

## Workshop

People registered to Tutorial & Workshop can attend both of the following sessions.

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Tutorial, Hotel Granvia Kyoto 3F, Genji-Ballroom West

- 13:30-14:20** **Characterization of growth and conformality during ALD**  
Prof. Christophe Detavernier, University of Ghent, Belgium
- 14:20-15:10** **Precursor characterizations & delivery**  
Satoko Gatineau, Air Liquide, Japan
- 15:10-15:30** **Break**
- 15:30-16:20** **Reactors for ALD - fundamentals and reactor types**  
Suvi Haukka, ASM, Finland
- 16:20-17:10** **ALD History**  
Riikka Puurunen, VTT, Finland
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Workshop, Hotel Granvia Kyoto 3F, Genji-Ballroom North

- 13:30-14:20** **Introduction to ALD Precursors and Reaction Mechanisms**  
Prof. Roy Gordon, Harvard University, USA
- 14:20-15:10** **ALD in semiconductor applications**  
Prof. Christophe Vallee, LETI-LTM, France
- 15:10-15:30** **Break**
- 15:30-16:20** **ALD in emerging applications I – PV, electrochemistry, textile coating**  
Prof. Greg Parsons, University of South Carolina University, USA
- 16:20-17:10** **ALD in emerging applications II – Lithium batteries and energy storage**  
Prof. Andy Sun, University of Western Ontario, Canada
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18:00 Welcome Reception, Hotel Granvia Kyoto 5F, Kokin Jr. Ballroom

# Program Overview

## Day 1: June 16th (Monday)

<b>Plenary Session:</b> Key-note speakers (Kyoto Theater)	
<u>Kyoto Theater</u>  <b>Session 1A "Precursors &amp; Chemistry I"</b>  Quick Poster Overview (16P1-53)  <b>Session 2A "Precursors &amp; Chemistry II"</b>	<u>Hotel Granvia Kyoto 3F, Genji Ballroom</u>  <b>Session 1B "Energy Applications I"</b>  <b>Session 2B "Energy Applications II"</b>  Quick Poster Overview (16P54-107)
Poster & Exhibit Hall, Hotel Granvia Kyoto 3F, Genji Ballroom <b>Poster Session 16P</b>	

## Day 2: June 17th (Tuesday)

<u>Kyoto Theater</u>  <b>Session 3A "AVS/JCS Joint Session"</b>  <b>Session 4A "Growth &amp; Characterizations I"</b>	<u>Hotel Granvia Kyoto 3F, Genji Ballroom</u>  <b>Session 3B "Energy Applications III"</b>  <b>Session 4B "Energy Applications IV"</b>
<u>Kyoto Theater</u>  <b>Session 5A "Growth &amp; Characterizations II"</b>  Quick Poster Overview (17P1-52)  <b>Session 6A "Growth &amp; Characterizations III"</b>	<u>Hotel Granvia Kyoto 3F, Genji Ballroom</u>  <b>Session 5B "ULSI BEOL Applications"</b>  <b>Session 6B "Metallization and Memory"</b>  Quick Poster Overview (17P53-104)
<u>Poster &amp; Exhibit Hall, Hotel Granvia Kyoto 3F, Genji Ballroom</u> <b>Poster Session 17P</b>	

## Day 3: June 18th (Wednesday)

<u>Kyoto Theater</u>  <b>Session 7A "Growth &amp; Characterizations IV"</b>  <b>Session 8A "Growth &amp; Characterizations V"</b>	<u>Hotel Granvia Kyoto 3F, Genji Ballroom</u>  <b>Session 7B "Emerging Applications I"</b>  <b>Session 8B "Emerging Applications II"</b>
<u>Kyoto Theater</u>  <b>Session 9A "Novel Materials I"</b>  <b>Session 10A "Novel Materials I"</b>	<u>Hotel Granvia Kyoto 3F, Genji Ballroom</u>  <b>Session 9B "Emerging Applications III"</b>  <b>Session 10B "Manufacturing"</b>

Conference Banquet, Hotel Granvia Kyoto 5F, Kokin Jr. Ballroom

## Day 1, Hall A (Kyoto Theater)

### Opening Session, June 16<sup>th</sup> Monday, Hall A (Kyoto Theater)

09:00-09:20 Opening Remarks

09:20-10:10 **Key Note Speech: Novel SiC & GaN Power-devices Evolution towards a Sustainable Energy Future** **43**  
Minoru Kubo, *Panasonic Corp., Japan*

#### 30 min Break

### Opening Session Continued, June 16<sup>th</sup> Monday, Hall A (Kyoto Theater)

10:40-11:30 **Key Note Speech: Atomic Layer Deposition for sub-14nm Semiconductor Roadmap Challenges** **44**  
Ivo J. Raaijmakers, *ASM International N.V., Netherland*

#### Lunch, Hotel Granvia Kyoto

### Session 1A, "Precursors & Chemistry I", June 16<sup>th</sup> Monday, Hall A (Kyoto Theater)

**Session Chairs: Scott Clendenning (Intel), Suvi Haukka (ASM)**

13:30-14:00 **Invited: Recent Developments of Heteroleptic Precursors Chemistry for Next Generation Metals and Metal Oxides thin films PEALD/ALD** **45**  
Nicolas Blasco, *Air Liquide Electronics, France*

14:00-14:15 **Silyl Elimination Reactions in the Atomic Layer Deposition of Titanium, Zinc, and Other Element Films** **46**  
Charles H. Winter, Joseph P. Klesko, and Chatu T. Sirimanne,  
*Wayne State University, Detroit, USA*

14:15-14:30 **High Purity Metallic Co and Ni Thin Films Using 1,4-Di-tert-butyl-1,3-diazadienyl Precursors** **47**  
Joseph P. Klesko and Charles H. Winter, *Wayne State University, Detroit, USA*

14:30-14:45 **Organometallic Approaches to New Reactivity Development and Precursor Design for Thermal Metal ALD** **48**  
David J. H. Emslie, Preeti Chadha, and Jeffrey S. Price,  
*McMaster University, Hamilton, Canada*

14:45-15:00 **Electron Enhanced Atomic Layer Deposition (EE-ALD): A New Approach for ALD Using Electron Stimulated Processes** **49**  
Andrew S. Cavanagh, James L. Young, Matthias Young, and Steven George,  
*University of Colorado, Boulder, USA*

### Quick Poster Over view P16A, June 16<sup>th</sup> Monday, Hall A (Kyoto Theater)

**Session Chairs: Dave Thompson (Applied Materials), Simon Elliott (Tyndall)**

15:00-15:45 **Poster No.16P001-16P0053**  
Each poster presenter will be given the opportunity to present his/her poster in one minute, one slide

