

Preliminary Program

Nanomechanical Testing
in
Materials Research and Development

October 9-14, 2011

Lanzarote, Canary Islands, Spain

Conference Chair:

Prof. Dr. Gerhard Dehm

Department Materials Physics, University of Leoben

and

Erich Schmid Institute of Materials Science of the Austrian Academy of Science



Engineering Conferences International

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Sunday, October 9, 2011

16:00 – 18:00	Registration
18:00 – 20:00	Dinner
	Opening Session
20:00 – 20:20	Welcome Conference Chair: Gerhard Dehm, University of Leoben, Austria ECI Technical Liaison: Herman Bieber
20:20 – 21:00	Topological optimization, fabrication, and characterization of 3-dimensional micro/nanoscale materials (Plenary) Kevin Hemker, Johns Hopkins University, MD, USA
21:00 - 21:40	Measuring nanoscale deformation in complex materials with synchrotron radiation X-rays (Plenary) Oskar Paris, University of Leoben, Austria
21:45 – 22:45	Opening Reception
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Plenary talk:	30 minutes plus discussion
Invited talk:	20 minutes plus discussion
Regular:	15 minutes plus discussion

Monday, October 10, 2011

07:30 – 09:00 Breakfast buffet

Micromechanics, Fracture and Fatigue

09:00 – 09:30 **Nanomechanical testing of materials and thin films with the bulge test (Invited)**
Mathias Göken, University of Erlangen-Nürnberg, Germany

09:30 – 09:50 **Initial plasticity of thin wires in torsion under forward and reversed loading (R)**
Andy Bushby, Queen Mary University of London, UK

09:50 – 10:10 **Small scale plasticity of silicon as a function of electronic doping (R)**
Rudy Ghisleni, Laboratory for Mechanics of Materials and Nanostructures – EMPA, Switzerland

10:10 – 10:30 **Effects of constraints in plasticity on cleavage fracture of tungsten single crystalline samples (R)**
Stefan Wurster, Austrian Academy of Sciences, Austria

10:30 – 11:00 Coffee break

11:00 – 11:30 **Yield and plastic flow in small volumes in soft metals in tension and flexure (Invited)**
David Dunstan, Queen Mary University of London, UK

11:30 – 12:00 **Ductibility in highly nanotwinned copper – myth or reality? (I)**
Andrea Hodge, University of Southern California, CA, USA

12:00 – 12:20 **Ultra-high strain hardening in nanocrystalline palladium thin films with nanotwins: an experimental study coupled to a phenomenological analytical model (R)**
Marie-Stephane Colla, University Catholique de Louvain, Belgium

12:20 – 12:40 **Fracture testing – From the microscale to the macroscale (R)**
David Armstrong, University of Oxford, UK

12:40 – 13:00 **Hydrogen embrittlement characterization of Fe-26Al-xCr Intermetallics with the aid of *in-situ* nanoindentation Technique (R)**
Afrooz Barnoush, Saarland University, Germany

13:00 – 14:00 Lunch

14:00 – 16:00 Free time /*ad hoc* sessions

16:00 – 16:30 Afternoon coffee and snacks

Monday, October 10, 2011 (continued)

In-situ Testing

- 16:30 – 17:10 **Uniaxial tensile testing of nanowires (Plenary)**
Reiner Mönig, Karlsruhe Institute of Technology, Germany
- 17:10 – 17:30 **Mechanical properties of Cu nanowires by in situ bending experiments (R)**
Gunther Richter, MPI for Intelligent Systems, Germany
- 17:30 – 18:00 **Micro-objects in-situ deformation of as a tool to uncover the role of dislocation nucleation in the brittle-to-ductile transition in InSb semi-conductor (Invited)**
Ludovic Thilly, University of Poitiers, France
- 18:00 – 18:20 **Modifying mechanical properties on a nanometer scale by controlled annealing of crystal defects (R)**
Daniel Kiener, University of Leoben, Austria
- 18:20 – 18:50 **Tensile properties of nano-twinned Cu nano-pillars through in-situ mechanical testing, electron microscopy, and atomistic simulations (Invited)**
Julia Greer, California Institute of Technology, USA
- 18:50 – 19:30 Poster Preview I
- 19:30 – 21:00 Dinner
- 21:00 – 23:00 Poster Session I with social hour

