Program

NANOMECHANICAL TESTING IN MATERIALS RESEARCH & DEVELOPMENT

October 11-16, 2009

Il Ciocco Hotel and Conference Center
Castelvecchio /Barga (Tuscany), Italy

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Mathias Göken
University Erlangen-Nürnberg, Germany

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SURFACE
Sunday, 11 October 2009

16:00 - 18:00  Arrival & Registration
18:00 - 19:00  Dinner

**Opening Session**

19:00 - 19:30  **Welcome and Opening**
Mathias Göken, University of Erlangen-Nürnberg, Erlangen, Germany
Herman Bieber, ECI, New York, USA

19:30 - 20:10  **Adhesion of biomimetic patterned surfaces (Plenary)**
Eduard Arzt, INM, Saarbrucken, Germany

20:10 - 20:50  **Insights into plasticity and fracture obtained by miniaturized mechanical testing (Plenary)**
Gerhard Dehm, Erich Schmid Institute, Leoben, Austria

21:00 - 22:00  Opening Reception (Sponsor: Agilent)

**Key for talks**
P: Plenary talk
E: extended, invited talk
R: regular contribution

**NOTES**

- Audiotaping, videotaping and photography of presentations are prohibited.
- Speakers – Please leave at least 5 minutes for questions and discussion.
- Please do not smoke at any conference functions.
- Turn your cellular telephones to vibrate or off during technical sessions.
- Payment for the optional tour should be made directly to Il Ciocco front desk.
- Be sure to make any corrections to your name/contact information on the Master Participant List or confirm that the listing is correct. A corrected copy will be sent to all participants after the conference.
Monday, 12 October 2009

07:30 - 09:00  Breakfast

Fundamentals

09:00 - 09:40  Nanoscale behavior of BCC metals—orientation and temperature dependence (Plenary)
Andrea M. Hodge, University of Southern California, Los Angeles, USA

09:40 - 10:10  The impact of point and line defect density on the onset of plasticity during nanoindentation (E)
David F. Bahr, Washington State University, Pullman, USA

10:10 - 10:40  On the role of surfaces in nanomechanical testing (E)
Juergen Biener, Lawrence Livermore National Laboratory, Livermore, USA

10:40 - 11:10  Coffee break

11:10 - 11:40  Comparison of plasticity size effects in uniaxial and non-uniform loading (E)
Andy Bushby, Queen Mary University of London, London, UK

11:40 - 12:10  Nanoindentation using atomic force microscope (E)
Alfonso H.W. Ngan, University of Hong Kong, Hong Kong, China

12:10 - 12:30  The correlation between the internal material length scale and the microstructure of metallic materials (R)
Bjorn Backes, Stanford University, Stanford, USA

12:30 - 12:50  Finite element analysis of the penetration depth/tip radius ratio dependence on the correction factor in indentation testing of elastic-plastic materials (R)
Fazilay Abbes, University of Reims Champagne Ardenne, Reims, France

13:00 - 14:00  Lunch

14:00 - 16:30  Free time / ad hoc discussions

Modeling

16:30 - 17:10  Probing mechanical properties of interfaces with nanoindentation: Results of large scale atomistic simulations (Plenary)
Alexander Hartmaier, ICAMS, Bochum, Germany

17:10 - 17:30  Crystal plasticity analysis of nanoindentation in intermetallic gamma TiAl (R)
Claudio Zambaldi, Max-Planck-Institute for Iron Research, Düsseldorf, Germany

17:30 - 17:50  Continuum crystal plasticity analysis of pyramidal nanoindentation experiments in thin metallic films (R)
Jorge Alcala, Polytechnic University of Catalunya (UPC), Barcelona, Spain

17:50 - 18:10  Local effects on the fibre matrix interfacial adhesion testing in fibre metal reinforced composites by the push-in/pull-out test (R)
Jon M. Molina-Aldareguia, IMDEA - Materials, Madrid, Spain

18:15 - 18:45  Refreshments
Monday, 12 October 2009

18:45 - 20:00  Poster Preview I
20:00 - 21:00  Dinner
21:00 - 23:00  Poster Session I / Social hour
Tuesday, 13 October 2009