#### 30 min Break

**Session 2A, "Precursors & Chemistry II", June 16<sup>th</sup> Monday, Hall A (Kyoto Theater)**

**Chairs: Charles Winter (Wayne State U), Roy Gordon (Harvard)**

- 16:15-16:45 **Invited: Beyond the Comfort Zone: Exploratory Chemistry for New ALD Materials and Applications** **50**  
Scott Clendenning, *Intel, United States*
- 16:45-17:00 **Explaining the Self-limiting Nature of ALD through Saturation and Activation of Acidity and Basicity at Oxide Surfaces** **51**  
Simon D. Elliott and Mahdi Shirazi,  
*Tyndall National Institute, University College Cork, Cork, Ireland*
- 17:00-17:15 **Full Wafer TiO<sub>2</sub> Deposition by Simultaneous Exposure with Titanium (IV) Isopropoxide and Water with-in the ALD Window in a High Vacuum CVD Reactor** **52**  
Michael Reinke, Yury Kuzminykh, and Patrik Hoffmann,  
*Empa, Thun & Ecole Polytechnique Fédérale de Lausanne, Lausanne, Switzerland*
- 17:15-17:30 **ALD of SiN<sub>x</sub>: Mechanisms at work** **53**  
C.K. Ande, H.C.M. Knoop, K. de Peuter, S.D. Elliott, and W.M.M. Kessels,  
*Eindhoven University of Technology, NL; Oxford Instruments, UK ; Tyndall National Institute, IR*
- 17:30-17:45 **Gas Residence Time: the Hidden Parameter for High-quality SiN<sub>x</sub> Prepared by Plasma-assisted ALD** **54**  
H.C.M Knoop, K. de Peuter, C.K. Ande, and W.M.M. Kessels,  
*Oxford Instruments, Bristol, UK; Eindhoven University of Technology, Eindhoven, NL*

**Poster Session 18:00-20:00**

**Poster & Exhibit Hall (Hotel Granvia Kyoto 3F, Genji Balloom)**

## Day 1, Hall B (Hotel Granvia Kyoto 3F, Genji Ballroom)

Session 1B, "Energy Application I", June 16<sup>th</sup> Monday, Hall B (Hotel Granvia Kyoto)

**Chairs: Jeff Elam (Argonne National Laboratory), Neil Dasgupta (Univ. Michigan)**

- 13:30-14:00 **Invited: Design of Electrodes by Atomic Layer Deposition for Li Ion Batteries and Fuel Cells** **55**  
Andy Sun, *University of Western Ontario, Canada*
- 14:00-14:15 **Atomic Layer Deposition of Lithium Sulfide for High-Energy Lithium-Sulfur Batteries** **56**  
Xiangbo Meng and Jeffrey W. Elam, *Argonne National Laboratory, USA*
- 14:15-14:30 **Nanostructured Cathode Synthesized using Atomic Layer Deposition for Lithium-Oxygen Batteries** **57**  
Yu Lei, Jun Lu, Khalil Amine, and Jeffrey W. Elam,  
*University of Alabama in Huntsville; Argonne National Laboratory, USA*
- 14:30-14:45 **Atomic Layer Deposition of Lithium Ion Conducting (AlF<sub>3</sub>)(LiF)<sub>x</sub> Alloys Using Trimethylaluminum, Hexamethyldisilazide and Hydrogen Fluoride-Pyridine** **58**  
Younghee Lee, Daniela Piper, Andrew Cavanagh, Matthias Young, Se-Hee Lee, and Steven George, *University of Colorado, Boulder, USA*
- 14:45-15:00 **Superior High-Voltage Cycling Behavior of Cathode Materials Coated with Solid-State Electrolyte by Atomic Layer Deposition** **59**  
Jian Liu, Xifei Li, Andrew Lushington, Ruying Li, Xueliang (Andy) Sun, and Mei Cai,  
*University of Western Ontario, London, ON, Canada ; General Motors, Warren, Michigan, USA*

### **30 min Break**

Session 2B, "Energy Application II", June 16<sup>th</sup> Monday, Hall B (Granvia Kyoto)

**Session Chairs: Andy Sun (Univ. Western Ontario), Won-Jun Lee (Sejong Univ.)**

- 15:30-15:45 **Atomic-Layer Deposition of Ru and RuO<sub>2</sub> for Charge Storage Application** **60**  
M. Ballarotto, D. Ketchum, W.N. Herman, and D.B. Danilo,  
*University of Maryland, United States*
- 15:45-16:00 **Improving the Uniformity and Stability of Precious Metal Fuel Cell Catalysts by ALD Templating and Inverted Synthesis** **61**  
Arrelaine Dameron, Justin Bult, K. Neyerlin, Jason Zack, Shyam Kocha, Katherine Hurst, and Bryan Pivovar,  
*National Renewable Energy Laboratory, Golden, United States*
- 16:00-16:15 **Ionic Properties of Yttria Stabilized Zirconia Fabricated Using Atomic Layer Deposition with Water, Oxygen, and Ozone** **62**  
Ho Keun Kim, Dong Young Jang, Jun Woo Kim, and Joon Hyung Shim,  
*Korea University, Seoul, Korea*
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Suk Won Park, Dong Young Jang, Hyung Jong Choi, Gwon Deok Han, and Joon Hyung Shim, *Korea University, Seoul, Korea*
- 16:30-16:45 **Thermoelectric properties of ALD Chalcogenides** **64**  
Tiina Sarnet, Timo Hatanpää, Mikko Ritala, Markku Leskelä, Kenichiro Mizohata, Timo Flyktman, and Jouni Ahopelto,  
*University of Helsinki, Finland; VTT Technical Research Centre of Finland, Espoo, Finland*

16:45-17:00 **Synthesis and Characterization of Titania Inverted Opals with Multiple Stop-Gaps and High-Temperature Stability** 65  
Robert Zierold, H.S. Lee, R. Pasquarelli, R. Kubrin, M. Waleczek, R. Janßen, A. Petrov, M. Eich, G.A. Schneider, and K. Nielsch,  
*Universität Hamburg & Hamburg University of Technology (TUHH), Hamburg, Germany*

**Session P16B, Quick Poster Over View, June 16<sup>th</sup> Monday, Hall B (Granvia Kyoto)**  
**Session Chairs: Jean-Marc Girard (Air Liquide), Norifusa Satoh (NIMS)**

17:00-17:45 Poster No.16P054-16P0107  
Each poster presenter is given the opportunity to present his/her poster in one minute, one slide

**Poster Session 18:00-20:00**  
**Poster & Exhibit Hall (Hotel Granvia Kyoto 3F, Genji Ballroom)**

Poster Session, June 16<sup>th</sup> Monday, 18:00-20:00

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Jean-Marc Girard (Air Liquide), Norifusa Satoh (NIMS)

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	Andrew Lushington et al., University of Western Ontario, Canada	
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- 16P099 **Growth behavior and properties of hybrid organic/inorganic structure using MLD and ALD techniques** 245  
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Charles Eddy et al., U.S. Naval Research Laboratory, United States
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- 16P105 **Extremely Flexible Thin-Film Encapsulation for Flexible OLEDs** 250  
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- 16P106 **III-V Nitride Heterojunctions by Atomic Layer Epitaxy** 251  
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Shui-Yang Lien et al., DaYeh University, Taiwan

## Day 2, Hall A (Kyoto Theater)

Session 3A, "AVS/JVS Joint Session", June 17<sup>th</sup> Tuesday, Hall A (Kyoto Theater)

