

# Technical Program Key

## Conference Topics

<b>AA</b>	ALD Applications
<b>AF</b>	ALD Fundamentals
<b>ALE</b>	Atomic Layer Etching
<b>AM</b>	ALD for Manufacturing
<b>AS</b>	Area Selective ALD
<b>EM</b>	Emerging Materials
<b>NS</b>	Nanostructure Synthesis and Fabrication
<b>PS</b>	Plenary Session

## Key to Session/Paper Numbers

Sessions sponsored by multiple topics are labeled with all acronyms (e.g. **AC+EM+SS**), then a number to indicate simultaneous sessions sponsored by the same topic(s) (e.g. **SS1, SS2**), then a dash followed by the first two characters of the day of the week:

**Monday, Tuesday, Wednesday, Thursday, Friday,**  
then a single letter for **Morning, Afternoon, Evening, Poster,**  
and finally a number indicating the starting time slot for the paper.  
Example: **SS1-MoM9** (Surface Science, Monday morning, 11:00 am).

# Technical Program Overview

Room /Time	Evergreen Ballroom & Foyer	Grand Ballroom A-C	Grand Ballroom A-G	Grand Ballroom E-G	Grand Ballroom H-K	Regency Ballroom A-C
<b>SuP</b>	ALE Poster Session 6:00 pm-8:00 pm  Welcome Reception & Exhibits 6:00 pm-8:00 pm					
<b>MoM</b>	Exhibits 10:00 am-7:30 pm  Morning Break 10:15 am-10:45 am		ALD 2019 Opening Remarks & ALD 2019 Innovation Award 8:30 am  PS1-MoM: ALD Plenary Session  ALE 2019 Opening Remarks 10:15 am  PS2-MoM: ALE Plenary Session			
<b>MoA</b>	Lunch 12:00 pm-1:30 pm  Afternoon Break 3:30 pm-4:00 pm	AA1-MoA: ALD for Biological & Space Applications  AA2-MoA: ALD for Solar Cells, Fuel Cells, & H <sub>2</sub> Storage		AF2-MoA: ALD Precursors I  AF3-MoA: Growth & Characterization I	AF1-MoA: ALD Growth Mechanisms I  AF4-MoA: Growth Mechanisms II	ALE1-MoA: Energy-enhanced ALE  ALE2-MoA: ALE of Compound Semiconductors
<b>MoP</b>	ALD/ALE Poster Session 5:45 pm-7:30 pm					
<b>TuM</b>	Exhibits 10:00 am-7:30 pm  Morning Break 10:00 am-10:30 am	AF1-TuM: In-Situ Characterization of ALD Processes  AF3-TuM: Growth & Characterization II		AA1-TuM: ALD for Catalysts, Electrocatalysts, & Photocatalysts  AA2-TuM: ALD for Batteries I	AF2-TuM: ALD Precursors II  AS1-TuM: Area-Selective ALD Techniques	ALE1-TuM: ALE: Gas-phase and/or Thermal ALE  ALE2-TuM: Alternative Methods to ALE
<b>TuA</b>	Lunch 12:00 pm-1:30 pm  Afternoon Break 3:30 pm-4:00 pm	AA3-TuA: ALD for Memory Applications I  AF-TuA: Plasma ALD: Growth & Characterization		AA1-TuA: Emerging Applications I  AA2-TuA: ALD for Batteries II	AS1-TuA: Area-Selective ALD by Area-Deactivation  AS2-TuA1: Area-Selective ALD: Combinations with Etching  AS2-TuA2: Late Breaking Abstracts	ALE1-TuA: Modeling & Instrumentation I  ALE2-TuA: Modeling & Instrumentation II
<b>TuP</b>	ALD/ALE Poster Session 5:30 pm-7:30 pm					
<b>WeM</b>	Exhibits 10:00 am-1:30 pm  Morning Break 10:00 am-10:30 am  Lunch 12:00 pm-1:30 pm	EM1-WeM: Molecular Layer Deposition  EM2-WeM: Organic-Inorganic Hybrid Materials		AM1-WeM: Spatial ALD, Fast ALD, and Large-Area ALD  EM3-WeM: Epitaxial Growth and III-V Materials	AA1-WeM: ALD for Memory Applications II  AA2-WeM: ALD for ULSI Applications I	ALE1-WeM: Integration & Application of ALE  ALE2-WeM: Materials Selective ALE
<b>WeA</b>		AA1-WeA: Emerging Applications II		NS-WeA: 2D Nanomaterials by ALD (including Transition Metal Dichalcogenides)	AA2-WeA: ALD for ULSI Applications II  ALD-ALE 2019 Closing Remarks & Student Awards 3:30 pm	EM1-WeA: Ternary & Quaternary Oxide Materials

