

Technical Program NMJ 2023

Sunday, November 26, 2023

16:00-18:00	Registration
18:00-20:00	Welcome Reception

Monday, November 27, 2023

From 08:00	Registration
	Chair: G. Wagner, S. Hausner
08:50-09:20	Opening - Welcome – Introduction Dr. Andreas Handschuh (Video greeting) Saxon State Ministry for Science, Culture and Tourism, Germany Secretary of State Dr. Gabriele Goldfuß Office for International Affairs Mayor's Department of Leipzig Prof. Anja Strobel (Video greeting) Chemnitz University of Technology, Germany Vice President for Research and University Development Prof. Lars Jeurgens Empa, Switzerland President of the Nanojoining and Microjoining Association
09:20-09:45	- Keynote - 4D materials for electronic skin and microrobotic systems <u>O.G. Schmidt</u> Chemnitz University of Technology, Germany
09:45-10:00	Impulse lectures from the industry EUROMAT GmbH FOCUS GmbH
10:00-10:35	Group Photo, Coffee Break, Poster Session and Industrial Exhibition
	Chair: O.G. Schmidt, L. Jeurgens
10:35-11:00	- Keynote - Bonding process of electronic package using IPL energy and Its Reliability of BGA Component <u>S.-B. Jung</u> Sungkyunkwan University, Korea

11:00-11:20	<p>Microstructure Analysis of Induction Sintered Ag Micro Particle Layers for Die-Attach Applications</p> <p><u>P. Rochala</u>¹, C. Hofmann², M. Kroll¹, K. Hiller²</p> <p>¹ Institute for Machine Tools and Production Processes (IWP), Professorship for Forming and Joining, Chemnitz University of Technology, Germany</p> <p>² Fraunhofer Institute for Electronic Nano Systems ENAS, Chemnitz, Germany</p>
11:20-11:40	<p>Characterization of microscale mechanical property and fracture behavior of sintered Ag/semiconductor material interface</p> <p><u>T. Matsuda</u>, R. Seo, M. Kambara, A. Hirose</p> <p>Division of Materials and Manufacturing Science, Graduate School of Engineering, Osaka University, Japan</p>
11:40-12:00	<p>Thermal effect on fracture behaviour of porous sintered silver nanoparticles by phase-field method</p> <p><u>X. Long</u>, J. Zhu, Y. Su</p> <p>School of Mechanics, Civil Engineering and Architecture, Northwestern Polytechnical University Xi'an, China</p>
12:00-13:05	Lunch
	Chair: M. Türpe, N. Zhou
13:05-13:30	<p>- Keynote -</p> <p>Latest integrated power module and unit technology using WBG devices</p> <p><u>Y. Takahashi</u></p> <p>Tohoku University, Japan</p>
13:30-13:50	<p>Cross-Correlation of Interconnection Technologies – A Case Study of Reduced Wire Bond Quality after Ultrasonic Welding</p> <p><u>A. Groth</u>^{1,2} and M. Hempel¹</p> <p>¹ Fraunhofer IZM, Berlin, Germany</p> <p>² Technische Universität Berlin, Research Center for Microperipheric Technologies, Berlin, Germany</p>
13:50-14:10	<p>Nanopaste sinter-bonding for transfer and integration of functional thin films</p> <p><u>B. Rheingans</u>¹, F. La Mattina², J. Bouaziz^{1,2}, C. Cancellieri¹, L. P. H. Jeurgens¹, J. Janczak-Rusch¹</p> <p>¹ Laboratory for Joining Technologies and Corrosion, Empa - Swiss Federal Laboratories for Materials Science and Technology, Switzerland</p> <p>² Transport at Nanoscale Interfaces Laboratory, Empa - Swiss Federal Laboratories for Materials Science and Technology, Switzerland</p>
14:10-14:30	<p>Joining of gold nanoparticles prepared by laser ablation with halide salt</p> <p><u>L. Catanzaro</u>¹, V. Scardaci¹, M. Scuderi², M. Condorelli¹, L. D'Urso¹, G. Compagnini^{1,3}</p> <p>¹ Department of Chemical Sciences (University of Catania), Italy</p> <p>² CNR—Institute for Microsystems and Microelectronics, Catania, Italy</p> <p>³ Istituto Nazionale Scienza e Tecnologia dei Materiali (INSTM), Catania, Italy</p>
14:30-15:00	Coffee Break, Poster Session and Industrial Exhibition
	Chair: G. Zou, S.-B. Jung
15:00-15:20	<p>- Invited -</p> <p>Joining Diamond with Copper in Additive Manufacturing</p> <p><u>Y. Lu</u></p> <p>University of Nebraska-Lincoln, USA</p>

