

Nanomechanical Testing in Materials Research and Development VII

Malaga, Spain
29 September - 4 October 2019

Editor:

Jon Molina-Aldareguia

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Sunday, September 29, 2019

- 09:30 – 10:00 Check-in for Optional Tutorial Session (Reception Lobby-Conference Center)
- 10:00 – 13:00 **Tutorial Session** (Salon Málaga – Level -1)
- Experimental fracture mechanics at the micron scale: Fundamentals, challenges and pitfalls...N/A**
Christoph Kirchlechner, MPIE, Germany
- Nanoscale residual stress and adhesion assessment...N/A**
Edoardo Bemporad, Università degli studi Roma Tre, Italy
- 13:00 – 14:00 Lunch (on your own)
- 15:00 – 16:30 Check-in for Conference (Reception Lobby – Conference Center)
- 16:30 – 16:40 Conference Welcome
Conference Chair: Jon Molina-Aldareguia
ECI Technical Liaison: Larry Kabacoff

Room locations and notes

- General Sessions will be held in the (Salon Málaga – Level -1)
- Poster Sessions will be in the Salon Torremolinos.
- The opening reception will be at the Central Pool
The cocktail dinner will be on the Roof.
- Meals will be in the Buffet Restaurant. Coffee breaks will be in the Salon Torremolinos
- Audio, still photo and video recording by any device (e.g., cameras, cell phones, laptops, PDAs, watches) is strictly prohibited during the technical sessions, unless the author and ECI have granted prior permission.
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Sunday, September 29, 2019 (continued)

Session I: In-Situ Micro and Nanomechanical Testing

Chair: Jon Molina-Aldareguia, IMDEA Materials Institute, Spain

- 16:40 – 17:20 **Opening lecture**
New electron microscopy techniques for determination of local structural features during plastic deformation...1
Andrew Minor, University of California Berkeley, USA
- 17:20 – 17:50 **(Highlight) Recent progresses in in-situ and 3D HR-EBSD techniques to assess deformation mechanism of materials at small scale...2**
Xavier Maeder, EMPA, Switzerland
- 17:50 – 18:10 **TEM in-situ deformation of magnesium-yttrium alloys...3**
Yu-Lung Chiu, University of Birmingham, United Kingdom
- 18:10 – 18:30 **In situ nanoindentation of Au crystals imaged by Bragg coherent X-ray diffraction...4**
Thomas Cornelius, CNRS, France
- 18:30 – 18:50 **TEM observation and in situ compression tests of transition alumina prepared by high pressure compaction at room temperature...5**
Karine Masenelli-Varlot, University of Lyon, INSA-Lyon, MATEIS, France
- 19:00 - 20:00 Welcome Reception (Central Pool)
- 20:00 - 21:30 Dinner (Roof)

Monday, September 30, 2019

07:30 – 09:00 Breakfast buffet

Session II: Plasticity at Small Scales I

Chairs: Gerhard Dehm, Max Planck Institute for Iron Research, Germany
Javier Llorca, IMDEA Materials Institute, Spain

09:00 – 09:40

Keynote

Determination of precipitate strengthening in Al-Cu alloys through micropillar compression: Experiments and multiscale simulations...6
Javier Llorca, IMDEA Materials Institute, Spain

09:40 – 10:10

(Highlight) Effect of sample size and grain boundaries on dislocation structures and damage evolution in small-scale samples: A micro-fatigue investigation...7

Christian Motz, Saarland University, Germany

10:10 – 10:40

(Highlight) The influence of 3-D interfacial structure and morphology on the mechanical behavior of nanocomposites...8

Nathan Mara, University of Minnesota, USA

10:40 – 11:00

On microstructural constraints for slip transfer in nanotwinned silver...9

Maya Katapadi Kini, MPIE, Germany

11:00 – 11:30

Coffee Break

11:30 – 12:00

(Highlight) Twin boundaries: Obstacles for or sources of dislocations?...10

Christoph Kirchlechner, MPIE, Germany

12:00 – 12:30

(Highlight) Probing grain boundary relaxation in ultra-fine grained tantalum by micromechanical spectroscopy in an SEM...11