**Chairs: Toshihide Nabatame (NIMS, Japan), Daisuke Hojo (Tohoku Univ.)**

- 08:30-08:45 **Adhesion Testing of Atomic Layer Deposited TiO<sub>2</sub> on Silicon and Glass Substrates by the Use of Embedded SiO<sub>2</sub> Microspheres** **66**  
Jussi Lyytinen, Maria Berdova, Sami Franssila, Quan Zhou, and Jari Koskinen,  
*Aalto University, Espoo, Finland*
- 08:45-09:00 **Effect of surface type and surface preparation on W nucleation for selective area W ALD** **67**  
Berc Kalanyan, Sarah E. Atanasov, and Gregory N. Parsons  
*North Carolina State University, Raleigh NC, United States*
- 09:00-09:15 **Initial Stage of Cu<sub>3</sub>Au Oxidation: Oxygen Induced Cu Segregation and the Protective Au Layer Formation** **68**  
Michio Okada, *Osaka University, Japan*
- 09:15-09:30 **Novel Heteroleptic ALD Precursor for Rare Earth Oxides** **69**  
Sanni Seppälä, Jaakko Niinistö, Timothee Blanquart, Kenichiro Mizohata,  
Clement Lansalot, Wontae Noh, Mikko Ritala, and Markku Leskelä  
*University of Helsinki, Finland; Air Liquide Laboratories Korea, Seoul, Korea*
- 09:30-09:45 **Platinum Overlayer on 3d Transition Metals: Reactivity Towards O<sub>2</sub> Dissociation and NO Oxidation** **70**  
Hideaki Kasai, Mary Clare Sison Escaño, and Ryan Lacdao Arevalo,  
*Osaka University & University of Fukui, Japan*
- 09:45-10:00 **Atomic Layer Deposition of Silicon Nitride using Trisilylamine and an Ammonia Plasma** **71**  
Stephen L. Weeks, Dennis Hausmann, and Sumit Agarwal,  
*Colorado School of Mines, Golden, United States; LAM Research Corporation, Tualatin, United States*

### **30 min Break**

Session 4A, "Growth & Characterizations I", June 17<sup>th</sup> Tuesday, Hall A (Kyoto Theater)

**Chairs: Christophe Detavernier (Univ. Ghent), Masato Miyake (NAIST)**

- 10:30-10:45 **Continuous and Ultrathin Pt ALD Films on High Surface Area Substrates Using W ALD Adhesion Layers** **72**  
J.W. Clancey, A.S. Cavanagh, R.S. Kukreja, A. Kongkanand, and S.M. George,  
*University of Colorado, Boulder; General Motors, United States*
- 10:45-11:00 **ABC Process for Pt ALD at Room Temperature: The Surface Chemistry studied by Surface Infrared Spectroscopy** **73**  
R.H.E.C. Bosch, F.L. Bloksma, A.J.M. Mackus, M.A. Verheijen, A.A. Bol,  
S. Agarwal, and W.M.M. Kessels,  
*Eindhoven University of Technology, The Netherlands; Colorado School of Mines, Golden, United States*
- 11:00-11:15 **Recipes for Increasing Uniformity and Reducing Carbon Impurities of Plasma-Enhanced Atomic Layer Deposition Platinum Films** **74**  
Timothy English, J Provine, Thomas Kenny, *Stanford University, United States*
- 11:15-11:30 **ALD of Ruthenium at 100°C using the ToRus-precursor** **75**  
M. Minjauw, B. Capon, J. Dendooven, M. Schaekers, and C. Detavernier,

*Ghent University, Belgium; imec, Leuven, Belgium*

11:30-11:45 **Atomic Layer Deposition of Ruthenium and Ruthenium Oxide Thin Films from Alkylbenzene-derived Ru(0) Complex and O<sub>2</sub>** **76**

Hyo Jun Jung, Jeong Hwan Han, Eun Ae Jung, Bo Keun Park, Sun Sook Lee, Jin-Ha Hwang, Chang Gyoung Kim, Taek-Mo Chung, Ki-Seok An,  
*KRICT; Hongik University, Seoul, Korea*

11:45-12:00 **Hydrogen Effect on Atomic Layer Deposition Silver Film Preparation** **77**

Chao-An Jong, C.-T. Ko, M.-J. Chen, J.-S. Hsu, T.-H. Chang, P. S. Chen, Yi-Ling Shen, Yi-Ling Jian,  
*NDL, Hsinchu ; NTU, Taipei ; Ming-Hsin U of Sci. and Tech., Hsin-Feng, Taiwan*

### Lunch, Hotel Granvia Kyoto

**Session 5A, "Growth & Characterizations II", June 17<sup>th</sup> Tuesday, Hall A (Kyoto Theater)**

**Session Chairs: Greg Parsons (NCSU), Ravi Kanjolia (SAFC)**

13:30-14:00 **Invited: Ozone based Atomic Layer Deposition for Gate Dielectrics** **78**

Jiyong Kim, *UT Dallas, United States*

14:00-14:15 **Comparative study on nucleation and growth of atomic layer deposition HfO<sub>2</sub> on grapheme** **79**

Il-Kwon Oh, Kangsik Kim, Mi Jin Lee, Zonghoon Lee, Clement Lansalot-Matras, Wontae Noh, Jukka Tanskanen, Han-Bo-Ram Lee, and Hyungjun Kim,  
*Yonsei University, Korea; UNIST, Ulsan, Korea; Air Liquide Korea; University of Eastern Finland; Incheon National University, Korea*

14:15-14:30 **Initial Growth Behavior of Atomic Layer Deposited TiO<sub>2</sub> Film on RuO<sub>x</sub> (x = 0~2) Substrate** **80**

Woojin Jeon, Woongkyu Lee, Yeon Woo Yoo, Cheol Hyun An, and Cheol Seong Hwang, *Seoul National University, Korea*

14:30-14:45 **Atomic Layer Deposition of SrTiO<sub>3</sub> Films with Sr(demamp)(tmhd) as Sr-precursor** **81**

Woongkyu Lee, Woojin Jeon, Yeon Woo Yoo, Cheol Hyun An, Min Jung Chung, Taek-Mo Chung, Chang Gyoung Kim, Bo Keun Park, Sheby M. George, and Cheol Seong Hwang, *Seoul National University, Seoul, Korea; KRICT, Korea*

14:45-15:00 **Atomic Layer Deposition of Thin, Amorphous VO<sub>2</sub> Films for Passive Thermal Management** **82**

Virginia Wheeler, Marko Tadjer, Neeraj Nepal, Michael Mastro, Kwok Cheung, Zachary Robinson, Fritz Kub, and Chip Eddy Jr.,  
*U.S. Naval Research Laboratory, Washington, DC, United States*

**Quick Poster Over View P17A, June 17<sup>th</sup> Tuesday, Hall A (Kyoto Theater)**

**Session Chairs: Masayuki Tanaka (Toshiba), Harm Knoop (Oxford Instruments)**

15:00-15:45 Poster No.17P001-17P0052

Each poster presenter will be given the opportunity to present his/her poster in one minute, one slide