15:20-15:40	<p>- Invited -</p> <p>High-strength bonding with low-temperature sintering copper nanoparticles</p> <p><u>T. Yonezawa</u> Hokkaido University, Japan</p>
15:40-16:00	<p>Sub 250°C sintering of substrates to baseplates with micro scale copper sinter paste</p> <p><u>S.K. Bhogaraju</u>¹, D. Busse², A. Dahlbüdding², G. Elger¹</p> <p>¹ Institute of Innovative Mobility (IIMo), Technische Hochschule Ingolstadt, Germany ² Budetec GmbH, Berlin, Germany</p>
16:00-16:20	<p>Enhanced Thermal Conductivity in Micro Composite Structure Joints Utilizing Porous Cu Sheets</p> <p><u>H. Tatsumi</u>, H. Nishikawa Joining and Welding Research Institute, Osaka University, Japan</p>
16:20-16:40	<p>Modified Nickel nanopastes to avoid high pressures during joining process</p> <p><u>B. Sattler</u>, S. Hausner, G. Wagner Chemnitz University of Technology, Group of Composites and Material Compounds, Germany</p>
16:40-17:00	<p>Ultrafast laser selective welding of sapphire and Invar alloy</p> <p><u>J. Yang</u>¹, Q. Jiang¹, M. Yang¹, Y.X. Zhao¹, R. Pan²</p> <p>¹ School of Materials Engineering, Shanghai University of Engineering Science, China ² Faculty of Materials and Manufacturing, Beijing University of Technology, China</p>
19:00-21:00	<p>Dinner</p>

Tuesday, November 28, 2023

From 08:00	Registration
	Chair: J. Janczak-Rusch, Y. Takahashi
08:55-09:20	- Keynote - Femtosecond laser processing in photonics -scribing, welding and 3D nano-structuring <u>P. Herman</u> University of Toronto, Canada
09:20-09:40	- Invited - Cu@Ag nanoparticles: synthesis, characterization, sintering mechanism and applications for power and flexible printed electronics <u>H. Ji</u> Harbin Institute of Technology (Shenzhen), China
09:40-10:00	Femtosecond laser induced nanofusion and nanoalloying of high-entropy alloy nanoparticles <u>A. Hu¹</u> , <u>D. Fieser¹</u> , <u>J. Whitlow²</u> , <u>P.K. Liaw²</u> ¹ Department of Mechanical, Aerospace and Biomedical Engineering, University of Tennessee Knoxville, USA ² Department of Materials Science and Engineering, University of Tennessee Knoxville, USA
10:00-10:20	Broadening the scope of sintering: silver and copper/ silver mixed pastes for substrate and die-attach on challenging surfaces such as Cu, Ni and Al-finishes <u>B. Rabay</u> Nano-Join GmbH, Berlin, Germany
10:20-10:40	A novel strategy for nano-alloys preparation for power electronics packaging <u>Q. Jia¹</u> , <u>B. Zhou¹</u> , <u>H. Hu¹</u> , <u>Y. Wang¹</u> , <u>F. Guo¹</u> , <u>G. Zou²</u> ¹ Faculty of Materials and Manufacturing, Beijing University of Technology, China ² Department of Mechanical Engineering, State Key Laboratory of Tribology, Tsinghua University, China
10:40-11:10	Coffee Break, Poster Session and Industrial Exhibition
	Chair: A. Hu, M. Calame
11:10-11:30	- Invited - Heterogeneous Direct Bonding: From Microelectronics to Biomedical Implantation <u>C. Wang</u> Harbin Institute of Technology, China
11:30-11:50	Microwelding of NiTi to stainless steel K. Zhang, A. Shamsolhodaei, S. Rathod, P. Peng, <u>N. Zhou</u> Centre for Advanced Materials Joining (CAMJ), University of Waterloo, Canada
11:50-12:10	Micro welding of glasses with USP-lasers – process models, results and applications <u>D. Nodop</u> , M. Kahle ifw Jena - Günter Köhler Institute for Joining Technology and Materials Testing, Jena, Germany
12:10-12:30	Laser Irradiation of Porcine Skeletal Muscle Tissue <u>K. Zhang^{1,2}</u> , <u>Y. Zhou^{1,2}</u> , <u>M. Mayer^{1,2}</u> ¹ Dept. of Mechanical and Mechatronics Engineering, University of Waterloo, Canada ² Centre for Advanced Materials Joining, University of Waterloo, Canada