Tuesday, October 11, 2011

07:30 – 09:00 Breakfast

Indentation I

09:00 – 09:40 **Multiscale modeling of indentation: From atom to continuum (Plenary)**
Marc Fivel, SIMaP-GPM2, France

09:40 – 10:00 **Single crystal plasticity of titanium quantified through orientation informed nanoindentation and crystal plasticity finite element simulation (R)**
Claudio Zambaldi, MPI for Iron Research, Germany

10:00 – 10:20 **Indentation-induced plasticity of metals with various lattice defects (R)**
Takahito Ohmura, National Institute for Material Science, Japan

10:20 – 10:40 **New method based on second harmonic detection to extract mechanical properties from dynamic nanoindentation Tests (R)**
Jean-Luc Loubet, Ecole Centrale de Lyon, France

10:40 – 10:10 Coffee break

10:10 – 11:40 **Mechanical properties mapping using probe experiments: Fact and fiction (Invited)**
Warren C. Oliver, Nanomechanics Inc., TN, USA

10:40 – 12:00 **In situ, elevated temperature nanoindentation: Best practices and case studies (R)**
J.M. Wheeler, Mechanics of Materials and Nanostructures Laboratory – EMPA, Switzerland

12:00 – 12:30 **Hot microcompression in vacuum up to 700°C (Invited)**
S. Korte, University of Cambridge, UK

12:30 – 12:50 **Elastic anisotropy of materials studied by nanoindentation and atomic force acoustic microscopy Techniques (R)**
Kong Boon Yeap, Fraunhofer Institute for Nondestructive Testing, Germany

13:00 – 14:00 Lunch

14:00 – 16:00 Free time / *ad hoc* sessions

16:00 – 16:30 Afternoon coffee with snacks

Tuesday, October 11, 2011 (continued)

Indentation II

- 16:30 – 17:00 **Extracting mechanical properties of copper coatings on stiff and compliant substrates by nanoindentation (Invited)**
Steve Bull, Newcastle University, UK
- 17:00 – 17:20 **Twin boundary motion in MAX phase materials activated by nanoindentation (R)**
Christoph Tromas, University of Poitiers, France
- 17:20 – 17:50 **Nanoindentation strain-rate jump and long-term creep tests on nanocrystalline materials (R)**
Verena Maier, University of Erlangen-Nuernberg, Germany
- 17:50 – 18:10 **The interpretation of spherical indentation through multiscale material modeling: from polycrystalline to single-crystal micro and nano-indentations (R)**
J. Alcala, Universitat Politecnica de Catalunya, Spain
- 18:10 – 18:30 **Nanoindentation based assessment of effective composite properties (R)**
J. Nemecek, Czech Technical University in Prague, Czech Republic
- 18:30 – 18:50 **Obtaining crystal plasticity parameters by inverse analysis of nanoindentation results (R)**
Benjamin Schmaling, ICAMS – Ruhr-University Bochum, Germany
- 18:50 – 19:30 **Poster Preview II**
- 19:30 – 21:00 Dinner
- 21:00 – 23:00 **Poster Session II**

Wednesday, October 12, 2011

07:30 – 09:00 Breakfast

Deformation Mechanisms I

09:00 – 09:40 **Dislocation multiplication and nucleation in small metallic fibers under stress: the input of in-situ transmission electron microscopy (Plenary)**
Marc Legros, CEMES-CNRS, France

09:40 – 10:10 **Size dependence of strength of metallic micropillars and the prerequisites for the formation of stable pinning points (Invited)**
Seok-Woo Lee, Stanford University, CA, USA

10:10 – 10:40 **Initial dislocation structures and boundary conditions in 3D discrete dislocation dynamics simulations and their influence on micro scale plasticity (Invited)**
Christian Motz, Austrian Academy of Sciences, Austria

10:40 – 11:10 Coffee break

11:10 – 11:30 **A simple stochastic model for yielding in specimens with a limited number of dislocations (R)**
George M. Pharr, University of Tennessee, TN, USA

11:30 – 11:50 **Influence of bulk pre-straining on the size effect in nickel compression pillars (R)**
Andreas Schneider, Leibniz Institut fuer neue Materialien, Germany