**30 min Break**

**Session 6A, "Growth & Characterizations III", June 17<sup>th</sup> Tuesday, Hall A (Kyoto Theater)**

**Session Chairs: Steve George (Univ. Colorado Boulder), Motoaki Kawase (Kyoto Univ.)**

- 16:15-16:45 **Invited: Characteristics of higher-k films fabricated by ALD and low annealing temperature process** **83**  
Toshihide Nabatame, *National Institute of Materials Science, Tsukuba, Japan*
- 16:45-17:00 **Towards an In-depth Understanding and a Significant Enhancement of the Doping Efficiency of Al-doped ZnO Films** **84**  
Y. Wu, S.E. Potts, A.D. Giddings, M.A. Verheijen, T.J. Prosa, D.J. Larson, F. Roozeboom, and W.M.M. Kessels,  
*Eindhoven U. Technology; Holst Centre, Netherland; Univ. of London, United Kingdom; CAMECA Instruments, United States*
- 17:00-17:15 **Study on Reaction Mechanism of Plasma-Enhanced of Plasma-Enhanced Atomic Layer Deposition of SiO<sub>2</sub> Films by In-Situ Fourier Transform Infrared Spectroscopy** **85**  
Yi Lu, Akiko Kobayashi, Hiroki Kondo, Kenji Ishikawa, Makoto Sekine, and Masaru Hori, *Nagoya University, Japan; ASM Japan, Tokyo, Japan*
- 17:15-17:30 **Atomic Layer Deposition of Hexagonal ErFeO<sub>3</sub> Thin Films on SiO<sub>2</sub>/Si** **86**  
S.Vangelista, C. Wiemer, A. Lamperti, G. Tallarida, E. Chikoidze, Y. Dumont, M. Fanciulli, and R. Mantovan,  
*Laboratorio MDM, IMM-CNR, Agrate Brianza, Italy; GEMaC, Versailles, France; Università di Milano Bicocca, Milano, Italy*
- 17:30-17:45 **Comformality Evaluation of ALD Thin Films with Microscope Lateral High-Aspect-Ratio (LHAR) test structures** **87**  
Gao Feng, Kestutis Grigoras, Sanna Arpiainen, Sergey Gorelick, and Riikka L. Puurunen, *VTT Technical Research Centre of Finland*

**Poster Session 18:00-20:00**

**Poster & Exhibit Hall (Hotel Granvia Kyoto 3F, Genji Ballroom)**

## Day 2, Hall B (Hotel Granvia Kyoto 3F, Genji Ballroom)

Session 3B, "Energy Application III", June 17<sup>th</sup> Tuesday, Hall B (Hotel Granvia Kyoto)

Chairs: Hyungjun Kim (Yonsei Univ.), Parag Banerjee (Washington Univ.)

- 08:30-09:00 **Invited: ALD of Noble Metals for Energy Application** **88**  
Ham-Bo-Ram Lee, *Incheon National University, Korea*
- 09:00-09:15 **Sintering-Resistant Platinum Nanoparticles Catalyst for Aqueous Phase Reforming for Hydrogen Production** **89**  
Yu Lei, Christopher L. Marshall, and Jeffrey W. Elam,  
*University of Alabama in Huntsville; Argonne National Laboratory, United States*
- 09:15-09:30 **Pd/Pt Core/Shell Nanoparticles Prepared with Subnanometer Control of Core and Shell Dimensions** **90**  
M.J. Weber, M.A. Verheijen, A.A. Bol, and W.M.M. Kessels,  
*Eindhoven University of Technology, Netherlands*
- 09:30-09:45 **ALD Synthesis of MgO Based Catalysts for the Aldol Condensation of Furfural and Acetone** **91**  
David H.K. Jackson, B. O'Neill, J. Lee, B. Dunn, G. Huber, J. Dumesic, and T. Kuech, *University of Wisconsin, Madison, United States*
- 09:45-10:00 **Atomic Layer Deposition of Cerium Oxide for Potential Use in Diesel Soot Combustion** **92**  
Tatiana Ivanova, *Lappeenranta University of Technology, Finland*

### **30 min Break**

Session 4B, "Energy Application IV", June 17<sup>th</sup> Tuesday, Hall B (Hotel Granvia Kyoto)

Session Chairs: Gary Rubloff (Univ. Maryland), Kornelius Nielsch (Univ. Hamburg)

- 10:30-10:45 **Improved Solar Cells with Tin Monosulfide Absorber** **93**  
Prasert Sinsermsuksakul, Leizhi Sun, Sang Woon Lee, Helen H. Park, Sang Bok Kim, Chuanxi Yang, and Roy G. Gordon,  
*Harvard University, Cambridge, MA, United States*
- 10:45-11:00 **Ultrathin Amorphous Zinc-tin-oxide Buffer Layer for Enhancing Heterojunction Interface Quality in Cu<sub>2</sub>O Thin-film Solar Cells** **94**  
Jaeyeong Heo, Yun Seog Lee, Sin Cheng Siah, Jonathan Mailoa, Riley Brandt, Sang BokKim, Roy G. Gordon, and Tonio Buonassisi,  
*Chonnam National University, Gwangju, Korea; Massachusetts Institute of Technology, Harvard University, Cambridge, MA, United States*
- 11:00-11:15 **ALD grown absorber materials for bulk heterojunction solar cells** **95**  
Neha Mahuli and Shaibal K Sarkar,  
*Indian Institute of Technology Bombay, Powai, India*
- 11:15-11:30 **At the Edge of Thickness: Few A ZnO on CuO Nanowires for Highly Efficient Photoreduction of CO<sub>2</sub>** **96**  
Fei Wu, Wei-Ning Wang, Yoon Myung, Hyung Soon Im, Jeunghee Park, Pratim Biswas, and Parag Banerjee,  
*Washington University in St. Louis, MO, United States; Korea University, Jochiwon, Korea*
- 11:30-11:45 **Oxide Composite Photocatalysts Made by ALD** **97**  
Markku Leskelä, Jani Hämäläinen, Tomi Iivonen, Jiyeon Kim, Roland Fischer, Marta Buchalska, and Wojciech Macyk,

*University of Helsinki, Finland; Ruhr-Universität Bochum, Germany; Jagiellonian University, Krakow, Poland*

- 11:45-12:00 **ALD of Core-Shell Nanowire Structures for Solar Photovoltaic and Photoelectrochemical Energy Conversion** 98  
Neil Dasgupta, *University of Michigan, United States*