# Sunday Evening Poster Sessions, July 21, 2019

## Atomic Layer Etching

### Evergreen Ballroom & Foyer - Session ALE-SuP

#### Atomic Layer Etching Poster Session

6:00pm

Note: ALE Posters Will Remain Posted All Week

**ALE-SuP1** Mechanistic Thermal Desorption Studies of Thermal Dry Etching Reactions for Cobalt and Iron Thin Films, *Mahsa Konh, A. Teplyakov*, University of Delaware

**ALE-SuP2** Mechanistic Study of the Thermal Atomic Layer Etch of Tungsten Metal Using  $O_2$  and  $WCl_6$ , *S. Kondati Natarajan, M. Nolan*, Tyndall National Institute, Ireland; *Patrick Theofanis, C. Mokhtarzadeh, S.B. Clendinning*, Intel Corp.

**ALE-SuP3** Using Etching of the Atomic Layer to Remove Damaged Layers Obtained by Plasma-Chemical Etching with Subsequent Growth of GaAs Quantum Dots by the Method of Droplet Epitaxy, *Victor Klimin, A. Rezvan, O. Ageev*, Southern Federal University, Russia

**ALE-SuP4** Atomic Layer Etching of Silicon Using a Conventional ICP Etch Chamber for Failure Analysis Applications, *John Mudrick, R. Shul, K.D. Greth, R. Goeke, D. Adams*, Sandia National Laboratories

**ALE-SuP5** Study of the Chemical Fabrication Process of NSOM Probes and the Modification of its Surface for Sensing Applications, *Muhammad Nazmul Hussain, J. Woehl*, University of Wisconsin-Milwaukee

**ALE-SuP6** A Mechanistic Study of the HF Pulse in the Thermal Atomic Layer Etch of  $HfO_2$  and  $ZrO_2$ , *Rita Mullins, S. Kondati Natarajan, M. Nolan*, Tyndall National Institute, Ireland

**ALE-SuP7** Atomic Precision Processing of Aluminum Mirrors for Enhanced Ultra-violet Optical Properties, *Scott Walton, A. Kozen*, U.S. Naval Research Laboratory; *J. del Hoyo, M. Quijada*, NASA Goddard Space Flight Center; *D. Boris*, U.S. Naval Research Laboratory

**ALE-SuP8** Surface Reaction Analysis for Atomic-Layer Etching and Deposition by Means of Beam Experiments, *Kazuhiro Karahashi, T. Ito, S. Hamaguchi*, Osaka University, Japan

**ALE-SuP9** Atomic Layer Etching of  $SiO_2$  and  $Si_3N_4$  with Fluorocarbon, Hydrofluorocarbon and Fluoroether Compounds, *H. Chae, Yongjae Kim, T. Cha, Y. Cho*, Sungkyunkwan University (SKKU), Republic of Korea

**ALE-SuP10** Cyclic Etching of Copper Thin Films using Two Sequential Steps, *Eun Tack Lim, J.S. Choi, J.S. Ryu, M.H. Cha, C.W. Chung*, Inha University, Republic of Korea

**ALE-SuP11** Analysis of Mechanisms Involved in Cryogenic ALE, *Thomas Tillocher, G. Antoun, P. Lefauchaux, R. Dussart*, GREMI Université d'Orléans/CNRS, France; *K. Yamazaki, K. Yatsuda*, Tokyo Electron Limited, Japan; *J. Faguet, K. Maekawa*, TEL Technology Center, America, LLC

