

July 2 Monday

8:00- Registration at Hokkaido University Conference Hall

8:30-8:40 Opening Address

TOPIC 1 MECHANICAL MODELING

Session Chair:

Dongil Kwon [Seoul National University, Korea]

8:40-9:25 **The Love equation for the normal loading of a rigid cone on an elastic half-space and its recent modification**

Keynote

Munawar Chaudhri

Cavendish Laboratory, Department of Physics, University of Cambridge, UK

Email: mmc11@cam.ac.uk

9:25-10:00 **Computational and experimental investigation of nanoindentation patterns and deformation mechanisms in pure zinc polycrystal**

Invited

Fazilay Abbès¹, Jean-Sébastien Lecomte², Nhan P. T. Nguyen¹ and Boussad Abbès¹

¹GRESPI, University of Reims Champagne Ardenne, France

²LEM3, University of Lorraine, France

Email: fazilay.abbes@univ-reims.fr

10:00-10:25 **Modes of Deformation in Wedge Indentation of Metals**

Srinivasan Chandrasekar¹, Koushik Viswanathan¹, Anirudh Udupa¹, Narayan Sundaram² and Yang Guo³

¹School of Industrial Engineering, Purdue University, USA

²Department of Civil Engineering, Indian Institute of Science, India

³Department of Mechanical Engineering, Michigan State University, USA

Email: chandy@purdue.edu

10:25-10:55 Coffee Break

Session Chair:

Boussad Abbès [University of Reims Champagne Ardenne, France]

10:55-11:30 **Mechanical Property Characterization Using Instrumented Indentation Test: Strength, Toughness and Residual Stress**

Invited

Dongil Kwon¹, Jong-hyoung Kim¹ and Kwang-ho Kim²

¹Department of Materials Science and Engineering, Seoul National University, Korea

²Frontics, Inc., Korea

Email: dongilk@snu.ac.kr

11:30-11:55 **Evaluating Directionality of Residual Stress Using Instrumented Indentation Test with Anisotropic Indenter in Multi Scale**

Jun Sang Lee, Jong-hyong Kim, Sungki Choi, Kyung-Yul Lee and Dongil Kwon

Department of Materials Science and Engineering, Seoul National University, Korea

Email: tpflwkdhk@snu.ac.kr

11:55-12:05 General Discussion

12:05-12:15 Workshop Photo at the Conference Hall

12:15-13:30 Lunch Break

TOPIC 2 IN-SITU STRAINING

Session Chair:

Jer-Ren Yang [National Taiwan University, Taiwan]

13:30-14:15 **Local Strain Analysis using Scanning Nanobeam Electron Diffraction during *in situ* TEM Nanomechanical Testing**

Keynote

Andrew M. Minor

Department of Materials Science & Engineering, University of California Berkeley, and the National Center for Electron Microscopy, Molecular Foundry, Lawrence Berkeley National Laboratory, USA

Email: aminor@berkeley.edu

- 14:15-14:50 **Deformation Mechanisms at the Nanoscale - From superplastic deformation to thin films**
Invited
Mathias Göken, Patrick Feldner, Jan Philip Liebig and Benoit Merle
Materials Science and Engineering, Institute I, Friedrich-Alexander-University Erlangen-Nürnberg, Germany
Email: mathias.goeken@fau.de
- 14:50-15:15 ***In Situ* TEM Fatigue of Copper Thin Films**
Daniel Bufford¹, Douglas Stauffer², William Mook¹, S.A. Syed Asif², Brad Boyce¹ and Khalid Hattar¹
¹Sandia National Laboratories, USA
²Bruker Nano, Inc., USA
Email: douglas.stauffer@bruker.com
- 15:15-15:40 **Dynamic Behavior and Interface Structure of Rhombohedral Twinning in Sapphires**
Eita Tochigi^{1,2}, Miao Bin¹, Shun Kondo², Atsutomo Nakamura³, Naoya Shibata^{1,2,4} and Yuichi Ikuhara^{1,2,4}
¹Institute of Engineering Innovation, The University of Tokyo, Japan
²ESISM, Kyoto University, Japan
³Department of Materials Physics, Nagoya University, Japan
⁴Japan Fine Ceramics Center, Japan
Email: tochigi@sigma.t.u-tokyo.ac.jp
- 15:40-16:10 Coffee Break