12:30-13:30	Lunch
	Chair: P. Herman, T. Yonezawa
13:30-13:50	- Invited - Direct laser writing of composite structures: process and application <u>S. Rathod</u> , P. Peng, N. Zhou University of Waterloo, Canada
13:50-14:10	Laser spiral spot welding of Al and Cu foils: process, microstructure and properties <u>W. Du</u> , R. Xiao, T. Huang High-Power and Ultrafast Laser Manufacturing Lab, Faculty of Materials and Manufacturing, Beijing University of Technology, China
14:10-14:30	Plasmonic-assisted heterogeneous integration of oxide-semiconductor interconnects under ultrafast laser irradiation <u>L. Lin</u> , Y. Hu, Z. Li School of Materials Science and Engineering, Shanghai Jiaotong University, China
14:30-14:50	Tuning Wettability of Graphene Oxide by Laser Induced Reduction in Liquids <u>V. Scardaci</u> ¹ , G. D'arrigo ² , G. Condorelli ¹ , G. Compagnini ¹ ¹ Department of Chemistry, University of Catania, Catania, Italy ² CNR—Institute for Microsystems and Microelectronics, Catania, Italy
14:50-15:10	Additive fabrication and adhesion enhancement of conformal interconnections on Al substrates with arbitrary 3D structures <u>Y. Li</u> ¹ , J. Li ¹ , P. Du ¹ , W. Li ¹ , H. Guo ² , X. Yu ³ , P. Zhang ¹ ¹ School of Materials Science and Engineering, Harbin Institute of Technology at Weihai, China ² Shenzhou Information Technology Research Institute at Weihai, China ³ Shandong Kaer Electric Co., Ltd., Weihai, China
15:10-15:40	Coffee Break, Poster Session and Industrial Exhibition
	Chair: J. Pomeroy, H. Ji
15:40-16:00	- Invited - Sintering behavior of nano porous film for device integration including power electronics, chiplet and flexible electronics <u>L. Liu</u> , G. Zou, W. Wang, B. Feng, Q. Jia, H. Bai Department of Mechanical Engineering, State Key Laboratory of Tribology, Tsinghua University, Beijing, China
16:00-16:20	Thermal fatigue damage mechanism of nano-foam sintered layer in the SiC device during thermal reliability testing <u>H. Zhang</u> , C. Yin, Z. Peng, W. Guo School of Mechanical Engineering and Automation, Beihang University, Beijing, China
16:20-16:40	Alloy-type lithium anode prepared by connecting nanosized alloy-type material with conductive material <u>T. Huang</u> High-Power and Ultrafast Laser Manufacturing Lab, Faculty of Materials and Manufacturing, Beijing University of Technology, Beijing, China
16:40-17:00	Transition metal chalcogenide cathode for printed flexible zinc ion batteries <u>S. Wang</u> , X. Wang, J. Feng, Y. Tian State Key Laboratory of Advanced Welding and Joining, Harbin Institute of Technology, Harbin, China

17:00-17:20	Fabrication of Flexible Electrodes by Nanojoining and Printing of Metal Nanowires H. Zhang, <u>Y. Tian</u> State Key Laboratory of Advanced Welding and Joining, Harbin Institute of Technology, Harbin, China
19:00-21:00	Dinner at Auerbachs Keller