**ALE-SuP12** Study on Dry Etching Characteristics of Germanium Oxide by Atomic Layer Deposition, *Donghyuk Shin, J. Jeong, H. Song, H. Park, D.-H. Ko*, Yonsei University, Republic of Korea

**ALE-SuP13** Laser Isotropic Atomistic Removal of Germanium, *D. Paeng, He Zhang, Y.S. Kim*, Lam Research Corp.

**ALE-SuP14** Anisotropic Atomic Layer Etching of Tungsten using Reactive Ion Beam, *Doo San Kim, J.E. Kim, W.O. Lee, Y.J. Gill, B.H. Jeong, G.Y. Yeom*, Sungkyunkwan University, Republic of Korea

# Monday Morning, July 22, 2019

Grand Ballroom A-G		
8:30am	ALD 2019 Opening Remarks and ALD 2019 Innovation Award Presentation	<b>Plenary Session Session PS1-MoM</b>  <b>ALD Plenary Session</b>  <b>Moderators:</b> Sumit Agarwal, Colorado School of Mines Dennis Hausmann, Lam Research Corp.
8:45am	<b>INVITED: PS1-MoM2</b> Atomic Scale Processing: From Understanding to Innovation, <i>Erwin Kessels</i> , Eindhoven University of Technology, Netherlands	
9:00am	Invited talk continues.	
9:15am	Invited talk continues.	
9:30am	<b>INVITED: PS1-MoM5</b> Elucidating the Mechanisms for Atomic Layer Growth through In Situ Studies, <i>Jeffrey W. Elam</i> , Argonne National Laboratory	
9:45am	Invited talk continues.	
10:00am	Invited talk continues.	
10:15am	<b>Break &amp; Exhibits</b>	
10:30am	<b>Break &amp; Exhibits</b>	
10:45am	<b>ALE 2019 Opening Remarks</b>	
11:00am	<b>INVITED: PS2-MoM11</b> Mapping the Future Evolution of Atomic Scale Processing to enable the World of Artificial Intelligence, <i>Eric A. Joseph</i> , IBM T.J. Watson Research Center	
11:15am	Invited talk continues.	<b>Plenary Session Session PS2-MoM</b>  <b>ALE Plenary Session</b>  <b>Moderators:</b> Craig Huffman, Micron Technology Gottlieb S. Oehrlein, University of Maryland
11:30am	Invited talk continues.	
11:45am	<b>ALD/ALE 2019 Sponsor Preview</b>	
12:00pm	<b>Lunch &amp; Exhibits</b>	