Daniel Kiener, Montanuniversität Leoben, Austria

12:30 – 12:50

Grain-scale investigation of the anisotropy of PLC-type plastic instability...12

Henry Ovri, Helmholtz Zentrum Geesthacht, Germany

13:00 – 14:30

Lunch

14:30 – 16:30

Networking / Time for *ad hoc* discussions

Session III: Plasticity at Small Scales II

Chair: Marc Legros, CNRS, France

16:30 – 17:10

Keynote

Nano-mechanical behavior of bcc irons characterized through nanoindentation and TEM In-situ straining...13

Takahito Ohmura, Kyushu University, Japan

17:10 – 17:30

Nanomechanical testing of bcc micropillars – power laws and lattice resistance correlations...14

Brian Derby, University of Manchester, United Kingdom

17:30 – 17:50

Size effect in polymer-supported ultrathin metallic glass films...15

Oleksandr Glushko, Erich Schmid Institute, Austria

Monday, September 30, 2019 (continued)

- 17:50 – 18:10 **Suppressing damage in dual phase steel: Insights from micromechanics...16**
Chunhua Tian, MPIE, Germany
- 18:10 – 18:30 **Compression of gold sub-micron crystallites: Method and experiments...17**
Marc Verdier, CNRS, France
- 18:30 – 18:50 **Direct observation of dislocation plasticity in FeCrCoMnNi high-entropy alloys...18**
Subin Lee, MPIE, Germany
- 19:00 – 20:00 Poster Preview I
Poster Chairs: Benoit Merle (University Erlangen-Nürnberg, Germany) and Verena Maier-Kiener (Montanuniversität Leoben, Austria)
- 20:00 – 21:30 Dinner
- 21:30 – 23:00 **Poster Session I**

Tuesday, October 1, 2019

07:30 – 08:30 Breakfast buffet

Session IV: Hard Materials

Chair: Johann Michler, EMPA, Switzerland

08:30 – 09:00 **(Highlight) Dislocations in Laves phases – Phantastical beasts and how to understand them...19**

Sandra Korte-Kerzel, RWTH Aachen University, Germany

09:00 – 09:30 **(Highlight) Nanomechanical testing study of the elementary deformation mechanisms in the Ti_2AlN and Cr_2AlC MAX phases...20**

Christophe Tromas, Institut Pprime - Université de Poitiers, France

09:30 – 09:50 **Superelasticity of $ThCr_2Si_2$ -structured intermetallic compounds at the micrometer scale...21**

Seok-Woo Lee, University of Connecticut, USA

09:50 – 10:10 **Small-scale mechanical response of cemented carbides: Correlation between mechanical properties and microstructure...22**

Joan Josep Roa, Universidad Politecnica de Cataluña, Spain

10:10 – 10:30 **Nanomechanical behavior of individual phases and size effect in WC-Co by means of high temperature nanoindentation and electron microscopy: A study from ambient to high temperature...23**

Francois De Luca, National Physical Laboratory, United Kingdom

10:30 – 11:00 Coffee break

Session V: Fracture and Fatigue at Small Scales

Chair: Daniel Kiener, Montanuniversität Leoben, Austria

11:00 – 11:30 **(Highlight) Fracture toughness determination of arc-PVD and HiPIMS hard coatings by micro-cantilever and pillar splitting tests...24**

Johannes Ast, Innovation Centre of Nanotechnology and Correlative Microscopy, Germany

11:30 – 11:50 **The fracture behavior of Cr_2AlC coatings...25**

Bernhard Völker, RWTH Aachen University, Germany

11:50 – 12:10 **Strain Evolution around corrosion pits under fatigue loading using digital image correlation...26**

Robert Akid, University of Manchester, United Kingdom

12:10 – 12:30 **Mechanical characterization of a tribolayer created by high temperature fretting wear in a ceramic/metal alloy contact...27**

Gaylord Guillonneau, Université de Lyon, France

12:50 – 13:00 Meet up at the front lobby of the hotel for the excursion.