### Lunch, Hotel Granvia Kyoto

**Session 5B, "ULSI FEOL Applications", June 17<sup>th</sup> Tuesday, Hall B (Hotel Granvia Kyoto)**

**Session Chairs: Hyeongtag Jeon (Hanyang Univ.), Annelies Delabie (IMEC)**

- 13:30-14:00 **Invited: On the ALD Double Replacement Reaction Mechanism** 99  
Wei-Min Li, Xiang Li, Tero Pilvi, Erik Østreg, Charles Dezelah, Zhixian Chen, and Guo-Qiang Lo,  
*Picosun Oy, Finland & Singapore & Michigan, United States; Institute of Microelectronics, Singapore*
- 14:00-14:15 **Integration of CMOS Devices Beyond the 14nm Technology Node: Scaling and Manufacturing with ALD** 100  
J. Rozen, T. Ando, H. Tsai, S. Bangsaruntip, M. A. Guillorn, V. Narayanan, Y. Ogawa, T. Masuda, M. Hatanaka, K. Suu, and Y. Ogawa,  
*IBM, Yorktown Heights, NY, United States; ULVAC, Shizuoka, Japan*
- 14:15-14:30 **Formation of Nickel Silicide from ALD NiO Films** 101  
Viljami Pore, Eva Tois, Raija Matero, Suvi Haukka, Marko Tuominen,  
*ASM, Helsinki, Finland*
- 14:30-14:45 **Atomic Layer Deposition of high-k Ta-doped Al<sub>2</sub>O<sub>3</sub> layers as Gate Dielectric for AlGaIn/GaN High Electron Mobility Transistors on 8-inch Si(111) Substrate** 102  
T. Partida-Manzanera, J.W. Roberts, S. Mather, T.N. Bhat, S.B. Dolmanan, Z. Zhang, H.R. Tan, S. Tripathy, and R.J. Potter,  
*University of Liverpool, United Kingdom; A\*STAR Singapore*
- 14:45-15:00 **High-purity and Conformal Co, Ni and Ru thin films by Hot-wire assisted ALD for Microelectronic Applications** 103  
Guangjie Yuan, Hideharu Shimizu, Takeshi Momose, and Yukihiro Shimogaki,  
*The University of Tokyo, Tokyo, Japan*

### 30 min Break

**Session 6B, "Metallization and Memory Applications", June 17<sup>th</sup> Tuesday, Hall B (Hotel Granvia Kyoto)**

**Chairs: Atsuhiko Tsukune (TNS), Christophe Vallee (LETI-LTM)**

- 15:30-16:00 **Invited: Synthesis of Ru-based thin films by atomic layer deposition as a Cu direct-plateable diffusion barrier** 104  
Soo-Hyun Kim, *Yeungnam University, Korea*
- 16:00-16:15 **Impact Of The Starting Surface On The Film Characteristics Of Thermal Ru ALD For Metal-Insulator-Metal Applications** 105  
Mihaela Popovici, A. Delabie, C. Adelman, K. Marcoen, B. Groven, J. Swerts, J. Meersschaut, A. Franquet, A. Redolfi, M. Jurczak, and S. Van Elshocht,  
*Imec & KU Leuven, Leuven, Belgium; Technical University of Eindhoven, Eindhoven, Netherland*

- 16:15-16:30 **Ru-Electrode fabrication process development for next generation DRAM using a new CVD/ALD precursor** **106**  
Taewoong Kim, Takeshi Momose, and Yukihiro Shimogaki,  
*The University of Tokyo, Tokyo, Japan*
- 16:30-16:45 **Tetragonal Zirconia Alloys deposited by PEALD for Metal Insulator Metal Capacitor Applications** **107**  
J. Ferrand, M. Gros-Jean, E. Blanquet,  
*STMicroelectronics, Crolles; SIMaP, Grenoble, France*
- 16:45-17:00 **Development of ALD Solutions for ReRAM Applications** **108**  
R. Roelofs, Q. Xie, J. W. Maes, Y.Y. Chen, A. Redolfi, R. Matero, S. Haukka, J. Woodruff,  
P. Raisanen, M. Givens, *ASM and IMEC, Belgium*

**Quick Poster Over View P17B, June 17<sup>th</sup> Tuesday, Hall B (Granvia Kyoto)**

**Chairs: Masato Kawakami (Tokyo Electron), Charles Eddy (Naval Research Lab)**

17:00-17:45 Poster No.17P053-17P0104

Each poster presenter will be given the opportunity to present his/her poster in one minute, one slide

**Poster Session 18:00-20:00**

**Poster & Exhibit Hall (Granvia Kyoto, 3F "Genji" Room)**

Poster Session, June 17<sup>th</sup> Tuesday, 18:00-20:00

Session Chairs: Masayuki Tanaka (Toshiba), Harm Knoops (Oxford Instruments),  
Masato Kawakami (Tokyo Electron), Charles Eddy (Naval Research Lab)

- 17P001 **Atomic Layer Deposition of Fluoride Films for the Coating of  $\text{LiNi}_x\text{Mn}_y\text{Co}_{1-x-y}\text{O}_2$  Battery Cathodes** 254  
David Jackson et al., University of Wisconsin - Madison, United States
- 17P002 **Research on thin films with high laser induced damage threshold deposited by atomic layer deposition** 255  
Yaowei Wei et al., Chengdu Fine Optical Engineering Research Center, China
- 17P003 **Fabrication of Pt Catalyst on TiN Inverse Opal Structure as Electrode for PEMFC by Atomic Layer Deposition** 256  
Yoh-Rong Liu et al., National Tsing Hua University, Taiwan
- 17P004 **The Influence of ALD  $\text{Al}_2\text{O}_3$  Process Parameters on Modified  $\text{SnO}_2$  Photoanode of Dye-Sensitized Solar Cells** 257  
Qiang Chen et al., Beijing Institute of Graphic Communication, China
- 17P005 **The ALD ZnO Coating As Inverted Organic Solar Cell Buffer Layer** 258  
Qiang Chen et al., Beijing Institute of Graphic Communication, China
- 17P006 **Performance Improvement of Nanotextured Black Silicon Solar Cells by Surface Passivation Using Atomic Layer Deposition** 259  
Wei-Cheng Wang et al., National Taiwan University, Taiwan
- 17P007 **An Experiment on Process Temperature Dependence of Electrical and Optical Characteristics of AZO thin Films by ALD** 260  
Kyung-Hoon Yoo et al., Korea Institute of Industrial Technology, Korea
- 17P008 **Atomic layer deposition of transition metal oxide thin films for energy harvesting application** 261  
Shingo Okubo et al., Air Liquide Laboratories, Japan
- 17P009 **Study of CIGS TCO and Buffer Layer Using Atomic Layer Deposition (ALD)** 262  
Hyo Sik Chang et al., Chungnam National University, Korea
- 17P010 **Development of Transparent Conductors (TCs) by Atomic Layer Deposition Technique** 263  
Soumyadeep Sinha et al., Indian Institute of Technology Bombay, India
- 17P011 **Atomic Layer Deposition of Cobalt Oxide Films Using a Novel Cobalt Precursor and Ozone** 264  
Won-Jun Lee et al., Sejong University, Korea
- 17P012 **Nitrogen doped  $\text{TiO}_2$  ALD thin films to achieve p-n junctions** 265  
Elisabeth Blanquet et al., CNRS, France
- 17P014 **Coating Electrospun Fiber Mats to Enhance Stability in Battery Anode Applications** 266  
Virginia Wheeler et al., U.S. Naval Research Laboratory, United States
- 17P015 **Atomic layer deposited  $\text{Al}_2\text{O}_3$ /diamond field effect transistors using surface p-channel prepared by thermal treatment with  $\text{H}_2$ + $\text{NH}_3$  gases** 267  
Imura Masataka et al., National Institute for Materials Science (NIMS), Japan
- 17P017 **A Study on Gallium-Doped ZnO Film for High-Speed Green GaN/GaN Light-Emitting Diodes by ALD** 268  
Chien-Lan Liao, National Tsing Hua University, Taiwan
- 17P018 **Ultrathin Insulator of  $\text{Al}_2\text{O}_3$  Film Deposited Using Atomic Layer Deposition on Grating Structure for Surface Plasmonic Device** 269  
Sheng-Hui Chen, National Central University, Taiwan