07:30 - 09:00
Breakfast

**Testing of Small Specimens**

09:00 - 09:40
**Prestraining and annealing of gold micropillars: Strengthening and weakening turned upside down (Plenary)**
William D. Nix, Stanford University, Stanford, USA

09:40 - 10:10
**Probing the mechanisms of small-scale plasticity by nanoindentation pop-in and micro-pillar compression testing (E)**
George M. Pharr, University of Tennessee and Oak Ridge National Laboratory, Knoxville, USA

10:10 - 10:40
**In-situ investigation of nano-scale mechanical properties via homogeneous deformation of nano-pillars (E)**
Julia R. Greer, California Institute of Technology, Pasadena, USA

10:40 - 11:10
Coffee break

11:10 - 11:40
**Micro-compression in the spotlight of a synchrotron (E)**
Helena Van Swygenhoven, Paul Scherrer Institute, Villingen, Switzerland

11:40 - 12:00
**Dislocation structures in solid and porous gold nanopillars after deformation (R)**
Brian Derby, University of Manchester, Manchester, UK

12:00 - 12:20
**The effect of orientation and size on the microcompression behavior of MgO (R)**
Sandra Korte, University of Cambridge, Cambridge, UK

12:20 - 12:40
**Anisotropy in the elastic and plastic behavior of alpha titanium micro cantilever beams (R)**
Jicheng Gong, Department of Materials, University of Oxford, Oxford, UK

12:40 - 13:10
**Determining the dimensionality of size effects by indentation with different shaped indenters and uniaxial compression of different shaped pillars (E)**
Nigel M. Jennett, National Physical Laboratory, Teddington, UK

13:00 - 14:00
Lunch

14:00 - 16:30
Free Time / ad hoc discussions / CSM-sponsored Scientific Session

**In-Situ Testing**

16:30 - 17:00
**Complementary in-situ methods for nanoscale materials characterization (E)**
Ralph Spolenak, ETH Zurich, Zurich, Switzerland

17:00 - 17:30
**In-situ mechanical testing of nanowires and nanodots (E)**
Johann Michler, EMPA, Thun, Switzerland

17:30 - 18:00
**In-situ fracture analysis of nanostructures (E)**
William Gerberich, University of Minnesota, Minnesota, USA

18:00 - 18:30
**In-situ TEM study of dislocation nucleation in confined crystalline volumes (E)**
Marc Legros, CNRS, Toulouse, France
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**Wednesday, 14 October 2009**

07:30 - 09:00  Breakfast

**Thin Films and Fracture**

09:00 - 09:40  Indentation fracture and toughness assessment for very thin oxide coatings on glass (Plenary)
Steve Bull, Newcastle University, Newcastle, UK

09:40 - 10:10  Buckle driven delamination in thin film compliant substrate systems - tests and simulations (E)
Neville R. Moody, Sandia National Laboratories, Livermore, USA

10:10 - 10:30  New testing method for ductility of thin Al films (R)
Michael Coulombier, Universite catholique de Louvain (UCL), Louvain-la-Nuwe, Belgium

10:30 - 11:00  Coffee break

11:00 - 11:20  Residual stress measurement at the micrometer scale: Focused Ion Beam (FIB) milling and nanoindentation testing (R)
Marco Sebastiani, University of Rome Tre, Rome, Italy

11:20 - 11:40  Quantification of the micro-plastic response of amorphous silicate through micro-Raman mapping of residual indentation strain (R)
E. Barthel, CNRS/ Saint - Gobain, Aubervilliers, France

11:40 - 12:00  Evaluation of residual stress with a Knoop indenter (R)
Seung-Kyun Kang, Seoul National University, Seoul, Korea

12:00 - 12:20  Indentation fracture toughness measurement of thin nanoporous films (R)
Dylan Morris, NIST, Gaithersburg, USA

12:30    Lunch boxes distributed in Il Ciocco reception lobby

12:45 - 18:00  Conference Excursion to Lucca and a Luchese villa (optional)