11:50 – 12:10 **Emergence of strain rate sensitivity in Cu nano-pillars: Transition from dislocation multiplication to dislocation nucleation (R)**
Andrew T. Jennings, California Institute of Technology, USA

12:10 – 12:40 **Exploiting interactions between indentation size and structure size effects to determine the characteristic dimension of nano-structured materials by indentation (Invited)**
Nigel M. Jennett, National Physical Laboratory, UK

13:00 – 19:00 Boxed lunch and excursion to Timanfaya National Park

20:00 – 23:00 Dinner

Thursday, October 13, 2011

07:30 – 09:00 Breakfast

Deformation Mechanisms II

09:00 – 09:40 **3DXRD - Results, limitations and outlook (Plenary)**
Dorte Juul Jensen, Risoe DTU, Denmark

09:40 – 10:00 **Expected and unexpected plastic behavior at the micron scale: An in situ Laue study (R)**
Christoph Kirchlechner, University of Leoben, Austria

10:00 – 10:30 **Probing strain hardening behavior in multilayer nanolaminate systems (Invited)**
David Bahr, Washington State University, WA, USA

10:30 – 11:00 Coffee break

11:00 – 11:30 **Testing of Ultra-sensitive materials for nano-electromechanical system - USENEMS (Invited)**
Peter Schaaf, TU Ilmenau, Germany

11:30 – 11:50 **Yield and buckling in nanowire arrays (R)**
Matthias Schamel, ETH Zurich, Switzerland

11:50 – 12:20 **Fracture toughness of micron-sized NiAl single crystalline cantilevers (Invited)**
Karsten Durst, University of Erlangen-Nürnberg, Germany

12:20 – 12:50 **Effect of ion irradiation on the micropillar compression of LiF single crystals (Invited)**
Jon M. Molina-Aldareguia, IMDEA Materials Institute, Spain

13:00 – 14:30 Lunch

14:30 – 16:00 Free time / *ad hoc* sessions

16:00 – 16:30 Afternoon coffee with snacks

New Instrumentations and Developments

16:30 – 16:50 Agilent
Jennifer Hay

16:50 – 17:10 Alemnis

17:10 – 17:30 CSM

17:30 – 17:50 Hysitron
Ude Hangen

17:50 – 18:10 Kleindiek
Stephan Kleindiek

Thursday, October 13, 2011 (continued)

18:10 – 18:30	Michalex Vincent Jardret
18:30 – 18:50	Nanomechanics Bryan Crawford
18:50 – 19:10	Surface Wolfgang Stein
19:30 – 22:00	Conference Banquet

Friday, October 14, 2011

07:30 – 09:00 Breakfast

“Novel” Materials

09:00 – 09:40 **A combinatorial approach using nano scanning calorimetry and x-ray diffraction to study the effect of composition and quench rate on the crystallization of Au-Si-Cu metallic glasses during rapid heating (Plenary)**

Joost J. Vlassak, Harvard University, USA

09:40 – 10:00 **The effect of topography features on modulus mapping of nanoscale interfaces in a deep sea sponge (R)**

Igor Zlotnikov, MPI of Colloids and Interfaces, Germany

10:00 – 10:20 **Semiconducting branched nanocrystals: mechanical behavior of single crystals and thin films (R)**

Alberto C. Barone, Istituto Italiano di Tecnologia, Italy

10:20 – 10:50 Coffee break

10:50 – 11:20 **Temperature dependence of visco-elastic properties of polymer thin films using nanoindentation (R)**

Diana Courty, ETH Zurich, Switzerland

11:20 – 11:50 **Multiscale approach to plastic deformation of silicate glasses at the micron scale (R)**

Etienne Barthel, CNRS / Saint-Gobain, France

11:50 – 13:00 General Discussion (Optional)