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	Esko Ahvenniemi, Aalto University, Finland	
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	Helmut Baumgart, Old Dominion University, United States	
17P021	<b>Surface modification using ALD for high voltage positive electrodes of Li-ion batteries</b>	<b><u>272</u></b>
	Yohei Shindo, Toyota Motor Corporation, Japan	
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	Kuang I Liu et al., National Tsing Hua University, Taiwan	
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	Christian Canlas et al., Argonne National Laboratory, United States	
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	Christian Canlas et al., Argonne National Laboratory, United States	
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	Matti Putkonen et al., VTT Technical Research Centre of Finland, Finland	
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	Matti Putkonen et al., VTT Technical Research Centre of Finland, Finland	
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Claire Burgess et al., Imperial College London, United Kingdom
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Adam Bertuch et al., Ultratech / Cambridge NanoTech, United States
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Wayne Gladfelter et al., University of Minnesota, United States
- 17P090 **Influence of Al<sub>2</sub>O<sub>3</sub> gate insulators deposited by PE-ALD method in electrical properties of IGZO-TFT** 337  
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- 17P091 **Atomic Layer Deposition of Tin Titanate Using Tin(II)Acetylacetonate and Tetrakis(Diethylamino)Titanium** 338  
Siliang Chang et al., University of Illinois at Chicago, United States
- 17P092 **Large Area ALD Coated MCPs for LAPPD** 339  
Michael Minot et al., Incom Inc., United States
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Seung Hak Song et al., Korea University, Korea
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Delin Kong et al., Beijing Institute of Graphic Communication, China

- 17P096 **Modification of Challenging Powdery Materials by ALD; Carbon Nanotubes, and Nano-Sized Copper and Titanium Dioxide as Examples** 342  
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Kyung-Hoon Yoo et al., Korea Institute of Industrial Technology, Korea
- 17P098 **Optimized Filtration and Purification for Contamination Control for Advanced ALD Processes** 344  
Matthew Wagner et al., Pall Corporation, United States
- 17P099 **Scalable Control Program for Multi-precursor Flow-type Atomic Layer Deposition System** 345  
Sathees Kannan Selvaraj et al., University of Illinois at Chicago, United States
- 17P100 **Tungsten Hexacarbonyl and Hydrogen Peroxide as Precursors for the Growth of Tungsten Oxide Thin Films on Titania Nanoparticles** 346  
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- 17P101 **Low Temperature Remote Plasma Spatial ALD (FAST-ALD) Process for Al-Based Dielectrics** 347  
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- 17P102 **High Speed ALD of Ultra-Barrier Films for Direct Encapsulation of Rigid Substrates and Roll to Roll Processing** 348  
Eric Dickey et al., Lotus Applied Technology, United States
- 17P103 **Numerical Analysis on Flow Field in a High-Speed Atomic Layer Deposition Reactor for Al<sub>2</sub>O<sub>3</sub> Thin Films** 349  
Kyung-Hoon Yoo et al., Korea Institute of Industrial Technology, Korea
- 17P104 **The Efficiency of Precursor Utilization in ALD on Nanoparticles** 350  
Ruud J. van Ommen, Delft University of Technology, Netherlands

## Day 3, Hall A (Kyoto Theater)

Session 7A, "Growth & Characterizations IV", June 18<sup>th</sup> Wednesday, Hall A (Kyoto Theater)

**Chairs: Motoaki Kawase (Kyoto Univ.), Iain Buchanan (Air Products)**

- 08:30-09:00 **Invited: In-situ analysis of the surface reactions in PEALD SiO<sub>2</sub> film for advanced litho applications** **109**  
Masaru Hori, *Nagoya University, Japan*
- 09:00-09:15 **Atomic Layer Deposition of Platinum Nanoparticles on Titanium Oxide and Tungsten Oxide Using Pt(hfac)<sub>2</sub> and Formalin as the Reactants** **110**  
Virginia Anderson, N. Leick, J. Clancey, K. Hurst, Kim Jones, Anne Dillon, and Steven George,  
*University of Colorado, Boulder, United States; TU Eindhoven, Netherlands; NREL, Golden, United States*
- 09:15-09:30 **In Situ Study of the Initial Island Growth Mode during ALD of Pt** **111**  
J. Dendooven, A. Coati, G. Portale, K. Devloo-Casier, R. K. Ramachandran, M. Minjauw, T. Dobbelaere, W. Bras, and C. Detavernier,  
*Ghent University, Belgium; Synchrotron SOLEIL, France; 3Dubble, ESRF, Grenoble, France*
- 09:30-09:45 **Combining ALD and XANES to Probe the Interfacial Atomic Arrangement Between PbS Quantum Dots and TiO<sub>2</sub> Nanoparticles** **112**  
Orlando Trejo, Katherine Roelofs, Ritimukta Sarangi, Dennis Nordlund, Stacey Bent, and Fritz Prinz, *Stanford University, United States*
- 09:45-10:00 **In Situ Study of Plasma Assisted Atomic Layer Epitaxy of AlN Using Synchrotron X-ray Methods** **113**  
N. Nepal, M.G. Rainville, S.D. Johnson, A. DeMasi, K.F. Ludwig, C.R. Eddy, Jr.,  
*U.S. Naval Research Laboratory, Washington; Boston University, United States*

### **30 min Break**

Session 8A, "Growth & Characterizations V" June 18<sup>th</sup> Wednesday, Hall A (Kyoto Theater)

**Session Chairs: Erwin Kessels (Tech. Univ. Eindhoven), Andrew Cavanagh (Univ. Colorado)**

- 10:30-10:45 **In-situ XPS Investigation of ALD Cu<sub>2</sub>O and Cu Thin-Films after Successive Reduction** **114**  
Dileep Dhakal, Thomas Waechtler, Robert Mothes, Stefan Schulz, Heinrich Lang, and T. Gessner,  
*Technische Universität Chemnitz, Fraunhofer - ENAS, Chemnitz, Germany*
- 10:45-11:00 **The Role of Hydrazine and its Derivatives in Atomic Layer Deposition of Tungsten Nitride Thin Films** **115**  
Karla Bernal-Ramos, Tianniu Chen, Ravindra Kanjolia, and Yves J. Chabal,  
*University of Texas at Dallas, Richardson; SAFC Hitech, Haverhill, United States*
- 11:00-11:15 **Growth Characteristics, Optical Properties, and Crystallinity of Thermal and Plasma-Enhanced ALD AlN Films** **116**  
H. Van Bui, F. B. Wiggers, A. Gupta, A. A. I. Aarnink, M. D. Nguyen, M. P. de Jong, and A. Y. Kovalgin, *MESA+, University of Twente, Enschede, Netherlands*
- 11:15-11:30 **Sub-atomic layer scale deposition using physically adsorbing precursor and kinetic analysis of deposition characteristics: Growth of (GeTe<sub>2</sub>)<sub>(1-x)</sub>(Sb<sub>2</sub>Te<sub>3</sub>)<sub>x</sub> layers using Ge<sup>4+</sup> alkoxides** **117**

