibited.
- Please do not smoke at any conference functions.
- Turn your cellular telephones to vibrate or off during technical sessions.
- Be sure to check your contact information on the Participant List in this program and make any corrections to your name/contact information online. A corrected copy will be sent to all participants after the conference.

**Monday, June 16, 2014**

- 09:00 – 09:15      **Welcome and Announcements**  
A.K. Vasudevan, Conference Chair  
R. Latanision, Exponent/MIT
- Session I: Special Topics**  
Session Chair: S. Baragetti, University of Bergamo, Italy
- 09:15 – 09:55      **Sea-based Aviation Experience with Combined Mechanical and Environmental Loading**  
William Nickerson, Office of Naval Research, USA
- 09:55 – 10:35      **Multi-Scale Investigation of Sub-Critical Crack Propagation Mechanisms in Oxide Glasses**  
Matteo Ciccotti, ESPCI Paristech, France
- 10:35 – 11:15      Coffee break
- 11:15 – 11:55      **Water Penetration at Crack Tips of Silica Glass Its Effect on Sub Critical Crack Growth**  
Sheldon Wiederhorn, NIST, USA
- 11:55 – 13:30      Lunch (Mimmo's Restaurant)
- Session I: Special Topics (continued)**  
Session Chair: Bill Mullins, ONR, Arlington, VA
- 13:30 – 14:10      **Role of excessive vacancies in TGSCC of pure copper**  
Hannu Hänninen, Helsinki University of Technology, Finland
- 14:10 – 14:50      **Experimental Techniques for Characterising and Understanding Environmentally Assisted Cracking**  
Stan P. Lynch, DSTO, Australia
- 14:50 – 15:30      Coffee break
- 15:30 – 16:10      **3D Visualization of Stress Corrosion Cracks in 7000 series Aluminium using X-ray Tomography data Spatially Correlated with Electron Microscopy Images of the Fracture Surface**  
Tim L. Burnett, University of Manchester, UK  
N. J. Henry Holroyd, Consultant, USA
- 16:10 – 16:50      **Stress Corrosion Cracking of Aluminum-Lithium Based Alloys**  
N. J. Henry Holroyd, Consultant, USA
- Evening on your own

**Tuesday, June 17, 2014**

**Session II: Models & Experiments**

Session Chair: Monica Trueba, Università Degli Studi di Milano, Italy

- 09:00 – 09:40      **An atomistically-informed energy based theory of environmentally assisted failure**  
V. Sundararaghavan, University of Michigan, USA
- 09:40 – 10:20      **Multiscale Analysis of Hydrogen-Induced Intergranular Cracking in Medium Strength Alloys Steel with Segregated Solute**  
M. Yamaguchi, Japan Atomic Energy Agency, Japan
- 10:20 – 11:00      **Dislocation mobility in alpha iron: An atomic-scale investigation of hydrogen interaction with an edge dislocation**  
K.N. Solanki, Arizona State University, USA
- 11:00 - 11:40      Coffee break

**Session II: Models & Experiments (Continued)**

Session Chair: Giovanna Gabetta, Eni S.p.A, Italy

- 11:40 – 12:20      **Modeling of Environmentally Assisted Crack Growth Behavior**  
Daniel Kujawski, Western Michigan University, USA
- 12:20 – 13:00      **Measurement and Modeling of Hydrogen Environment Assisted Cracking in Monel K-500**  
James Burns, University of Virginia, USA
- 13:00 – 14:30      Lunch (Franco's Restaurant)
- 14:30                Guided walking tour of Upper Town (2-3 hours)
- Free time / evening on your own



**Wednesday, June 18, 2014**

**Session III: Microstructure**

Session Chair: Dan Kujawski, Western Michigan University, USA

09:00 – 09:40

**Effects of Grain Size on Hydrogen Gas Induced Crack Growth Susceptibility**

N. R. Moody, Sandia National Laboratories, USA

09:40 – 10:20

**Effect of Thermal Processing & Weld Residual Stress on Stress Corrosion Cracking of Stainless Steels at Low Temperature in Salt-Containing Environments**

Ron Ballinger, Massachusetts Institute of Technology, USA

10:20 – 11:00

Coffee Break

11:00 – 11:40

**Effect of Sensitization on Stress-Corrosion Cracking of Ship Structural Alloy Al 5083**

Ramasis Goswami, Naval Research Laboratory, USA

11:40 – 12:20

**Grain Boundary Anodic Phases on Environmental Damage**

A.K. Vasudevan, Office of Naval Research (retired), USA

12:20 – 13:50

Lunch (Mimmo's Restaurant)