Buses leave promptly at 13:00

Tuesday, October 1, 2019 (continued)

13:00 – 18:30 Excursion – Lunch boxes on bus

Guided tour of Malaga*, ending with drinks/snacks at El Palmeral Restaurant and transfer back to hotel

*When the group arrives in Malaga, the guides will divide the group into smaller groups of 25. Some groups will start at the Museo Picasso and others at the Alcazaba. At 16:30, all groups will arrive at the El Palmeral Restaurant where they will enjoy a cocktail and a variety of canapés. The buses returning the group to the hotel will be waiting at the pick-up point (to be announced) to return the group to the conference hotel.

Session VI: High Throughput Testing

Chair: Karsten Durst, Technische Universität Darmstadt, Germany

18:45 – 19:15 **(Highlight) Deformation and fracture mechanisms in nanocomposite and nanolaminate thin films revealed through combinatorial design and nanomechanical testing...28**

Johann Michler, EMPA, Switzerland

19:15 – 19:45 **(Highlight) Mechanical phase mapping of meteorites: Combining EDX and nanoindentation...29**

Jeffrey Wheeler, ETH Zurich, Switzerland

19:45 – 20:05 **Nanoindentation: A powerful tool to explore the wide chemical space of high entropy alloys...30**

Mathilde Laurent-Brocq, Université Paris-Est (UPE), France

20:15 – 22:00 Dinner

Wednesday, October 2, 2019

07:30 – 09:00 Breakfast buffet

Session VII: In Operando/Extreme Conditions

Chairs: Mathias Göken, University Erlangen-Nurnberg, Germany
David Armstrong, University Of Oxford, United Kingdom

09:00 – 09:30 **(Highlight) Effects of temperature and irradiation damage on fracture around nanoindents...31**

David Armstrong, University Of Oxford, United Kingdom

09:30 – 09:50 **Micropillar compression study of Fe-irradiated 304L steel...32**

Marc Legros, CNRS, France

09:50 – 10:10 **Localized mechanical properties of SiC-SiC fiber composites in extreme environments – a micromechanical study...33**

Yevhen Zayachuk, University of Oxford, United Kingdom

10:10 – 10:30 **Evaluation of the environmental degradation of interphases in Ceramic Matrix Composites (CMCs) via in-situ SEM micromechanical testing...34**

Oriol Gavalda Diaz, Imperial College London, United Kingdom

10:30 – 10:50 **Elevated temperature nanoindentation and in-situ SEM mechanical testing of uranium fuels...35**

David Frazer, Los Alamos National Laboratory, USA

10:50 – 11:20 Coffee break

11:20 – 11:50 **(Highlight) Measuring nanoindentation hardness at high sustained strain-rates...36**

Benoit Merle, University Erlangen-Nürnberg (FAU), Germany

11:50 – 12:20 **(Highlight) Impact of temperature and hydrogen on the nanomechanical properties of a highly deformed high entropy alloy...37**

Verena Maier-Kiener, Montanuniversität Leoben, Austria

12:20 – 12:40 **Studying deformation mechanisms of nanocrystalline nickel by thermal activation analysis at subambient temperatures and high strain rates...38**

Johann Jakob Schwiedrzik, EMPA, Switzerland

12:40 – 13:00 **Hydrogen-microstructure interactions by novel back-side hydrogen charging during in situ nanoindentation...39**

