

Program

Instrumented Indentation Testing in Materials Research and Development

9 - 14 October 2005

**Fodele Beach Hotel
Crete, Greece**

Tel: +30.2810.521.251/5 Fax: +30.2810.521.249

Conference Co-Chairs

Carl J. McHargue

University of Tennessee

George M. Pharr

University of Tennessee

ECI

ENGINEERING CONFERENCES INTERNATIONAL, INC.

Six MetroTech Center -- Brooklyn, NY 11201

T: 1-718-260-3743 - F: 1-718-260-3754

E: info@eci.poly.edu - www.engconfintl.org

Engineering Conferences International (ECI) is the successor program to the United Engineering Foundation conferences program that was established in 1962 to provide an opportunity for the exploration of problems and issues of concern to engineers from many disciplines. ECI is a not-for-profit partnership between the Engineering Conferences Foundation (ECF) and Polytechnic University.

ECF Board Members

Barry C. Buckland
Allen I. Laskin
Raymond J. McCabe
Shivendra S. Panwar
Eli M. Pearce
Gary W. Poehlein
P. Somasundaran

Jules L. Routbort, *ex officio*
Herman Bieber, Director Emeritus
John C. Chen, Director Emeritus
Anna K. Longobardo, Director Emeritus
Paul A. Parisi, Director Emeritus
Frank W. Schmidt, Director Emeritus
Norman S. Stoloff, Director Emeritus

President of the ECF Board: Barry C. Buckland

Chair of ECF Conferences Committee: Jules L. Routbort

ECF Technical Liaison: Herman Bieber

President, Polytechnic University: Jerry Hultin

ECI Director: Barbara K. Hickernell

ECI Assistant Director: Kevin Korpics

Engineering Conferences International
6 Metro Tech Center
Brooklyn, NY 11201
+1 718 260 3743
+1 718 260 3754
info@eci.poly.edu
www.engconfintl.org

SPONSORS

MTS Systems Corporation

Oak Ridge National Laboratory – Materials and Ceramics Division

Sunday, 9 October 2005

17:00 - 19:00	Registration
19:00 - 19:30	Welcome Reception
19:30 - 21:00	Dinner

NOTES FOR CONFERENCE PARTICIPANTS

Participants should observe no smoking at ECI technical and social events.

During technical sessions please keep cell phones on vibrate or shut off. Take any telephone conversations out of the session room.

Presenters should leave time at the end of their talks for discussion.

Monday, 10 October 2005

- 07:30 - 08:30 Breakfast
- 08:30 - 09:00 **Conference Welcome, Introductions, and Conference Overview**
Carl McHargue and George Pharr, University of Tennessee;
Conference Chairs
Herman Bieber, ECI Conferences Committee
- 09:00 – 09:40 **Plenary Talk**
John Pethica, Trinity College, Ireland
- Session 1: Fundamental Studies**
- 09:40 – 10:20 *Elasticity and Viscoelasticity of Coating/Substrate Composites*
M. Sakai, Toyohashi University of Technology, Japan (Invited)
- 10:20 – 10:50 *Evaluation of Mechanical Properties Using Instrumented Indentation Techniques: Strength, Fracture Toughness and Residual Stress*
Dong-II Kwon, Seoul National University, Korea
- 10:50 – 11:20 Coffee Break
- 11:20 – 11:50 *The Stress Field Around an Elastoplastic Indentation*
Gang Feng, Stanford University, USA
- 11:50 – 12:20 *Measurement of Yield Strength by Spherical Indentation*
Eric G. Herbert, MTS Nano Instruments, USA
- 12:20 – 12:50 *Classical Differential and Integral Hardness – Aspects of Quantifying the Deformation Response in Indentation Experiments*
B. Wolf, Fachhochschule Lausitz, Germany
- 13:00 – 14:00 Lunch
- 14:00 – 17:00 Free Time
- 17:00 – 17:30 Refreshments
- Session 2: Micromechanics of Contacts/Size Effects**
- 17:30 – 18:10 *Spherical Indentation Size Effect: A Study via the Theory of Mechanism-based Strain Gradient Plasticity*
Y. Huang, University of Illinois - UC, USA (Invited)
- 18:10 – 18:40 *Mechanical Properties and Rate Sensitivity of Nanocrystalline and Ultrafine-Grained Metals*
Mathias Goeken, University Erlangen, Germany

Monday, 10 October 2005 (continued)

- 18:40 – 19:10 *On the Indentation Size Effect*
Andy Bushby, University of London, UK
- 19:10 – 19:40 *Size Effects in Plasticity of Gold at the Sub-micron Scale*
Julia R. Greer, Stanford University, USA
- 20:00 – 21:00 Dinner
- 21:00 Social Hour and **Poster Sessions 1-P, 2-P, 3-P**

Tuesday, 11 October 2005

08:00 - 09:00 Breakfast

Session 3: Modeling

09:00 – 09:40 *Modeling Indentation Measurements*
P-L Larssen, Royal Institute of Technology, Sweden (Invited)

09:40 – 10:10 *The Indentation of an Elastic Half Space Revisited*
J. Woirgard, University of Poitiers, France

10:10 – 10:40 *Analytical Techniques for Indentation of Viscoelastic Materials*
Michelle L. Oyen, University of Virginia, USA