TOPIC 3

STEELS, SHAPE MEMORY ALLOYS

Session Chair:

Alfonso H.W. Ngan [University of Hong Kong, China]

16:10-16:45

In-situ nanoindentation (coupled with TEM) investigation of deformation behavior of spinodal nanostructured theta-ferrite nanopillars in a duplex stainless steel

Invited

Jer-Ren Yang¹, Yi-Chieh Hsieh¹, Ling Zhang², Tsai-Fu Chung¹ and Takahito Ohmura³

¹Department of Material Science and Engineering, National Taiwan University, Taiwan

²College of Materials Science and Engineering, Chongqing University, China

³Research Center for Structural Materials, National Institute for Materials Science, Japan

Email: jryang@ntu.edu.tw

16:45-17:10

Nanoindentation characterization of heterogeneous multilayered interstitial-free steel

Ling Zhang^{1,2}, Xiaojuan Jiang¹, Guilin Wu¹ and Xiaoxu Huang¹

¹College of Materials Science and Engineering, Chongqing University, China

²Electron Microscopy Center of Chongqing University, Chongqing University, China

Email: zhangling2014@cqu.edu.cn

17:10-17:35

Finite Element Simulations on Indentation Response of Shape Memory Alloys

Anuja Jaganathan¹, R. Narasimhan² and U. Ramamurty¹

¹Department of Materials Engineering, Indian Institute of Science, India

²Department of Mechanical Engineering, Indian Institute of Science, India

Email: anujaj3891@gmail.com

17:35-17:45

General Discussion

July 3 Tuesday

TOPIC 4 FILMS AND COATINGS, TRIBOLOGY, SURFACE

Session Chair:

Mathias Göken [Friedrich-Alexander-University Erlangen-Nürnberg, Germany]

8:45-9:30 **Finite Element Modeling of Nanoindentation and Scratch Testing in the Hard Coating/Softer Substrate System**

Keynote

František Lofaj and Dušan Németh

Institute of Materials Research of the Slovak Academy of Sciences, Slovakia

Email: flofaj@saske.sk

9:30-10:05 **Utilization and Issues of Nanoindentation in the Tribology Field**

Invited

Shinya Sasaki

Department of Mechanical Engineering, Tokyo University of Science, Japan

Email: s.sasaki@rs.tus.ac.jp

10:05-10:35 Coffee Break

Session Chair:

František Lofaj [Institute of Materials Research of the Slovak Academy of Sciences, Slovakia]

10:35-11:00 **Rebound Hardness Testing by Using Hammer with Pyramidal Indenter - Effect of Substrate on Restitution Coefficient of Coatings -**

Kenji Matsuda and Tomohiro Inoue

Department of Mechanical and Control Engineering, Kyushu Institute of Technology, Japan

Email: matsuda@mech.kyutech.ac.jp

11:00-11:25 **The Impact of Thermal Annealing on the Mechanical and Thermal Characteristics of Electroformed Ni-52wt%Fe Alloy Film**

Hyeonjin Eom¹, Minsu Lee¹, Tai Hong Yim¹ and Giovanni Maizza²

¹Surface Technology R&D Group, Korea Institute of Industrial Technology, Korea

²Department of Applied Science and Technology, Polytechnic University of Turin, Italy

Email: hyeonjin@kitech.re.kr

11:25-11:50 **Indentation Hardness of Ion-Irradiated Materials Revisited**

Ryuta Kasada

Institute for Materials Research, Tohoku University, Japan

Email: r-kasada@imr.tohoku.ac.jp

11:50-12:00 General Discussion

12:00-13:30 Lunch Break

TOPIC 5 SOFT MATTER

Session Chair:

Karsten Durst [Technical University Darmstadt, Germany]

13:30-14:05 **Indentation of ultra-soft materials: pico-indentation of non-adherent cells in the Pa-modulus range**