# Monday Afternoon, July 22, 2019

Grand Ballroom A-C		
1:30pm	<b>AA1-MoA1</b> Atomic Layer Deposition on Pharmaceutical Particles for Inhaled Drug Delivery, <i>Damiano La Zara</i> , Delft University of Technology, Netherlands; <i>D. Zhang, M.J. Quayle, G. Petersson, S. Folestad</i> , AstraZeneca, Sweden; <i>J.R. van Ommen</i> , Delft University of Technology, Netherlands	<b>ALD Applications Session AA1-MoA</b>
1:45pm	<b>AA1-MoA2</b> The Use of Atomic Layer Deposition to Increase the Availability of Medical Radio-Isotopes, <i>Ruud van Ommen, J. Moret, B. Wolterbeek, E. Pidko, A. Denkova</i> , Delft University of Technology, Netherlands	<b>ALD for Biological and Space Applications</b>
2:00pm	<b>AA1-MoA3</b> Atomic Layer Deposition for Biosensing Applications, <i>O. Graniel, Matthieu Weber, S. Balme, P. Miele, M. Bechelany</i> , Institut Européen des Membranes, France	<b>Moderators:</b> Elton Graugnard, Boise State University Mato Knez, CIC nanoGUNE
2:15pm	<b>AA1-MoA4</b> Multi-layer Stacked ALD Coating for Hermetic Encapsulation of Implantable Biomedical Microdevices, <i>J. Jeong</i> , Pusan National University, Republic of Korea; <i>S. Sigurdsson, F. Laiwalla</i> , Brown University; <i>R. Ritasalo, M. Pudas, T. McKee, T. Pilvi, Juhana Kostama</i> , Picosun Oy, Finland; <i>A. Nurmikko</i> , Brown University; <i>Tom Blomberg</i> , Picosun Oy/ASM, Finland	
2:30pm	<b>AA1-MoA5</b> Modification of Spaceflight Radiator Coating Pigments by Atomic Layer Deposition for Thermal Applications, <i>Vivek Dwivedi</i> , NASA Goddard Space Flight Center; <i>R. Adomaitis, H. Salami, A. Uy</i> , University of Maryland; <i>M. Hasegawa</i> , NASA Goddard Space Flight Center	
2:45pm	<b>AA1-MoA6</b> Novel Atomic Layer Deposition Process/Hardware for Superconducting Films for NASA Applications, <i>Frank Greer, D. Cunnane</i> , Jet Propulsion Laboratory	
3:00pm	<b>AA1-MoA7</b> Fluoride-based ALD Materials System for Optical Space Applications, <i>John Hennessy</i> , Jet Propulsion Laboratory, California Institute of Technology	
3:15pm	<b>AA1-MoA8</b> Atomic Layer Deposition of Aluminum Fluoride for use in Astronomical Optical Devices, <i>Alan Uy, H. Salami, A. Vadapalli, C. Grob, R. Adomaitis</i> , University of Maryland; <i>V. Dwivedi</i> , NASA Goddard Space Flight Center	
3:30pm	<b>Break &amp; Exhibits</b>	
3:45pm	<b>Break &amp; Exhibits</b>	
4:00pm	<b>AA2-MoA11</b> Nucleation Layer for Atomic Layer Deposition Enabling High Efficiency and Flexible Monolithic All-Perovskite Tandem Solar Cells, <i>Axel F. Palmstrom, G. Eperon, T. Leijtens</i> , National Renewable Energy Laboratory; <i>R. Prasanna</i> , Stanford University; <i>S. Nanayakkara, S. Christensen, K. Zhu</i> , National Renewable Energy Laboratory; <i>M. McGehee</i> , University of Colorado Boulder; <i>D. Moore, J.J. Berry</i> , National Renewable Energy Laboratory	<b>ALD Applications Session AA2-MoA</b>
4:15pm	<b>AA2-MoA12</b> Perovskite Solar Cells Fabricated using Atomic Layer Deposited Doped ZnO as a Transparent Electrode, <i>Louise Ryan, M. McCarthy, S. Monaghan, M. Modreanu, S. O'Brien, M. Pemble, I. Povey</i> , Tyndall National Institute, Ireland	<b>ALD for Solar Cells, Fuel Cells, and H<sub>2</sub> Storage</b>
4:30pm	<b>AA2-MoA13</b> Metal Oxide Barrier and Buffer Layers by Atomic Layer Deposition and Pulsed-Chemical Vapor Deposition for Semi-Transparent Perovskite Solar Cells, <i>Helen Hejin Park, T. Eom, R.E. Agbenyeke, S.M. Yeo, G.J. Kim, S.S. Shin, T.-Y. Yang, N.J. Jeon, Y.K. Lee, C.G. Kim, T.-M. Chung, J. Seo</i> , Korea Research Institute of Chemical Technology (KRICT), Republic of Korea	<b>Moderators:</b> Christophe Detavernier, Ghent University Nicholas Strandwitz, Lehigh University
4:45pm	<b>AA2-MoA14</b> Particle Atomic Layer Deposition of Tungsten Nitride Environmental Barrier Coatings from Bis(t-butylimido)bis(dimethylamino) tungsten(VI) and Ammonia, <i>Sarah Bull, A. Weimer</i> , University of Colorado - Boulder	
5:00pm	<b>AA2-MoA15</b> Atomic Layer Deposition on Mg(BH <sub>4</sub> ) <sub>2</sub> : A Route to Improved Automotive H <sub>2</sub> storage, <i>Noemi Leick</i> , National Renewable Energy Laboratory; <i>K. Gross</i> , H <sub>2</sub> Technology Consulting LLL; <i>T. Gennett, S. Christensen</i> , National Renewable Energy Laboratory	
5:15pm	<b>AA2-MoA16</b> Plasmonic Mediated Hydrogen Desorption from Metal Hydrides, <i>Katherine Hurst, A. Gauling, M. Martinez, N. Leick, S. Christensen, T. Gennett</i> , National Renewable Energy Laboratory	
5:30pm	<b>AA2-MoA17</b> Surface Modification of Solid Oxide Fuel Cell Cathodes by Atomic Layer Deposition, <i>Dong Hwan Kim, H.J. Choi, J. Koo</i> , Korea University, Republic of Korea; <i>J.H. Park, J.-W. Son</i> , Korea Institute of Science and Technology (KIST), Republic of Korea; <i>J.H. Shim</i> , Korea University, Republic of Korea	
5:45pm	<b>Poster Session</b>	