Jazmin Maria Duarte Correa, MPIE, Germany

13:00 – 14:30 Lunch

14:30 – 16:30 Networking / Time for *ad hoc* discussions

Session VIII: Novel Methodologies

Chair: George Pharr, Texas A&M University, USA

16:30 – 17:00 **(Highlight) A new nanoindentation creep technique using constant contact pressure...40**

Karsten Durst, Technische Universität Darmstadt, Germany

Wednesday, October 2, 2019 (continued)

- 17:00 – 17:20 **Indentation creep testing of superalloys...41**
Mathias Göken, University Erlangen-Nurnberg, Germany
- 17:20 – 17:40 **Measurement of the creep behavior of thin ZrNi metallic glass films – a comparison between nanoindentation relaxation, nanoindentation creep and lab-on-chips experiments...42**
Guillaume Kermouche, CNRS, France
- 17:40 – 18:00 **Direct observation of yield in films by flat punch indentation...43**
John Pethica, Trinity College Dublin, Ireland
- 18:00 – 18:20 **Measurement of hardness and elastic modulus by depth sensing indentation: Further advances in understanding and refinements in methodology...44**
Sudharshan Phani Pardhasaradhi, International Advanced Research Centre for Powder Metallurgy and New Materials, India
- 18:20 – 18:40 **A new approach to evaluate residual stress using instrumented indentation testing at nano scale...45**
Dongil Kwon, Seoul National University, South Korea
- 19:00 – 20:00 Poster Preview II
Poster Chairs: Benoit Merle (University Erlangen-Nürnberg, Germany) and Verena Maier-Kiener (Montanuniversität Leoben, Austria)
- 20:00 – 21:30 Dinner
- 21:30 – 23:00 **Poster Session II**

Thursday, October 3, 2019

07:30 – 09:00 Breakfast

Session IX: Biological Materials

Chair: Sandra Korte-Kerzel, RWTH Aachen University, Germany

09:00 – 09:40

Keynote

Passive and active mechanics of Banksia seed pods...46

Michaela Eder, Max-Planck-Institute of Colloids and Interfaces, Germany

09:40 – 10:10

(Highlight) Small scale fracture of bone to understand the effect of fibrillar organization on toughness...47

Finn Giuliani, Imperial College London, United Kingdom

10:10 – 10:30

Microtensile properties and failure mechanisms of bone on the lamellar level...N/A

Daniele Casari, EMPA Thun, Switzerland

10:30 – 10:50

Correlation of ultra-fine real-geometry FEM models of diatoms derived from nano-X-ray tomography with in-situ nanomechanical testing...48

André Clausner, Fraunhofer IKTS, Germany

10:50 – 11:20

Coffee break

Session X: Novel Instrumentation

Chair: Jeffrey Wheeler, ETH Zurich, Switzerland

11:20 – 11:40

High strain rate plasticity in microscale glass...49

Rajaprakash Ramachandramoorthy, EMPA, Switzerland

11:40 – 12:00

High-resolution strain-mapping during in-situ nanoindentation of CVD thin films...50

Gudrun Lotze, MAX IV Laboratory, Sweden

12:00 – 12:20

Correlative in situ total and elastic strain mapping on micromechanical test pieces by DIC and HR-EBSD...51

Thomas E.J. Edwards, EMPA, Switzerland

12:20 – 12:40

In-situ microcompression high cycle fatigue tests: Up to 1 kHz frequencies and 10 million oscillation cycles...52

Gaurav Mohanty, Tampere University, Finland

12:40 – 13:00

Surface acoustic wave spectroscopy versus nanoindentation: Potentials and limits for coating characterization...53

Martin Zawischa, Fraunhofer Institute for Material and Beam Technology IWS, Germany

13:00 – 14:30

Lunch

14:30 – 16:30

Networking / Time for *ad hoc* discussions

Thursday, October 3, 2019 (continued)

Session XI: Novel Applications

Chairs: Jon Molina-Aldareguia, IMDEA Materials Institute, Spain
Ralph Spolenak, ETH Zurich, Switzerland