Invited

Alfonso H.W. Ngan¹, Z.L. Zhou¹, X.X. Sun¹ and B. Tang²

¹Department of Mechanical Engineering, University of Hong Kong, China

²Department of Biomedical Engineering, South University of Science and Technology, China

Email: hwngan@hku.hk

14:05-14:40 **Mechanical Properties of Polymer Thin Films near Interfaces and Free Surfaces**

Invited

Yoshihisa Fujii¹ and Naoya Torikai²

¹Department of Chemistry for Materials, Graduate School of Engineering, Mie University, Japan

²Graduate School of Regional Innovation Studies, Mie University, Japan

Email: fujii@chem.mie-u.ac.jp

14:40-15:05 **Micro-indentation Hardness of Lysozyme Crystals**

Ryo Suzuki¹, Chika Shigemoto¹, Marina Abe¹, Hidenobu Murata¹, Masaru Tachibana¹ and

Kenichi Kojima²

¹Graduate School of Nanobioscience, Yokohama City University, Japan

²Department of Education, Yokohama Soei University, Japan

Email: kkojima@soei.ac.jp

- 15:05-15:30 **Mechanical Behavior of Molecular Crystals**
Kiran Mangalampalli¹ and Upadrasta Ramamurty²
¹SRM Research Institute, Department of Physics and Nanotechnology, SRM University, India
²Department of Materials Engineering, Indian Institute of Science, India
Email: kiranmangalampalli.k@ktr.srmuniv.ac.in
- 15:30-16:00 Coffee Break

TOPIC 6 GLASSES

Session Chair:

Shinya Sasaki [Tokyo University of Science, Japan]

16:00-16:35 **Towards the Design of Indentation Crack Resistant Oxide Glasses**

Invited

Morten M. Smedskjaer

Department of Chemistry and Bioscience, Aalborg University, Denmark

Email: mos@bio.aau.dk

16:35-17:00 **In-situ Raman Measurements of Silicate Glasses during Indentation**

Satoshi Yoshida, Thu Huyen Nguyen, Akihiro Yamada and Jun Matsuoka

Department of Materials Science, The University of Shiga Prefecture, Japan

Email: yoshida@mat.usp.ac.jp

17:00-17:10 General Discussion

17:10-19:30 Poster Session

- Core Time -

presentation of odd-numbered posters (17:10-18:10)

presentation of even-numbered posters (18:10-19:10)

July 4 Wednesday

TOPIC 7	INSTRUMENTATION, STANDARDIZATION
	Session Chair: Jae-il Jang [Hanyang University, Korea]
8:45-9:30	High Temperature, High Strain Rate and Two Dimensional Indentation Testing <i>Keynote</i> <u>Warren C. Oliver</u> Nanomechanics, Inc., USA Email: warren.oliver@nanomechanicsinc.com
9:30-10:05	Towards the standardization of Dynamic Instrumented Indentation Testing <i>Invited</i> <u>Michael Griepentrog</u> Bundesanstalt für Materialforschung und –prüfung, Germany Email: michael.griepentrog@bam.de
10:05-10:35	Coffee Break - Instrument Marker Session - Session Chair: Michael Griepentrog [Bundesanstalt für Materialforschung und –prüfung, Germany]
10:35-10:55	Anton Paar GmbH
10:55-11:15	Bruker Corporation
11:15-11:35	Frontics, Incorporated
11:35-11:55	Nanomechanics, Incorporated
11:55-12:05	General Discussion
12:40-	Excursion, BBQ Dinner

July 5 Thursday

TOPIC 8 CRYSTAL DEFECTS

Session Chair:

Jorge Alcalá [Universitat Politècnica de Catalunya, Spain]

8:45-9:30 **Indentation Size Effect - New insights based on High Resolution EBSD and etch pit analysis**

Keynote

Karsten Durst and Farhan Javaid

Physical Metallurgy, Technical University Darmstadt, Germany

Email: k.durst@phm.tu-darmstadt.de

9:30-10:05 **Atomistic Prediction of Temperature and Loading-rate Dependent Critical Indentation Load of the Onset of Homogeneous Dislocation Nucleation**