# Monday Afternoon, July 22, 2019

<b>Grand Ballroom E-G</b>		
1:30pm	<b>INVITED: AF2-MoA1</b> The Materials Supplier Challenge: Flawless Execution from Precursor Design to High Volume Manufacturing, <i>Madhukar B. Rao</i> , Versum Materials	<b>ALD Fundamentals Session AF2-MoA</b>  <b>ALD Precursors I</b>  <b>Moderators:</b> Daniel Alvarez, RASIRC Charles H. Winter, Wayne State University
1:45pm	Invited talk continues.	
2:00pm	<b>AF2-MoA3</b> Precursor and Co-Reactant Selection: A Figure of Merit, <i>Seán Barry</i> , <i>M. Griffiths</i> , Carleton University, Canada	
2:15pm	<b>AF2-MoA4</b> Designing Thermal Atomic Layer Deposition Processes for Gold Metal using New Organogold Precursors and Co-reagents, <i>Matthew Griffiths</i> , <i>G. Bačić</i> , <i>A. Varga</i> , <i>S. Barry</i> , Carleton University, Canada	
2:30pm	<b>AF2-MoA5</b> A New Carbene Based Silver Precursor Applied in APP-ALD Yielding Conductive and Transparent Ag Films: A Promising Precursor Class for Ag Metal ALD, <i>Nils Boysen</i> , Ruhr University Bochum, Germany; <i>T. Hasselmann</i> , <i>D. Theirich</i> , <i>T. Riedl</i> , University of Wuppertal, Germany; <i>A. Devi</i> , Ruhr University Bochum, Germany	
2:45pm	<b>AF2-MoA6</b> Transition Metal $\beta$ -ketoiminates: A Promising Precursor Class for Atomic Layer Deposition of Binary and Ternary Oxide Thin Films, <i>Dennis Zywitzki</i> , <i>A. Devi</i> , Ruhr University Bochum, Germany	
3:00pm	<b>AF2-MoA7</b> A New and Promising ALD Process for Molybdenum Oxide Thin Films: From Process Development to Hydrogen Gas Sensing Applications, <i>Jan-Lucas Wree</i> , Ruhr University Bochum, Germany; <i>M. Mattinen</i> , University of Helsinki, Finland; <i>E. Ciftyürek</i> , <i>K.D. Schierbaum</i> , Heinrich Heine University Düsseldorf, Germany; <i>M. Ritala</i> , <i>M. Leskelä</i> , University of Helsinki, Finland; <i>A. Devi</i> , Ruhr University Bochum, Germany	
3:15pm	<b>AF2-MoA8</b> Atomic Layer Deposition of Gallium Oxide Thin Films using Pentamethylcyclopentadienyl Gallium and Combinations of H <sub>2</sub> O and O <sub>2</sub> Plasma, <i>Fumikazu Mizutani</i> , <i>S. Higashi</i> , Kojundo Chemical Laboratory Co., Ltd., Japan; <i>M. Inoue</i> , <i>T. Nabatame</i> , National Institute for Materials Science, Japan	
3:30pm	<b>Break &amp; Exhibits</b>	
3:45pm	<b>Break &amp; Exhibits</b>	
4:00pm	<b>AF3-MoA11</b> Understanding Elemental Steps of ALD on Oxidation Catalysts, <i>Kristian Knemeyer</i> , <i>M. Piernavieja Hermida</i> , <i>R. Naumann d'Alnoncourt</i> , Technische Universität Berlin, Germany; <i>A. Trunschke</i> , <i>R. Schlögl</i> , Fritz Haber Institute of the Max Planck Society, Germany; <i>M. Driess</i> , Technische Universität Berlin, Germany; <i>F. Rosowski</i> , BASF SE, Germany	<b>ALD Fundamentals Session AF3-MoA</b>  <b>Growth and Characterization I</b>  <b>Moderators:</b> Somilkumar Rathi, Eugenius, Inc. Sumit Agarwal, Colorado School of Mines