**New Instrumentations and Developments**

19:00 – 19:20  In- situ techniques for mechanical testing of nanoscale structures
Julia Nowak, Hysitron, USA

19:20 – 19:40  Using the DCM II to make mechanical measurements at the nanoscale
Warren Oliver, Nanomechanics, Inc., Oak Ridge, USA

19:40 – 20:00  Recent nanotest breakthroughs – environmental control for reliable cold (to -50°C) and hot nanoindentation (to 750°C), and improved nano-cratch and wear testing
Ben Beake, Micro Materials Ltd., Wrexham, Wales, UK

20:00 – 20:20  Apex as new nano and micro indentation, scratch and imaging instrument for nano-mechanical testing of materials
Norm Gitis, CETR, California, USA

20:30 - 21:30  Dinner

21:30 - 22:30  Social hour (sponsored by Agilent Technologies)
Thursday, 15 October 2009

07:30 - 09:00  Breakfast

Applications, high temperature and different environments

09:00 - 09:40  Shape memory and superelasticity of Cu-Al-Ni in confined volumes (Plenary)
Ying Chen, MIT, Cambridge, USA

09:40 - 10:10  Micromechanical testing for superplasticity at the nanoscale (E)
Amiya K. Mukherjee, University of California, Davis, USA

10:10 - 10:40  The effect of hydrogen and grain boundaries on dislocations by means of nanomechanical testing methods (E)
Horst Vehoff, Saarland University, Saarbrücken, Germany

10:40 - 11:10  Coffee break

11:10 - 11:40  Local modifications in ultra low-k (ULK) insulating materials in micro-electronic products studied with nanoindentations and FM-AFM (E)
Ehrenfried Zschech, Globalfoundries Inc, Dresden, Germany

11:40 - 12:00  High Temperature instrumented microindentation: a local probe to test the mechanical behavior of turbine materials (R)
Michel Fajfrowski, Micalex, Orsay, France

12:00 - 12:20  High temperatures nanoindentation: The effect of indenter temperature on apparent material response (R)
Nicola M. Everitt, University of Nottingham, Nottingham, UK

12:20 - 12:40  Plasticity of the new MAX - Phase material Ti/SnC studied by nanoindentation (R)
Christophe Tromas, Universite de Poitiers, Chasseneuil, France

13:00 - 14:00  Lunch

14:00 - 16:30  Free Time / ad hoc discussions

Soft Matter (Polymers and Bio)

16:30 – 17:00  Nanomechanical dynamic testing of tissues and tissue surrogate materials (E)
Krystyn J. Van Vliet, MIT, Cambridge, USA

17:00 - 17:20  Dynamic nanoindentation of articular cartilage (R)
Oliver Franke, MIT, Cambridge, USA

17:20 - 17:40  Quantifying arterial stiffness changes due to diabetes using nanoindentation (R)
Riaz Akhtar, University of Manchester, Manchester, UK

17:40 - 18:10  Refreshments

18:10 - 18:40  Dynamics of confined polymer deformation during mechanical processing for nanostructure fabrication (E)
Graham L. W. Cross, Trinity College Dublin, Dublin, Ireland

18:40 - 19:00  Nanoindentation and the mechanical characterization of viscoelastic solids (R)
Erik G. Herbert, University of Tennessee, Oak Ridge, USA
Thursday, 15 October 2009 (continued)

20:00 - 22:00  Conference Banquet (Sponsor: Hysitron)
Friday, 16 October 2009

07:30 – 09:00   Breakfast

09:00 – 12:00   General Discussion (Optional)

12:30          Lunch and Departures
Poster Session I

1. Hydrogen embrittlement: Quantitative evaluation of sensitivity in extremely small volumes via in situ electrochemical nanoindentation  
   Afrooz Barnoush, Saarland University, Germany

2. Analysis of the inverse square - root plasticity size effect  
   Andy Bushby, Queen Mary University of London, UK

3. Towards a safe procedure for measuring the unloading stiffness in instrumented indentation  
   Jon Alkorta, CEIT, Spain