Taeyong Eom, Taehong Gwon, Sijung Yoo, Moo-Sung Kim, Iain Buchanan, Manchao Xiao, and Cheol Seong Hwang,  
*Seoul National University, Seoul, Korea; Air Products, Korea and USA*

11:30-11:45 **Atomic Layer Deposition of  $\text{AlF}_3$  Using Halide Precursors** **118**

Miia Mäntymäki, Mikko Ritala and Markku Leskelä,  
*University of Helsinki, Finland*

11:45-12:00 **ALD Metal Fluorides for Optical Coatings in the Ultraviolet** **119**

John Hennessy, A. Jewell, S. Nikzad, B. Balasubramanian, C. Moore, and K. France,  
*Jet Propulsion Laboratory, CalTech, Pasadena, CA; CASA, University of Colorado, Boulder, CO, United States*

### **Lunch, Hotel Granvia Kyoto**

**Session 9A, “Novel Materials I”, June 18<sup>th</sup> Wednesday, Hall A (Kyoto Theater)**

**Session Chairs: Mikko Ritala (Univ. Helsinki), Shi-Woo Rhee (Postech)**

13:30-14:00 **Invited: Atomic Layer Epitaxy of III-N Semiconductors: Early Progress and Future Perspectives** **120**

Charles Eddy, *Naval Research Laboratory, United States*

14:00-14:15 **Growth and Characterization of Uniform  $\text{In}_x\text{Al}_{1-x}\text{N}$  and  $\text{In}_x\text{Ga}_{1-x}\text{N}$  Alloys by ALE for next Generation Device Applications** **121**

N. Nepal, J.K. Hite, V.R. Anderson, V.D. Wheeler, S.B. Qadri, and C.R. Eddy, Jr.,  
*U.S. Naval Research Laboratory, Washington, DC, United States*

14:15-14:30 **Surface Chemistry of Deposition Processes for Epitaxial Si-O Superlattices** **122**

A. Delabie, S. Jayachandran, A. Billen, B. Douhard, T. Conard, J. Meersschaut, H. Bender, J. Demeulemeester, W. Vandervorst, M. Caymax, M. Heyns,  
*Imec, Leuven, Belgium ; KU Leuven, Leuven, Belgium*

14:30-14:45 **Synthesis of Thickness Controlled Molybdenum Disulfide using Atomic Layer Deposition** **123**

Youngjun Kim, Jeong-Gyu Song, Jusang Park, and Hyungjun Kim,  
*Yonsei University, Seoul, Republic of Korea*

14:45-15:00 **A chemical route to epitaxial oxides on semiconductors: Crystalline  $\text{SrTiO}_3$  and  $\text{SrHfO}_3$  grown directly on Ge (001) by ALD** **124**

Martin D. McDaniel, Thong Q. Ngo, Agham Posadas, Alexander A. Demkov, and John G. Ekerdt, *University of Texas at Austin, USA*

### **30 min Break**

**Session 10A, “Novel Materials II”, June 18<sup>th</sup> Wednesday, Hall A (Kyoto Theater)**

**Session Chairs: Masao Inoue (Renesas), Nobuyuki Kobayashi (ASM)**

15:30-15:45 **Synthesis, Characterization, and Application of Tunable Resistance Coatings Prepared by Atomic Layer Deposition** **125**

Anil U. Mane, Joseph A. Libera, and Jeffrey W. Elam,  
*Argonne National Laboratory, Argonne, Illinois, United States*

15:45-16:00 **Unusual Atomic Layer Deposition of Bi-Metallic Fluorides and Oxyfluoride** **126**

Anil U. Mane, Mahua Biswas, and Jeffrey W. Elam,  
*Argonne National Laboratory, Argonne, Illinois, United States*

- 16:00-16:15 **Organic-Inorganic Hybrid Semiconductor Thin Films Deposited by Molecular-Atomic Layer Deposition (MALD)** 127  
Jie Huang, Antonio Lucero, Lanxia Cheng, and Jiyoung Kim,  
*University of Texas at Dallas, Richardson, Texas, United States*
- 16:15-16:30 **Pyrolysis of Alucone MLD Films to Form Electrically Conducting and Nanodomained Al<sub>2</sub>O<sub>3</sub>/C Composite Films** 128  
Jaime W. DuMont, Jonathan J. Travis, and Steven M. George,  
*University of Colorado, Boulder, CO, United States*
- 16:30-16:45 **Atomic/Molecular Layer Deposition of Hybrid Inorganic-Organic [(Ti<sub>1-x</sub>Nb<sub>x</sub>O<sub>2</sub>)<sub>m</sub>(Ti-O-C<sub>6</sub>H<sub>4</sub>-O-)]<sub>n</sub> Superlattice Thin Films from TiCl<sub>4</sub>, H<sub>2</sub>O, Nb(OEt)<sub>5</sub> and Hydroquinone Precursors** 129  
Janne-Petteri Niemelä and Maarit Karppinen, *Aalto University, Espoo, Finland*
- 16:45-17:00 **ALD Enabled Accelerated Development of Functional Low-Density Bulk Materials** 130  
Monika M. Biener  
*Lawrence Livermore National Laboratory (LLNL), Livermore, CA, United States*

### Closing Remarks

**Conference Banquet 18:00-20:00, Hotel Granvia Kyoto, Kokin Jr. Ballroom**

## Day 3, Hall B (Hotel Granvia Kyoto 3F, Genji Ballroom)

Session 7B, "Emerging Applications I", June 18<sup>th</sup> Wednesday, Hall B (Hotel Granvia Kyoto)

Session Chairs: Paul Poodt (TNO, Holst Center), Matti Putkonen (Beneq)

- 08:30-09:00 **Invited: Atomic Layer Deposition for Optical Microcavities** **131**  
Yongfeng Mei, *Fudan University, China*
- 09:00-09:15 **Novel synthesis and characterization of advanced materials for dental and orthopedic implants** **132**  
Arman Butt, Sweetu Patel, Cortino Sukotjo, Mathew Mathew, Tolou Shokuhfar, and Christos Takoudis,  
*University of Illinois at Chicago, IL; Michigan Technological University, Houghton, MI, United States*
- 09:15-09:30 **Preparation of Hydroxyapatite Thin Films by Conversion of Atomic Layer Deposited CaCO<sub>3</sub>** **133**  
Jani Holopainen, Kyösti Kauppinen, Kenichiro Mizohata, Eero Santala, Markku Leskelä, Juha Tuukkanen, and Mikko Ritala,  
*University of Helsinki & University of Oulu, Finland*
- 09:30-09:45 **Al-infiltrated Spider Dragline Silk and its Molecular Deformation Behaviors** **134**  
Seung-Mo Lee, Eckhard Pippel, Oussama Moutanabbir, Jae-Hyun Kim, Hak-Joo Lee, and Mato Knez,  
*KIMM & UST, Daejeon, Korea; MPI Microstructure Physics, Halle, Germany; Ecole Polytechnique, Canada; nanoGUNE San Sebastian, Spain; IKERBASQUE, Bilbao, Spain*
- 09:45-10:00 **Atomic Layer Deposition of Superconducting Aluminum Thin Films Using Dimethylethylamine Alane** **135**  
Yuichi Harada, Hajime Suzuki, and Hiroshi Yamaguchi,  
*NTT Basic Research Laboratories, Japan*