Wednesday, November 29, 2023

From 08:00	Registration
	Chair: Z. Gu, Y. Tian
08:55-09:20	- Keynote - Heterogenous Integration - Thermal and Mechanical Challenges <u>J. Pomeroy</u> University of Bristol, United Kingdom
09:20-09:40	- Invited - Integrating Low Dimensional Materials for Quantum Technology and Sensing <u>M. Calame</u> EMPA, Switzerland
09:40-10:00	Intra/interlayer Atomic Diffusion Behavior of Al/Ni Reactive Multilayer Nanofoils Excited by Electrical/Thermal/Mechanical Multi-fields <u>L. Cheng, Z. Yansong</u> Shanghai Key Laboratory of Digital Manufacture for Thin-Walled Structure, Shanghai Jiao Tong University, China
10:00-10:20	Atomistic Modeling of Nano-Multilayers for Nano-/Micro-Joining Applications <u>V. Turlo</u> Empa – Swiss Federal Laboratories for Materials Science and Technology, Switzerland
10:20-10:40	Contribution of molecular dynamics to the study of metallic nanometric multilayers <u>O. Politano</u> ¹ , <u>Y. Li</u> ¹ , <u>V. Turlo</u> ² , <u>F. Baras</u> ¹ ¹ Laboratoire Interdisciplinaire Carnot de Bourgogne, UMR 6303, CNRS-Université de Bourgogne, France ² Laboratory for Advanced Materials Processing, Empa - Swiss Federal Laboratories for Materials Science and Technology, Switzerland
10:40-11:00	Ag directional outflow in Ag/AlN nano-multilayers <u>C. Cancellieri</u> ¹ , <u>A.V. Druzhinin</u> ² , <u>L.P.H. Jeurgens</u> ¹ , <u>B.B. Straumal</u> ² , <u>J. Janczak-Rusch</u> ¹ ¹ Empa, Swiss Federal Laboratories for Materials Science and Technology, Laboratory for Joining Technologies and Corrosion, Switzerland ² Osipyan Institute of Solid State Physics, Russian Academy of Sciences, Russian Federation
11:00-11:20	Coffee Break, Poster Session and Industrial Exhibition
	Chair: Y. Lu, Y. Joseph
11:20-11:40	Thermo-mechanical characterization and reliability of advanced system integration technologies <u>B. Wunderle</u> Chemnitz University of Technology, Germany
11:40-12:00	Microstructural evolution of Cu-Nb nanomultilayer on Si substrate upon annealing <u>J. Yeom, G. Lorenzin, C. Cancellieri, L.P.H. Jeurgens, J. Janczak-Rusch</u> Empa, Swiss Federal Laboratories for Materials Science and Technology, Laboratory for Joining Technologies and Corrosion, Switzerland
12:00-12:20	Controlled directional Cu outflow in Cu/W nanomultilayers for joining technologies <u>G. Lorenzin, B. Rheingans, J. Janczak-Rusch, L.P.H. Jeurgens, C. Cancellieri</u> Empa, Swiss Federal Laboratories for Materials Science and Technology, Laboratory for Joining Technologies and Corrosion, Switzerland