- 16:30 – 17:00 **(Highlight) Multi-metal electrohydrodynamic redox 3d printing at the submicron scale: Microstructure – geometrical gradients – chemical gradients and the resulting mechanical properties...54**
Ralph Spolenak, ETH Zurich, Switzerland
- 17:00 – 17:20 **Understanding fracture in laser additive manufactured bulk metallic glass through small-scale mechanical measurement...55**
James P. Best, CSIRO, Australia
- 17:20 – 17:40 **Micromechanical testing at high strain rates and varying temperatures of 3D-printed polymer structures...56**
Nadia Rohbeck, EMPA, Switzerland
- 17:40 – 18:00 **Small scale mechanical testing of nanoporous tungsten tailored by reverse phase dissolution...57**
Mingyue Zhao, Montanuniversität Leoben, Austria
- 18:00 – 18:20 Refreshments
- 18:20 – 18:50 **(Highlight) Mechanical and electrical failure of transparent nanowire Electrodes...58**
Erdmann Spiecker, Institute of Micro- and Nanostructure Research & Center for Nanoanalysis and Electron Microscopy (CENEM), Germany
- 18:50 – 19:10 **Nanomechanical characterization of high pressure torsion processed HfNbTaTiZr high entropy alloy...59**
Petr Haušild, Czech Technical University in Prague, Czech Republic
- 19:10 – 19:30 **Electroplastic deformation studies of an Al-Cu eutectic alloy using nanoindentation...60**
Doreen Andre, Institute of Physical Metallurgy and Metal Physics, Germany
- 19:30 – 19:50 **Characterization of particle distribution in a black carbon-filled elastomer via nanoindentation...61**
Paul Baral, LTDS, France
- 20:30 – 22:30 Conference Dinner

Friday, October 4, 2019

07:30 – 09:00

Breakfast and Departures

Poster Presentations

Monday, September 30, 2019

- M1 **Local fatigue characterisation of ARB processed copper sheets by dynamic micropillar compression...62**
Sebastian Krauß, Friedrich-Alexander-University Erlangen-Nürnberg (FAU), Germany
- M2 **Effect of lamellar orientation and width on the strength and operating deformation mechanisms of fully lamellar TiAl alloys determined by micropillar compression...63**
Cristina Gutiérrez-García, Imdea Materials, Spain
- M3 **Nanomechanical behavior of optically optimized AlN/SiO₂ and AlN/Ag nanomultilayers...64**
Chelsea Applegate, University of Southern California, USA
- M4 **Investigating thermally activated deformation mechanisms by high temperature nanoindentation – A Study on W-Re alloys...65**
Johann Kappacher, Montanuniversitaet Leoben, Austria
- M5 **Mechanical characterisation of the protective Al₂O₃ scale in Cr₂AlC MAX phases...66**
James S.K-L. Gibson, RWTH Aachen University, Germany
- M6 **Nanomechanical testing for crystal plasticity constitutive framework identification at high strain rates...67**
Simon Breumier, Ecole des Mines de Saint-Etienne, France
- M7 **Measurement of enhanced ductility in nanolayered ceramics via micro-compression testing and digital image correlation...68**
Julia T. Pürstl, University of Cambridge, United Kingdom
- M8 **In-situ deformation monitoring of thin electrochemically deposited copper lines during thermo-mechanical pulsing...69**
Manuel Kleinbichler, Kompetenzzentrum Automobil- und Industrieelektronik GmbH, Austria
- M9 **Tension-compression strength asymmetry of bone extracellular matrix...70**
Daniele Casari, EMPA Thun, Switzerland
- M10 **3D-Laue micro diffraction to characterize fatigue damage in bi-crystalline micro cantilevers...71**
Jean-Baptiste Molin, Max-Planck-Institut für Eisenforschung GmbH, Germany
- M11 **Strength and hardness enhancement and slip behaviour of high-entropy carbide grains during micro-compression and nanoindentation...72**
Tamás Csanádi, Slovak Academy of Sciences, Slovakia
- M12 **In situ ultrafine force measurement with nanowire based cantilevers in SEM...73**
Erdmann Spiecker, Friedrich-Alexander University Erlangen-Nuremberg, Germany
- M13 **Nanoindentation testing conditions - Controlling temperature and humidity?...74**
Wolfgang Stein, SURFACE, Germany
- M14 **Effect of impurity doping on mechanical performance and microstructure in ultra-fine grained tungsten processed by HPT...75**
Michael Wurmshuber, Montanuniversitaet Leoben, Austria