13:00 – 14:30 Lunch and Departure

Poster Presentations

Nr.:	Title	Author
1	A computational study on mechanical behavior of nanoscale materials (polymer gels and biological tissues), by tools of nanoindentation	Katya Marinova Simeonova
2	Experimental and statistical study on nonlinear effect of Carbon Nanotube on Mechanical properties of Polypropylene Composites	Yasser Rostamiyan
3	Polyurethane nanocomposites derived by organically modified nanosilicas	Mir Mohammad Alavi Nigjeh
4	Synthesis and characterization of bundle-like CeO ₂ nanofibers	Ruixing Li
5	Hardness and elastic properties of nanostructured films-based carbides, nitrides and borides	R.A. Andrievski
6	Determination of fracture properties of (Pt,Ni)Al bond coats by microbeam bend tests	Nagamani Jaya B
7	Micro-indentation fracture from flat-ended cylindrical indenter	Y.J. Xie
8	Deformation mechanisms of nanocomposite metals composed of a Cu matrix reinforced by Nb nanowhiskers studies by in-situ deformation in the TEM and under synchrotron beam	Ludovic Thilly
9	Prediction of abrasive wear rate of <i>in-situ</i> Cu ₀ Al ₂ O ₃ nanocomposite using artificial neural networks	Ahmed Abou El-Wafa Megahed
10	ESR study of structural changes in Li ₂ Mn ₂ <(MoO ₄) ₃ on local scale and Li intercalation/deintercalation induced stresses	N.M. Suleimanov
11	Mechanical properties of superelastic hard carbon materials produced by high-pressure high-temperature treatment of fullerenes	Chernogorova O.P.
12	Structural transformations of bimetal nanofilms under the influence of two-dimensional pressure deformation	M.D. Starostenkov
13	Effects of vanadium ion implantation on the structural and mechanical properties of TiN coatings	Deng Bin
14	Study on the microstructure and mechanical properties of Si-ion implanted TiN coatings	Qin Hua
15	Nanoindentation applied to ion-irradiated iron-chromium alloys	Frank Bergner
16	Deformation behavior of miniaturized copper bicrystals and corresponding dislocation boundary interactions	Peter J. Imrich
17	Mechanical behavior of reaction wood: A multiscale approach	Rejin Raghavan
18	Preparation and characterization of aluminum - fullerene composite	V.V. Milyavskiy
19	Use of mechanical strength of nano-materials in defence	Jyoti Srivastava
20	In situ evaluation of pile-ups height during scratch hardness test	Alex Useinov
21	Mechanical properties, structure and shock behavior of yttria-doped tetragonal zirconia	V.V. Milyavskiy
22	Effects of nanosilver particles on thermal and mechanical properties of particleboard wood	Moloud Binae Saalab
23	Electromechanical test of single-wall carbon nanotube thin film	Won Seok Chang
24	The mechanism of initiation and coalescence of short fatigue cracks stainless steel aisi 316	Zahiruddin Shaikh
25	Investigation of the fracture of thin amorphous alumina films during spherical nanoindentation	David Mercier
26		
27	Fracture modes in micropillar compression	P.R. Howie
28	Plasticity in brittle intermetallics	W.J. Clegg
29	Interaction between the indentation size effect and the Hall-Petch effect in polycrystalline zirconia	Andy Bushby