4. Nanoindentation: considerations on the area function calibration  
   Peter Nagy, CRC Hungarian Academy of Sciences, Hungary

5. Reversible deformation and incipient plasticity during nanoindentation test in MgO  
   Christophe Tromas, Université de Poitiers, France

6. Mechanical properties of individual inorganic fullerene-like nanoparticles  
   Ofer Tevet, Weismann Institute of Science, Israel

7. Mechanical properties of wear-tested (001) nickel using nanoindentation techniques  
   Neville Moody, Sandia National Laboratories, USA will present for Megan J. Cordill, Erich Institute, Austrian Academy of Sciences

8. Modulus Mapping – Mechanical testing at ultralow loads  
   Ude Hangen, Hysitron, Inc., USA

9. Techniques for the analysis of indentation experimental data  
   Warren Oliver, Nanomechanics, Inc., USA

10. TEM study of deformation mechanisms during nanoindentation of NiTi  
    Janine Pfetzing-Micklich, Ruhr University Bochum, Germany

11. Calibration issues in nanoindentation experiments  
    Alberto Barone, Instituto Italiano di Technologia, Italy

12. Time dependent effects on glass indentation  
    Carlos Mauricio Lepienski, Univerdidade Federal do Paraná, Brazil

13. The concept of instrumented indentation hardness of lamellar materials  
    Carlos Mauricio Lepienski, Univerdidade Federal do Paraná, Brazil

14. The hardness of amorphous solids  
    Joseph Jakes, University of Wisconsin-Madison, USA

15. Influence of pre-straining and indenter angle on the indentation size effect of single-crystal Mo and W  
    Benedikt Scharfe, University of Erlangen-Nürnberg, Germany

16. A critical reassessment of the elastic unloading in sharp instrumented indentation experiments: Mechanical properties extraction  
    Sara Rodriguez Pulecio, University of São Paulo, Brazil

17. Effects of plastic indenter deformation on spherical instrumented indentation tests: The reduced elastic modulus  
    Sara Rodriguez Pulecio, University of São Paulo, Brazil

18. Indentation size effect at elevated temperatures  
    Oliver Franke, Massachusetts Institute of Technology, USA
19. Determination of dislocation density from atomistic data
   Jun Hua, Ruhr University Bochum, Germany

20. Nanoindentation experiments with mixed load for the determination of Young's modulus and
    Poisson's ratio: A comparison between analytical theory, FEM and measurement
   Andre Clausner, TU Chemnitz, Germany

21. Effective indenter concept for the determination of thin films Young’s modulus and yield
    strength
   Matthias Herrmann, Chemnitz University of Technology, Germany

22. Experimental and numerical study of the indentation response of granular materials
   Guillaume Kermouche, University of Lyon, France

23. The effect of surface roughness on nanoindentation of hard coatings: Simulation and experiment
   Claudia Walter, University of Leoben, Austria

24. Effect of hydrostatic pressure on mechanical properties of ZDTP tribofilms investigated by nanoindentation
   Sandrine Bec, UMR CNRS 5513, Ecole Centrale de Lyon, France

25. Measuring the elastic modulus and residual stress of free-standing thin films using nanoindentation techniques
   Erik Herbert, University of Tennessee, USA

26. Investigations of the fracture toughness of thin films with bulge testing – Thickness dependence in silicon nitride films
   Benoit Merle, University of Erlangen-Nürnberg, Germany

27. The experimental study of the perimeter plastic deformation during scratch hardness test
   Alexey Useinov, Technological Institute for Superhard and Novel Carbon Materials, Russia

28. Determination of fracture toughness of bulk materials and thin films by nanoindentation
   Kirsten Schiffmann, Fraunhofer IST, Germany

29. Preparation and characterization of model porous silica thin films
   Etienne Barthel, CNRS/Saint-Gobain, France

30. Scratching behavior of nanostructured Ti-Al-N and Ti-Al-Si-N protective coatings
    Peter Nagy, CRC Hungarian Academy of Sciences, Hungary