12:20-12:40	<p>Reactive joining for temperature sensitive strain sensors <u>J. Böttcher</u>¹, A. Schumacher², P. Meyer², G. Dietrich¹, E. Pflug¹, S. Knappmann², A. Dehé^{2,3}</p> <p>¹ Fraunhofer-Institut für Werkstoff- und Strahltechnik IWS Dresden, Germany ² Hahn-Schickard-Gesellschaft für angewandte Forschung e.V., Villingen-Schwenningen, Germany ³ Albert-Ludwigs-Universität Freiburg, IMTEK, Georg H. Endress Professur für Smart Systems Integration, Germany</p>
12:40-13:00	<p>Interfacial melting and low-temperature reactive bonding in sequential Sn and Bi layers for hybrid flip chip joining in flexible electronics <u>Sri Harini Rajendran</u>, Seong Min Seo, and Jae Pil Jung Department of Materials Science and Engineering, University of Seoul, Rep. of Korea</p>
13:00-13:20	<p>Hybrid material joining with Al/Ni multilayers directly sputtered on thermoplast substrates <u>M. Glaser</u>¹, E. Vardo², S. Matthes², J. Hildebrand¹, P. Schaaf², J.P. Bergmann¹</p> <p>¹ Department Production Technology Group, TU Ilmenau, Germany ² Department Materials for Electrical Engineering, TU Ilmenau, Germany</p>
13:20-14:00	<p>Lunch</p>
	<p>Chair: L. Liu, C. Wang</p>
14:00-14:20	<p>- Invited - New Materials for Joining Microelectronic Components <u>Y. Joseph</u> TU Bergakademie Freiberg, Germany - Invited -</p>
14:20-14:40	<p>Low Temperature In-bearing Solders for Microelectronic Applications <u>C.R. Kao</u>, F. L. Chang, Y. S. Lin, and Y. J. Fang Department of Materials Sci and Engineering, National Taiwan University, Taipei, Taiwan</p>
14:40-15:00	<p>Site-Selective Solder Deposition on Multi-Segment Nanowires as a New Approach for Nanowire Joining and Interconnection <u>E. Fratto</u>¹, J. Wang¹, Z. Yang¹, H. Sun², <u>Z. Gu</u>¹</p> <p>¹ Department of Chemical Engineering, University of Massachusetts Lowell, U.S. ² Department of Mechanical and Industrial Engineering, Northeastern University, Boston, U.S.</p>
15:00-15:20	<p>Transient Liquid Phase Infiltration Bonding of Copper for Die-attach <u>S. Fukumoto</u>, S. Kuroiwa, R. Miyajima, Y. Masuda, M. Matsushima Graduate School of Engineering, Osaka University, Japan</p>
15:20-15:40	<p>Effect of Reducing Agent on Bridge Formation and Thermal Conductivity of Metal Bridged Electrically Conductive Adhesive <u>M. Matsushima</u>, T. Senda, K. Taniyama, S. Fukumoto Graduate School of Engineering, Osaka University, Japan</p>
15:40-15:50	<p>Closing Remarks</p> <p>Prof. Guntram Wagner Chemnitz University of Technology, Germany Head of the Composites and Material Compounds Group</p> <p>Prof. Lars Jeurgens Empa, Switzerland President of the Nanojoining and Microjoining Association</p>
15:50-16:20	<p>Coffee Break</p>

Poster

Can Nanojoining be an alternative to brazing?

S. Hausner, B. Sattler, G. Wagner

Chemnitz University of Technology, Group of Composites and Material Compounds, Germany

Cu/Mo layered composites: from macro- to nanoscale

L. Ghisalberti, J. Yeom, T. Burgdorf, B. Rheingangs, G. Lorenzin, C. Cancellieri, H. R. Elsener, L.P.H.

Jeurgens, J. Janczak-Rusch

Empa, Swiss Federal Laboratories for Materials Science and Technology, Laboratory for Joining Technologies and Corrosion, Switzerland

Effect of aging conditions on the surface state of CuO nanopowders as studied by in-situ X-ray Photoelectron Spectroscopy

A. Batenkova^{1,2}, B. Rheingangs¹, J. Kollender¹, P. Schmutz¹, M. Kovalenko², L.P.H. Jeurgens¹

¹Empa, Laboratory for Joining Technologies and Corrosion, Switzerland

²ETH Zürich, Department of Chemistry and Applied Biosciences, Switzerland

Free-standing Silver Nanobelt Foils for Sintering Die Bonding of Power Electronics and Its Power Cycle Reliability

X. Wang, W. Guo, T. Liu, H. Zhang, P. Peng

School of Mechanical Engineering and Automation, Beihang University, China

High power femtosecond laser induced additive manufacturing of refractory materials

A. Hu, D. Fieser

Department of Mechanical, Aerospace and Biomedical Engineering, University of Tennessee Knoxville, USA

Influence of alumina fiber on characteristics of hybrid bonding

Jiwan Kang^{1,2}, S.H. Rajendran¹, J.P. Jung¹

¹Department of Materials Science and Engineering, University of Seoul, Rep. of Korea

²Department of Mechanical Design and Robot Engineering, Seoul National University of Science and Technology, Rep. of Korea

Influence of nano additive shape in Sn-3.0Ag0.5Cu (SAC 305) nanocomposite solder

G.A. Lee, S.H. Rajendran, J.P. Jung

Department of Materials Science and Engineering, University of Seoul, Rep. of Korea