30	Novel preparation methods for silver nanoparticles with precise control over size and shape	Jignasa Solanki
31	TEM investigations of the formation of martensite during nanoindentation of an austenitic NiTi shape memory alloy	J. Pfetzing-Micklich
32	AFM-based indentation in KBr(100): Measurement of homogeneous dislocation nucleation in three dimensions and Time dependent plasticity	Robert Gralla
33	Elastic nanoindentation experiments with mixed load and superposed mixed vibration for the determination of Young's modulus and Poisson's ratio.	Andre Clausner
34	Hardness and elastic modulus gradients in plasma nitrided 316l polycrystalline stainless steel investigated by nanoindentation tomography	Christoph Tromas
35	Synchrotron-based in situ mechanical testing of nanocrystalline metals and alloys	Jochen Lohmiller
36	Mechanical properties of self-assembled nanoparticle arrays	Anna Campbellova
37	Natural bio-ceramic nano composites, Strombus gigas conch shell : The hierarchical microstructure and the mechanical properties	Yoon Ah Shin
38	Combined characterization of thin films using scanning probe microscopy and nanoindentation	O. Lysenko
39	Natural bio-ceramic nano-composites: The hierarchical microstructure and the mechanical properties of nacre	Subin Lee
40	Dislocation plasticity of Au nanowires under strain gradient condition observed by <i>in-situ</i> TEM compression	Jiseong Im
41	Evaluation and comparison of lab-scale and commercially available advanced new generation multi-scale carbon fiber composites	Jonas Engstrom
42	Modulus mapping of implant microcomposites	Erik F.-J. Rettler
43	Experimental determination of the effective indenter shape and epsilon factor for nanoindentation	B. Merle
44	Fatigue testing of gold thin films with the bulge test	B. Merle
45	Micro-shear deformation of fcc crystals	Jenna-Kathrin Heyer
46	Heat- and erosion-resistant nanostructured coatings for the compressor blades of gas turbine engines	Aleksandrs Urbahs
47	Experimental investigation of physico-mechanical properties nanostructured ion-plasma coatings	Margarita Urbach
48	High temperature nanomechanical testing	K.A. Rzepiejewska-Malyska
49	A method to estimate the cone indentation hardness of materials from their rheological schemes	G. Kermouche
50	Local identification of the stress-strain curves of metal materials at a high strain rate using repeated micro-impact testing	G. Kermouche
51	Fracture of glass-ceramic materials by instrumented indentation	Carlos Mauricio Lepienski
52	Micro-tensile test of nano-thick thin film specimen fabricated by transferring process	Bongkyun Jang
53	Strain rate sensitivity effects on the failure of metal films on compliant substrates	Megan J. Cordill
54	Adequateness of the effectively shaped indenter approach for the determination of yield strength	Frank Richter
55	Extreme high temperature nanoindentation testing to 750°C - for aerospace applications	Ben Beake
56	A coupled two degree of freedom model for nano/micromirrors under van der Waals Force	Hamid Moeenfarid
57		
58	Preparation of novel polyimide nanofoams and investigation of their physical and mechanical properties	Elham Aram

59	Direct measurement of contact area during spherical indentation of viscoelastic polymers	Andy Bushby
60	Determining real indenter geometry in spherical nanoindentation taking into account infinitesimal deformation of the indenter	Seung-Kyun Kang
61	High temperature instrumented microindentation tests to explore mechanical properties of architectutal cellular materials	Passilly Bruno
62	Nanomechanical testing of environmental barrier coatings	C.A. Botero
63	Nanoindentation testing of Ti6Al4V nanolayers modified by ion beam Methods	F. Cerny
64	Influence of pre-existing dislocations on the pop-in phenomenon during nanoindentation in MgO	Christoph Tromas
65	Broadband nanoindentation viscoplastic and viscoelastic spectroscopy	Joseph E. Jakes
66	Nanoscale deformation mechanism and fracture characterization by nanoindentation	Reza A. Mirshams
67	Dislocation substructures evolution in fatigue loaded and failed stainless steels processed by high-intensity electron beam	Victor Gromov
68	Fracture testing – from the microscale to macroscale	David E.J. Armstrong
69		
70	Micro-cantilever tests of strengthening from α/α and α/β boundaries in titanium alloys	Jicheng Gong
71	Nanoindentation study of homo-epitaxied 4H-SiC single crystals: the effect of doping	J. Rabier
72	Effect of in situ hydrogen charging on the pulsed plasma nitiding layer in stainless steels	Masoud Asgari
73	Direct evaluation of dislocation networks and dislocation density tensors from atomistic data	Christoph Begau
74	Onset of plasticity in silicon nanowires	Julien Godet
75	Theoretical and numerical investigation of nanoindentation of polymer layers involving effects of friction and adhesion	Zhaoyu Chen
76	Deformation analysis of vertically aligned carbon nanotube bundles under uniaxial compression	Shelby B. Hutchens
77	Nanoscale dynamic mechanical analysis of cartilaginous endplate	J. Sepitka
78	Micromechanical testing of stress corrosion cracking behaviour at individual Grain boundaries in stainless steel	Alisa Stratulat
79	Grain boundary strength in SiC system	Vineet Bhakhri
80	A New FIB-DIC material removal method for Poisson's Ratio and residual stress measurement at the micron scale	Marco Sebastiani
81	Investigation of the size dependent mechanical behavior of γ -Fe and non-alloyed DC04 steel	Simone Schendel
82	Effect of specimen size on the tensile strength of WC-Co hard metal	Thomas Klünsner
83	Observation of dislocation-movement in passivated Al film using in situ transmission electron microscopy nanoindentation	Ludvig de Knoop
84	3D-Experimental study of the formation of slip bands near boundaries in bicrystals with small dimension	Afrooz Barnoush