- M15 **Probing the limits of strength in diamonds: From single- and nano-crystalline to diamond-like-carbon (DLC)...76**
Ming Chen, Laboratory for Nanometallurgy, ETH Zurich, Switzerland
- M16 **In-situ TEM straining experiments in Cantor's alloy at room and LN2 temperatures...77**
Daniela Oliveros, CEMES-CNRS, France
- M17 **Small scale fracture of multi metal carbide coatings...78**
Hariprasad Gopalan, MPIE, Düsseldorf, Germany
- M18 **Micro-mechanical testing of ceramic matrix composites; Extraction of critical interface properties and impact on composite optimization...79**
Joey Kabel, University of California, Berkeley, USA
- M19 **Deep-learning assisted damage observations on the microscale – A new viewpoint on microstructural deformation, fracture and decohesion processes...80**
Carl F. Kusche, RWTH Aachen, Germany
- M20 **A fully integrated in-situ solution for materials testing in SEM...81**
Fang Zhou, Carl Zeiss Microscopy GmbH, Germany
- M21 **In-situ bending tests of penta-twinned Ag NWs and their structure analyses...82**
Hu Zhao, University of Manchester, United Kingdom
- M22 **Machine learning based characterization of nanoindentation induced acoustic events...83**
Antanas Daugela, Nanometronix LLC, USA
- M23 **Micromechanical characterization of single-crystalline niobium at low temperature...84**
Gyuho Song, University of Connecticut, USA
- M24 **Subcritical crack growth in freestanding silicon nitride and silicon dioxide thin films using residual stress-induced crack on-chip testing technique...85**
Sahar Jaddi, Université catholique de Louvain, Belgium
- M25 **Tensile behavior of amorphous alumina thin films deposited by plasma enhanced atomic layer deposition (PEALD)...86**
Jeong-Hyun Woo, UNIST, South Korea
- M26 **Characterization of mechanically alloyed FeAlSi intermetallic powders...87**
Jaroslav Čech, Czech Technical University in Prague, Czech Republic
- M27 **Improved burst pressure of LPCVD Si₃N₄ membranes by nanometer thick compressive adlayers...88**
Airat Shafikov, University of Twente, Netherlands
- M28 **Enhanced strength and ductility of multilayers made by Electrolytic Additive Manufacturing...89**
Naresh Radaliyagoda, Coventry University, United Kingdom
- M29 **Nanoindentation properties of shock-compressed single crystal Magnesium...90**
Tyler J. Flanagan, University of Connecticut, USA
- M30 **Nanomechanical testing of freestanding polymer thin films...91**
Nathan R. Velez, University of California, Berkeley, USA