10:40 – 11:10 Coffee Break

11:00 – 11:40 *The Extended Hertzian Theory and Its Use in Analyzing Indentation Experiments*
Norbert Schwarzer, Saxonian Institute of Surface Mechanics, Germany

11:40 – 12:10 *Determination of Rheological Properties of Metals Using Indentation Techniques in Combination with Inverse Methods*
Johann Michler, Swiss Federal Laboratories for Materials Testing and Research, Switzerland

12:10 – 12:40 General Discussion

13:00 – 14:00 Lunch

14:00 – 17:00 Free Time

17:00 – 17:30 Refreshments

Session 4: Brittle Solids and Biological Materials

17:30 – 18:10 *Designing Brittle Layer Structures for Biomedical Applications*
B. Lawn, NIST, USA (Invited)

18:10 – 18:40 *Mechanical Properties of Thermal Barrier Coatings by Hertzian Contact and Nanoindentation*
Emilio Jimenez-Pique, Universitat Politecnica de Catalunya, Spain

18:40 – 19:10 *Mechanical Properties of Pyrolyzed Wood – A Nanoindentation Study*
Gerald A. Zickler, Max Planck Institute of Colloids and Interfaces, Germany

19:10 – 19:40 *Nanoindentation in Teeth – The Influence of Experimental Conditions on Local Mechanical Properties*
Griselda M. Guidoni, Montanuniversität Leoben, Austria

Tuesday, 11 October 2005 (continued)

20:00 – 21:00 Dinner

21:00 Social Hour and **Poster Sessions 4 -P, 5-P, 6-P, 7-P**

Wednesday, 12 October 2005

08:00 - 09:00 Breakfast

Session 5: Thin Films and Tribology

- 09:00 – 09:40 *Analyzing the Deformation Behavior of Thin Metal Films Using Nanoindentation*
O. Kraft, Forschungszentrum Karlsruhe and University of Karlsruhe, Germany (Invited)
- 09:40 – 10:10 *Elastic Contact to Coated Substrates: An Efficient Algorithm with Applications to Instrumented Indentation*
Etienne Barthel, CNRS/Saint-Gobain, France
- 10:10 – 10:40 *Nanoindentation Hardness and Surface Characterization of Metal Oxide Thin Films*
R. Horvath, IESL FORTH, Greece
- 10:40 – 11:10 Coffee Break
- 11:00 – 11:40 *Measuring and Modeling in the Nanoindentation Response to Coated Systems*
Trevor Page, University of Newcastle upon Tyne, UK
- 11:40 – 12:10 *Application of Highly Resolved Lateral Force-Displacement Measurements for Mechanical Characterization of Surfaces and Coatings*
T. Chudoba, ASMEC GmbH, Germany
- 12:10 – 12:40 Discussion
- 13:00 – 14:00 Lunch
- 14:30 Conference Excursion to Knossos Ruins and Heraklion
- 20:00 – 21:00 Dinner
- 21:00 Social Hour

Thursday, 13 October 2005

08:00 - 09:00 Breakfast

Session 6. Polymers and Time-Dependent Deformation

09:00 – 09:40 *Viscoelastic Behavior of a Thin Polymer Film on a Rigid Substrate*
J-L Loubet, Ecole Centrale de Lyon, France (Invited)

09:40 – 10:10 *Viscoelastic Effects During Depth-Sensing Indentation*
Alfonso H. W. Ngan, University of Hong Kong, Hong Kong

10:10 – 10:40 *Nano Pillar Compression Test for Viscoelastic Property Measurement of Polymeric Microstructures*
Jae-Hyun Kim, KIMM, Korea

10:40 – 11:10 Coffee Break

11:10 – 11:40 *The Evolution of Mechanical Properties in Wear Tested Single Crystal Nickel*
Neville Moody, Sandia National Laboratory, USA

11:40 – 12:10 *Predicting the Microscopic Response of Glassy Polymers Using Flat-tip Micro-indentation*
L. E. Govaert, Eindhoven University of Technology, The Netherlands

12:10 – 12:40 Discussion

13:00 – 14:00 Lunch

14:00 – 17:00 Free Time or visit to Science and Technology Park

17:00 – 17:30 Refreshments

Session 7: New Techniques and In-Situ Experiments

17:30 – 18:00 *Hardness Testing Under a Different Light: Combining Synchrotron X-Ray Microdiffraction and Indentation Techniques for Polymer Fiber Structure*
A. Gourrier, Max-Planck Institute of Colloids and Surfaces, Germany

18:00 – 18:30 *Investigation of Plastic Instabilities in Amorphous Metallic Alloys by In-situ SEM Indentation Experiments*
Benedikt Moser, EMPA Materials Science and Technology, Switzerland

Thursday, 13 October 2005 (continued)

- 18:30 – 19:00 *Optical Indentation Microscopy – A new Family of Instrumented Indentation Testing*
Tatsuya Miyajima, National Institute for Advanced Industry Science and Technology, Japan
- 20:00 – 22:00 Banquet
- 22:00 Social Hour

Friday, 14 October 2005

- 08:00 - 09:00 Breakfast
- Session 8: Needs and Opportunities**
Discussion Leader - W. D. Nix, Stanford University, USA
- 09:00 – 10:30 Panel Discussion
- 10:30 – 11:00 Coffee Break
- 11:00 – 12:00 General Discussion
- 12:00 – 12:30 Closing
- 12:30 – 1400 Lunch