Invited

Shigenobu Ogata¹, Takahito Ohmura² and Yuji Sato¹

¹Department of Mechanical Science and Bioengineering, Osaka University, Japan

²Research Center for Structural Materials, National Institute for Materials Science, Japan

Email: ogata@me.es.osaka-u.ac.jp

10:05-10:35 Coffee Break

Session Chair:

Heung Nam Han [Seoul National University, Korea]

10:35-11:10 **Understanding nanoscale hardness across crystal structures and temperatures**

Invited

Jorge Alcalá¹, Javier Varillas^{1,2}, Jordi Torner¹ and Jan Očenášek²

¹InSup, Department of Materials Science and Metallurgical Engineering, ETSEIB. Universitat Politècnica de Catalunya, Spain

²New Technologies Research Centre, University of West Bohemia in Pilsen, Czech Republic

Email: jorge.alcala@upc.es

- 11:10-11:35 **Investigations of structural phase transformations of Si, Ge, GaAs single crystals, and GaN nanomembranes due to nanoindentation for advanced applications**
M. M. Khayyat¹, E. Le. Bourhis², B. S. Ooi³ and Munawar M. Chaudhri⁴
¹Materials Science Research Institute, King Abdullaziz City for Science and Technology (KACST), Saudi Arabia
²Université de Poitiers, Département de Physique et Mécanique des, France
³Computer, Electrical & Mathematical Sciences & Engineering Division (CEMSE), King Abdullah University for Science and Technology (KAUST), Saudi Arabia
⁴Emeritus Reader, University of Cambridge, UK
Email: mkhayyat@kacst.edu.sa
- 11:35-12:00 **High fracture strength of flaw containing alumina hollow nanostructures for high-efficiency GaN LEDs**
Sung-gyu Kang, Daeyoung Moon, Euijoon Yoon, Heung Nam Han and In-suk Choi
Department of Materials Science and Engineering, RIAM, Seoul National University, Korea
Email: insukchoi@snu.ac.kr
- 12:00-12:10 General Discussion
- 12:10-13:30 Lunch Break

TOPIC 9 BULK METALS

Session Chair:

Morten M. Smedskjaer [Aalborg University, Denmark]

- 13:30-14:05 **A study on ductile-brittle transition of tungsten using nano-indentation**

Invited

Yeonju Oh¹, Nojun Kwak¹, Won-seok Ko² and Heung Nam Han¹

¹Department of Materials Science and Engineering & Research Institute of Advanced Materials, Seoul National University, Korea

²School of Materials Science and Engineering, University of Ulsan, Korea

Email: hnhan@snu.ac.kr

- 14:05-14:40 **Mechanics of Instrumented Indentation Test for Elastoplastic Alloys**
Invited
Giovanni Maizza¹, Frediano De Marco² and Renato Pero³
¹Department of Applied Science and Technology (DISAT), Politecnico di Torino, Italy
²National Interuniversity Consortium of Materials Science and Technology (INSTM), Italy
³Department of Industrial Engineering, Università di Roma "Tor Vergata", Italy
Email: giovanni.maizza@polito.it
- 14:40-15:15 **Nanoindentation study on advanced structural materials: Beyond hardness and modulus**
Invited
Dong-Hyun Lee¹, Guanghui Yang¹, Megumi Kawasaki², Upadrasta Ramamurty³ and
Jae-il Jang¹
¹Division of Materials Science and Engineering, Hanyang University, Korea
²School of Mechanical, Industrial & Manufacturing Engineering, Oregon State University, USA
³Department of Materials Engineering, Indian Institute of Science, India
Email: jijang@hanyang.ac.kr
- 15:15-15:40 **Size dependent beam bending toughness on porous network structure in sintered Ag targeted for wide bandgap power device packaging**
Shijo Nagao, Chuantong Chen, Hao Zhang and Katsuaki Suganuma
The Institute of Scientific and Industrial Research, Osaka University, Japan
Email: shijo.nagao@sanken.osaka-u.ac.jp
- 15:40-16:10 Coffee Break

TOPIC 10 INDENTATION CREEP

Session Chair:

Giovanni Maizza [Polytechnic University of Turin, Italy]

- 16:10-16:45 **Mechanical Characterization at High Temperature through Instrumented Indentation Testing Techniques**

Invited

Hidenari Takagi

Department of General Education, College of Engineering, Nihon University, Japan

Email: takagi.hidenari@nihon-u.ac.jp

16:45-17:10 **Evaluation of creep compliance in necking part of thermoplastic by multicycle indentation**

Shunnosuke Kishibe and Kenichi Sakaue

Department of Mechanical Engineering, Shibaura Institute of Technology, Japan

Email: md17030@shibaura-it.ac.jp

TOPIC 11 HYDROGEN EFFECTS

17:10-17:35 **Contributions of hydrogen on the mechanical properties of Nickel**

Mohammad Zamanzade, Christian Müller and Christian Motz

Department of Materials Science, Saarland University, Germany

Email: m.zamanzade@matsci.uni-sb.de

17:35-18:00 **Hydrogen Embrittlement Evaluation of Drawn Pearlitic Steel by In-situ Microbending Test during Cathodic Hydrogen Charging**

Kota Tomatsu¹, Takafumi Amino¹, Tetsushi Chida¹, Makoto Okonogi², Hikaru Kawata³,
Syunya Uji³, Tomohiko Omura¹, Naoki Maruyama³ and Yoshitaka Nishiyama¹

¹ Steel Research Laboratories, Nippon Steel & Sumitomo Metal Corporation, Japan

² Kimitsu R & D Lab., Nippon Steel & Sumitomo Metal Corporation, Japan

³ Advanced Technology Research Laboratories, Nippon Steel & Sumitomo Metal Corporation, Japan

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18:00-18:10 General Discussion

19:00- Banquet

July 6 Friday

TOPIC 12 NEW METHODOLOGY

Session Chair:

Warren C. Oliver [Nanomechanics, Inc., USA]

8:45-9:20 **Adhesive Indentation Contact of Soft Matter**

Invited

Tatsuya Miyajima and Mototsugu Sakai

National Institute of Advanced Industrial Science and Technology (AIST), Japan

Email: t.miyajima@aist.go.jp

9:20-9:45 **The Diamond Indenter Working as an Optical Objective**

Igor Maslenikov¹, Vladimir Reshetovand² and Alexey Useinov¹

¹ Technological Institute for Superhard and Novel Carbon Materials, Russia

² NRNU Moscow Engineering Physics Institute (MEPhI), Russia

Email: useinov@mail.ru

9:45-10:10 **Temperature measurement and calibration in SP testing machines and equipment**

Daniel Omacht, Zdenek Kubanek and Roman Dolezal

¹ Material and Metallurgical Research Ltd., Czech Republic

Email: daniel.omacht@mmvzyzkum.cz

10:10-10:40 Coffee Break

Session Chair:

Tatsuya Miyajima [National Institute of Advanced Industrial Science and Technology, Japan]

10:40-11:15 **Microfracture strength evaluation for diamond related materials using nano-polycrystalline diamond spherical indenter**

Invited

H. Sumiya, K. Hamaki and K. Harano

Advanced Materials Laboratory, Sumitomo Electric Industries, LTD., Japan

Email: sumiya@sei.co.jp

- 11:15-11:40 **New Methods of Static and Dynamic Industrial Hardness Testing: Equivalent Indentation Depth and Small Ball Rebound Hardness Tests**
Takashi Yamamoto¹ and Kensuke Miyahara²
¹Yamamoto Scientific Tool Laboratory, Japan
²National Institute for Materials Science, Japan
Email: info@ystl.jp
- 11:40-12:05 **Measurements of pressure-impressed electric currents during indentation-rock fracture with gas flow**
Yuji Enomoto¹, Tsuneaki Yamabe¹, Hitoshi Kondo² and Shigeki Sugiura²
¹Shinshu University, Japan
²Genesis Research Institute, Inc., Japan
Email: enomoto@shinshu-u.ac.jp
- 12:05-12:15 General Discussion
- 12:15-12:25 Closing remarks
- 12:25-14:00 Lunch