### 30 min Break

Session 8B, "Emerging Applications II", June 18<sup>th</sup> Wednesday, Hall B (Granvia Kyoto)

Chairs: Virginia Wheeler (US Naval Labs), Markku Leskela (Univ. Helsinki)

- 10:30-11:00 **Invited: ALD for Surface Engineering and Fabrication of Electrode Nanomaterials** **136**  
Hongjin Fan, *Nanyang Technological University, Singapore*
- 11:00-11:15 **Challenges for ALD coating of large-area microchannel plate substrates** **137**  
Anil Mane, Jeffrey Elam, Joseph Libera, Wagner Robert, Aileen O'Mahony, Christopher Craven, Michael Minot, Oswald Siegmund, Jason McPhate, Henry Frisch, Andrey Elagin, and Matthew Wetstein, *Argonne National Laboratory, IL; University of Chicago; University of California, Berkeley; Incom, Inc., Charlton, MA, United States*
- 11:15-11:30 **Microfabricated Thin-layer Chromatography Plates on Patterned Carbon Nanotube Forests by Atomic Layer Deposition of Silica** **138**  
Supriya Kanyal, David Jansen, Andrew Miles, Andrew Dadson, Michael Vail, Richard Vanfleet, Robert Davis, and Matt Linford,  
*Brigham Young University, Provo, UT; Diamond Analytics, Orem, UT, United States*

- 11:30-11:45 **Nanopatterning of Inorganic Materials by Sequential Infiltration Synthesis: In Situ FTIR Investigation of the Precursor-Polymer Interaction** **139**  
 Mahua Biswas, Joseph A. Libera, Seth B. Darlingb, and Jeffrey Elam,  
*Argonne National Laboratory, Illinois; University of Chicago, Illinois, United States*
- 11:45-12:00 **Highly Adsorptive, MOF-Functionalized Nonwoven Fiber Mats for Hazardous Gas Capture Enabled by Atomic Layer Deposition** **140**  
 Junjie Zhao, Mark Losego, Paul Lemaire, Philip Williams, Bo Gong, Sarah Atanasov, Trent Blevins, Christopher Oldham, Howard Walls, Sarah Shepherd, Matthew Browe, Gregory Peterson, and Greg Parsons,  
*North Carolina State University, Raleigh; RTI Intl, NC; Edgewood Chemical Biological Center, United States*

### **Lunch, Hotel Granvia Kyoto**

**Session 9B, “Emerging Applications III”, June 18<sup>th</sup> Wednesday, Hall B (Granvia Kyoto)**  
**Session Chairs: Hongjin Fan (Nanyang Tech. Univ.), Ganesh Sundaran (Ultratech)**

- 13:30-14:00 **Invited: Progress in rational ALD design for semiconductor high volume manufacturing** **141**  
 Dave Thompson, *Applied Materials, United States*
- 14:00-14:15 **Mechanisms of selectivity during infiltration synthesis of directed block copolymer assembly for high-density bit-patterned media** **142**  
 Y.-A. Chapuis, L. Wan, S. Xiong, H. Gao, J. Lille, K. Panel, E. Dobisz, A. Bogdanov, P. Nealey, T. R. Albrecht, and R. Ruiz,  
*HGST, a Western Digital company, San Jose, CA; University of Chicago, Chicago, IL, United States*
- 14:15-14:30 **In situ Process Optimization of Lithium-based Multicomponent Oxides** **143**  
 Laurent Lecordier, *Ultratech, MA, United States*
- 14:30-14:45 **Solvation of molecular oxide by atomic layer deposition oxide** **144**  
 Norifusa Satoh and Roy G. Gordon,  
*National Institute for Materials Science (NIMS), Tsukuba, Japan; Harvard University, MA, United States*
- 14:45-15:00 **Synthesis of CNT/Ni Nanocomposite Using Atomic Layer Deposition for High Performance Non-enzymatic Glucose Sensing** **145**  
 Taejin Choi, Soo Hyeon Kim, Chang Wan Lee, Eunkyong Kim, Sang-Kyung Choi, Soo-Hyun Kim, and Hyungjun Kim,  
*Yonsei University, Seoul, South Korea; Yeungnam University, Korea*

### **30 min Break**

**Session 10B, “Manufacturing”, June 18<sup>th</sup> Wednesday, Hall B (Granvia Kyoto)**  
**Session Chairs: Yongfeng Mei (Fudan Univ.), Jiro Yugami (Hitachi Kokusai Electric)**

- 15:30-16:00 **Invited: Temporal and Spatial Reactors for ALD on particles** **146**  
 J. Ruud van Ommen, Dirkjan Kooijman, Mojgan Talebi, and Aris Goulas,  
*Delft University of Technology, ChemE, Delft, Netherlands*
- 16:00-16:15 **An Industrial Scale Spatial Atomic Layer Deposition of Al<sub>2</sub>O<sub>3</sub> Films as a Moisture Permeation Barrier at Low Temperature (<100°C)** **147**

Hagyoung Choi, Seokyeon Shin, Junghun Kim, Byeongseong Cho, Jinyoung Jung, Sanghun Kim, Seog Chul Chung, Kiyoung Oh, and Hyeontag Jeon,  
*Hanyang University, Seoul, Korea*

16:15-16:30 **Spatial Atomic Layer Deposition of Amorphous TiO<sub>x</sub> Films** **148**

Fieke van den Bruele, Andrea Illiberi, Yves Creyghton, Fred Roozeboom, and Paul Poodt, *Holst Centre/TNO; Eindhoven University of Technology, Eindhoven, Netherlands*

16:30-16:45 **Pulse to Pulse Variability in Precursor Flow Rates when using Evaporated Liquid Precursors Entrained in a Carrier Gas** **149**

William A. Kimes, J. E. Maslar, and B. A. Sperling,  
*National Institute of Standards and Technology, Gaithersburg MD, United States*

16:45-17:00 **PE-ALD of Metallic Nickel Thin Films** **150**

Sascha Bönhardt, Stefan Riedel, and Jonas Sundqvist,  
*Fraunhofer IPMS, Dresden, Germany*

17:00-17:15 **ALD of Aluminium Nitride in a Large Batch Reactor** **151**

B. Jongbloed, D. Pierreux, W. Knaepen, R. Roelofs, H. Sprey, T. Blomberg, and S. Haukka,  
*ASM, Leuven, Belgium & Helsinki, Finland*

### **Closing Remarks**

**Conference Banquet 18:00-20:00, Hotel Granvia Kyoto, Kokin Jr. Ballroom**