**Session III: Microstructure (continued)**

Session Chair: Hollie Louise Rosier, Swansea University, UK

13:50 – 14:30

**Microstructural and Environmental Effects on Corrosion and Fatigue Crack Growth in 7075 Aluminum Alloy**

Nikhilesh Chawla, Arizona State University, USA

14:30 – 15:10

**The Effect of Grain Boundary Precipitates on the Fracture Behavior of Al-Li Alloys with and without Corrosive Environments**

Ramasis Goswami, Naval Research Laboratory, USA

15:10 – 15:50

Coffee Break

15:50 – 16:30

**Pre-exposure Embrittlement of Al-Cu-Mg Alloy, AA2024**

N. J. Henry Holroyd, Consultant, USA

16:30 – 17:10

**Hydrogen Effects on Fracture of High-Strength Steels with Different Micro-Alloying**

Olga Madelen Ingrid Todoshchenko, Aalto University, Finland

Evening on your own

**Thursday, June 19, 2014**

**Session IV: Fatigue**

Session Chair: Andrew Girling, Swansea University, UK

- 09:00 – 09:40      **UniGrow Program Status and Planned Future Enhancements**  
N. Iyyer Technical Data Analysis, Inc., USA
- 09:40 – 10:20      **Analysis of Transition from Corrosion Pits to Catastrophic Cracks**  
K. Sadananda, Technical Data Analysis, Inc., USA
- 10:20 – 11:00      **Time and Cycle Dependent Environmental Damage in 7075 Alloy**  
A.K. Vasudevan, Office of Naval Research(retired), USA
- 11:00 – 11:40      Coffee break
- 11:40 – 12:20      **Effect of Cyclic Crack Opening Displacement Rate on Corrosion Fatigue Crack Velocity and Fracture Mode Transitions for White Zone of Al-Zn-Mg-Cu Alloy Welds**  
Meryl M. Hall, Jr., MacRay Consulting, USA
- 12:20 – 13:00      **Notch sensitivity in Environmentally Assisted Cracking (EAC): Test methodology**  
Jaime T. P. Castro, Rodrigo V. Landim, PUC-RIO, Brazil
- 13:00 – 14:30      Lunch (Franco's Restaurant)
- Session IV: Fatigue (continued)**  
Session Chair: N. Chawla, Arizona State University, USA
- 14:30 – 15:10      **Analysis of Time and Cycle Dependent Crack Growth in 4340 Steels**  
K. Sadananda, Technical Data Analysis, Inc., USA
- 15:10 – 15:50      **Environmentally assisted cracking of alloy 7050-T7451 exposed to aqueous chloride solutions**  
Reinhold Braun, DLR - German Aerospace Center, Germany
- 15:50 – 16:30      **Repassivation kinetics of 2024 and 7075 AL alloys as a function of age hardening**  
Monica Trueba, Università Degli Studi di Milano, Italy
- 16:30 – 17:10      **Corrosion Fatigue of Line Pipe Steels in Sour Environments**  
Ramgopal Thodla, DNV, USA
- 19.00                  Reception & Banquet Dinner (Mimmo's Restaurant)

**Friday June 20, 2014**

**Session V: Hydrogen Assisted Cracking**

Session Chair: N. Moody, Sandia Labs, USA

- |               |   |
|---------------|---|
| 09:00 – 09:40 | <b>Hydrogen Entry under Galvanostatic Polarization</b><br>Eiji Akiyama, National Institute for Materials Science, Japan                                       |
| 09:40 – 10:20 | <b>Effects of carbides on hydrogen embrittlement resistance of tempered martensitic steel</b><br>Junmo Lee, POSTECH, Korea                                    |
| 10:20 – 11:00 | <b>Environmental assisted cracking and hydrogen diffusion of traditional and highstrength pipeline steels</b><br>Marina Cabrini, University of Bergamo, Italy |
| 11:00 – 11:30 | Coffee break  |
| 11:30 – 12:10 | <b>Notch Sensitivity Effects under Stress Corrosion Cracking Conditions</b><br>Jaime T. P. Castro, PUC-Rio, Brazil  |
| 12:10 – 12:50 | <b>Quasi-static behaviour of notched Ti-6Al-4V in corrosive Methanol Environment</b><br>Sergio Baragetti, University of Bergamo, Italy                        |
| 12:50 – 13:30 | <b>35 years in Environmentally Assisted Cracking: What is left?</b><br>Giovanna Gabetta, Eni S.p.A, Italy   |
| 13:30 – 15:00 | Lunch (Franco's Restaurant)   |
| 15:00 – 15:30 | Feedback + Comments   |
| 15.30         | Conference conclusion   |