- M31 **Increase in stretchability of thermally grown silicon dioxide film...92**
Na-Hyang Kim, UNIST, South Korea
- M32 **Micro-mechanical testing by fibre pushout of the BN interlayer in SiCf/SiC composites for aero-propulsion...93**
Robin De Meyere, University of Oxford, United Kingdom
- M33 **Advanced adhesion evaluation for brittle coating materials using the scratch test method...94**
Martin Zawischa, Fraunhofer Institute for Material and Beam Technology IWS, Germany
- M34 **Micromechanisms of compressive failure of fibre reinforced polymers...95**
Finn Giuliani, Imperial College London, United Kingdom
- M35 **Significance of the interconnectivity of intermetallic Laves phases on the mechanical behavior of Mg-Al-Ca alloys...96**
Muhammad Zubair, Institut für Metallkunde und Metallphysik (IMM), RWTH Aachen, Germany
- M36 **Evaluation of tensile properties using instrumented indentation technique for small scale testing...97**
Jongho Won, Seoul National University, South Korea
- M37 **Measuring the fracture energy of WC grain boundaries...98**
Max Emmanuel, Imperial College London, United Kingdom
- M38 **Wear mechanism of olivine at the small-scale: An in situ TEM study...99**
Ude Hangen, Bruker, Germany
- M39 **On the use of nano-indentation for tensile property correlation of ferrous metals...100**
Ana Ruiz Moreno, Joint Research Centre. European Commission, Netherlands
- M40 **Addressing the impact of fracture during indentation of molecular crystals...101**
Alexandra C. Burch, Purdue University, USA
- M41 **Gallium-free micromechanical sample preparation from ECAPed aluminium...102**
Hana Tesařová, Tescan Orsay Holding, Czech Republic

Wednesday, October 2, 2019

- W1 **The influence of pre-deformation on the fracture toughness of chromium, studied by microcantilever bending...103**
Stefan Gabel, Friedrich-Alexander University Erlangen-Nuremberg, Germany
- W2 **Deformation and failure of microscale mechanical metamaterials...104**
Chantal Miriam Kurpiers, Karlsruhe Institute of Technology, Germany
- W3 **In situ fragmentation analysis of ALD-PVD multilayers on flexible substrates...105**
Barbara Putz, EMPA Thun, Switzerland
- W4 **Exploring the mechanical character of molybdenum grain boundaries via nanoindentation and three-point-bending...106**
Severin Jakob, Montanuniversitaet Leoben, Austria
- W5 **Investigation of a high angle grain boundary in Fe_{2.4}wt.%Si BCC micropillars...107**
Martin Heller, Institute of Physical Metallurgy and Metal Physics RWTH Aachen, Germany
- W6 **Multi-mechanical in situ testing for automotive industry DLC/interlayer/M2-Steel coatings...108**
Sergio Sao Joao, Mines Saint-Etienne, LGF UMR5307 CNRS, France
- W7 **Role of film microstructure on interface stability: in-situ and ex-situ investigations...109**
Alice Lassnig, Erich Schmid Institute of Materials Science, Austria
- W8 **High frequency acoustic emission monitoring in nano-impact of bulk ceramics...110**
Ben D. Beake, Micro Materials Ltd, United Kingdom
- W9 **Microscale fracture of chromia scales...111**
Anand H. S. Iyer, Chalmers University of Technology, Sweden
- W10 **Ni-P: Microstructure and micro-compression...112**
Chaowei Du, Max-Planck-Institut für Eisenforschung GmbH, Germany
- W11 **Influence of transition metals on the solid solution strengthening and creep behavior of Nickel studied by ultra-high temperature nanoindentation testing...113**
Christian Minnert, Technische Universität Darmstadt, Germany
- W12 **Microstructure and high temperature mechanical properties of hard TaSiN coatings...114**
Miguel A. Monclus, IMDEA Materials Institute, Spain
- W13 **Influence of alloying elements on the mechanical properties, especially fracture toughness, of the WB₂-z base system...115**
Rainer Hahn, CDL-SEC, Technische Universitaet Wien, Austria
- W14 **Stress-strain curves and derived mechanical parameters of P91 steel from spherical nanoindentation at a range of temperatures...116**
Ana Ruiz Moreno, Joint Research Centre. European Commission, Netherlands
- W15 **Grain boundary-based plasticity mechanisms in nanostructured metals...117**
Romain Gautier, CEMES-CNRS, France
- W16 **The influence of surface roughness on elastic nanoindentation measurements...118**
Wieland Heyn, Fraunhofer IKTS, Germany