31. Local residual stress and delamination behavior of industrial DLC coatings
    Jens Schaufler, University of Erlangen-Nürnberg, Germany
32. A combinatorial approach to investigate solid solution hardening by nanoindentation  
Oliver Franke, Massachusetts Institute of Technology, USA

33. Mechanical behavior of products from Zr-based alloys  
Yuriy Perlovich, Moscow State University Engineering Physics Institute, Russia

34. Challenges and applications of elevated temperature nanoindentation  
Ben Beake, Mico Materials, Ltd., UK

35. Indentations on YSZ thermal barrier coating layers deposited using different morphologies of starting powders  
Kee Sung Lee, Kookmin University, Korea

36. Nanomechanical Testing of Nanofibers  
Adam Parviz, Islamic Azad University-Naragh Branch

37. Influence of the dendritic/interdendritic chemical composition on the mechanical properties of a 4th generation superalloy studied by nanohardness cartography  
Christophe Tromas, PHYMAT, Université de Poitiers, France

38. Grinding additive effect on fatigue sensitivity of brittle material tested with nanoindentation  
Christell Guerret, LTDS/Ecole Centrale de Lyon/CNRS, France presenting for Mathieu Skrzypczak

39. Nanoindentation at sample temperatures up to 900° K  
Wolfgang Stein, SURFACE, Germany

40. Mechanical behavior of thermal barrier bondcoats with high temperature instrumented microrindentation  
Michel Fajfrowski, Michalex, France

41. Influence of the production process of ultrafine AL99.5 on the local and macroscopic mechanical behavior in terms of the strain rate sensitivity  
Verena Maier, University of Erlangen-Nürnberg, Germany

42. Experimental and numerical investigations of the scratch response of amorphous polymers: Recovery and healing phenomena  
Guillaume Kermouche, University of Lyon, ENISE, LTDS, France

43. Nanomechanical investigations on polyoxazolines  
Erik Rettler, Friedrich-Schiller-University-Jens, Germany

44. Fast feedback control for nanoindentation on polymers  
Ude Hangen, Hysitron, Inc., USA

45. Investigation of polymers with an ultra high stability nanoindentation tester  
Nicholas Conte, CSM Instruments SA, Switzerland

46. Links between microstructure, mechanical properties and scratching behavior of injection-moulded polypropylene  
Sandrine Bec, UMR CNRS 5513, Ecole Centrale de Lyon, France

47. Direct measurement of contact area in macro indentatin of viscoelastic polymers  
Tanya Ekers, Queen Mary University of London, UK

48. Probing mechanical properties of fully hydrated, electrochemically stimulated polymer composites via instrumented nanoindentation  
Zeynep Kalcioglu, Massachusetts Institute of Technology, USA
49. Uniaxial compression of sub-micron sized pillars milled in nanolayered AL/PD thin films displaying layer-thickness dependent strengthening
   Pranesh Dayal, University of New South Wales, Australia

50. Microcompression behavior of silicon between 25 and 400°
   Sandra Korte, University of Cambridge, UK

51. Size dependent brittle to ductile transition in semiconductors
   Rudy Ghisleni, EMPA, Switzerland

52. Loss of mechanical size effect in micropillars of an ODS superalloy
   Baptiste Girault, Leibniz Institute for New Materials, Germany

53. Correlation between critical temperature and strength of small-scale bcc pillars
   Andreas Schnieder, Leibniz Institute for New Materials, Germany

54. Enhanced superlayer test method for the characterization of thin film adhesion
   Michael Coulombier, UCL/iMMC, Belgium presenting for Alexandre Boé

55. In-situ Laue diffraction during compression of Mo pillars
   Julien Zimmermann, Paul Scherrer Institute, Switzerland

56. Indentation fracture toughness measurement of thin film nanoporous films
   Dylan Morris, National Institute of Standards & Technology, USA

57. In-situ electron backscatter diffraction (EBSD) during the compression of micropillars
   Johann Michler, EMPA, Switzerland will present for Christoph Niederberger

58. Free edge and heterophase interface effects in nanoindentation measurements
   Joseph Jaks, University of Wisconsin-Maison/USFS Forest Products Laboratory, USA