- W17 **The smallest macroscale tensile test - a model to describe constrained flow at the microscale...119**
Hi T. Vo, University of California, Berkeley, USA
- W18 **New instrumentation and analysis methodology for nano-impact testing...120**
Mario Rueda-Ruiz, IMDEA Materials Institute, Spain
- W19 **Modulus and hardness determination using instrumented nanoindentation tests – How reliable are the results?...121**
Dennis Bedorf, SURFACE, Germany
- W20 **Quantitative percussion diagnostics for detecting ultrafine cracks...122**
James Earthman, University of California, Irvine, USA
- W21 **DMA Dynamic characterization of viscoelastic solids by AFM: The nano DMA mode...123**
Ude Hangen, Bruker, Germany
- W22 **One million indents, a hardness (and modulus) story...124**
Ude Dirk Hangen, Bruker BNS, Germany
- W23 **Fatigue damage in Ag nanowire networks...125**
Chongguan Liu, University of Manchester, United Kingdom
- W24 **Graphene effect on mechanical response of copper film...126**
Farzaneh Bahrami, Université catholique de Louvain, IMMC,IMAP, Belgium
- W25 **Hydrogen effects on nanomechanical behavior of additively manufactured 316L stainless steels...127**
Jeong-Min Park, Hanyang University, South Korea
- W26 **Influence of annealing temperature on the mechanical properties of carbon supersaturated TaW coatings...128**
Stefan Fritze, Uppsala University, Sweden
- W27 **Micro-nano scale characterization of thermally treated single basalt fibres...129**
Edoardo Rossi, Roma Tre University, Italy
- W28 **The influence of reinforcing nano-particles on indentation size effect and microhardness of metallic materials...130**
Miriam Kupková, Slovak Academy of Sciences, Slovakia
- W29 **Exploring size effects in copper-chromium-zirconium using indentation techniques and in-situ micro-pillar compression...131**
Alexandra J. Cackett, UKAEA, United Kingdom
- W30 **In situ nanocompression tests in an environmental TEM to study plasticity of cerium oxides...132**
Rongrong Zhang, University of Lyon, INSA-Lyon, France
- W31 **Highly-stretchable and water impermeable thermally-grown silicon dioxide thin film with wavy structures...133**
Na-Hyang Kim, UNIST, South Korea
- W32 **Effect of anisotropic elasticity on dislocation pile-ups at grain boundaries...134**
Xiaolei Chen, Université de Lorraine, CNRS, Arts et Métiers ParisTech, France

- W33 **Nano-mechanical behavior of ultra-stable amorphous metallic thin films...135**
Jeong-Hyun Woo, UNIST, South Korea
- W34 **The impact of twin boundary migration on mechanical performance of magnesium...136**
Mohammadhadi Maghsoudi, Helmholtz-Zentrum Geesthacht, Germany
- W35 **Effect on Nanoindentation in La₂O₃-reinforced W and W–V alloys produced by hot isostatic pressing...137**
Javier Martínez-Gómez, Universidad Internacional SEK, Spain
- W36 **From micro-mechanical properties to tribological performance...138**
Jona Engel, ETH Zurich, Switzerland
- W37 **Influence of densification on the indentation cracking behaviour...139**
Karsten Durst, Technical University of Darmstadt, Germany
- W38 **Identification of residual stress directionality using anisotropic indenter in instrumented indentation testing...140**
JunSang Lee, Seoul National University, South Korea
- W39 **Measurement of Young's modulus of thin SmS films by Nanoindentation and surface acoustic wave...141**
Francois De-Luca, National Physical Laboratory, United Kingdom
- W40 **Atomic arrangement and mechanical properties of chemical vapor deposited amorphous boron...142**
Jessica M. Maita, University of Connecticut, USA