4:15pm	<b>AF3-MoA12</b> Advanced Lateral High Aspect Ratio Test Structures for Conformality Characterization by Optical Microscopy, <i>Oili Ylivaara</i> , <i>P. Hyttinen</i> , VTT Technical Research Centre of Finland Ltd, Finland; <i>K. Arts</i> , Eindhoven University of Technology, Netherlands; <i>F. Gao</i> , VTT Technical Research Centre of Finland Ltd, Finland; <i>W.M.M. Kessels</i> , Eindhoven University of Technology, Netherlands; <i>R. Puurunen</i> , Aalto University, Finland; <i>M. Utriainen</i> , VTT Technical Research Centre of Finland Ltd, Finland	
4:30pm	<b>AF3-MoA13</b> Dopant Concentration Analysis of ALD Thin Films in 3D Structures by ToF-SIMS, <i>A.M. Kia</i> , <i>Wenke Weinreich</i> , Fraunhofer-Institut für Photonische Mikrosysteme (IPMS), Germany; <i>M. Utriainen</i> , VTT Technical Research Centre of Finland Ltd, Finland; <i>R. Puurunen</i> , Aalto University, Finland; <i>N. Haufe</i> , Fraunhofer-Institut für Photonische Mikrosysteme (IPMS), Germany	
4:45pm	<b>AF3-MoA14</b> Metallic Ruthenium Coating on SiO <sub>2</sub> Powder by Atomic Layer Deposition using H <sub>2</sub> O Reactant., <i>Chi Thang Nguyen</i> , Incheon National University, Republic of Korea	
5:00pm	<b>AF3-MoA15</b> Low Energy Ion Scattering Study of Pt@Al <sub>2</sub> O <sub>3</sub> Nanoparticle Coarsening, <i>Philipp Brüner</i> , IONTOF GmbH, Germany; <i>E. Solano</i> , ALBA Synchrotron Light Source, Spain; <i>C. Detavernier</i> , <i>J. Dendooven</i> , Ghent University, Belgium	
5:15pm	<b>AF3-MoA16</b> Physical and Electrical Characterization of ALD Chalcogenide Materials for 3D Memory Applications, <i>Vijay K. Narasimhan</i> , <i>V. Adinolfi</i> , <i>L. Cheng</i> , <i>M.E. McBriarty</i> , Intermolecular, Inc.; <i>M. Utriainen</i> , <i>F. Gao</i> , VTT Technical Research Centre of Finland Ltd, Finland; <i>R. Puurunen</i> , Aalto University, Finland; <i>K. Littau</i> , Intermolecular, Inc.	
5:30pm	<b>AF3-MoA17</b> The Tailoring of the Single Metal Atom-Oxide Interface, <i>Bin Zhang</i> , <i>Y. Qin</i> , Institute of Coal Chemistry, Chinese Academy of Sciences, China	
5:45pm	<b>Poster Session</b>	

# Monday Afternoon, July 22, 2019

Grand Ballroom H-K		
1:30pm	<b>AF1-MoA1</b> Hybrid Computational Fluid Dynamics / Machine Learning Approaches to Reactor Scale Simulations and Optimization of ALD, ALEt, and LPCVD Processes, <i>Angel Yanguas-Gil, S. Letourneau, A. Lancaster, J.W. Elam</i> , Argonne National Laboratory	<b>ALD Fundamentals Session AF1-MoA</b>  <b>ALD Growth Mechanisms I</b>  <b>Moderators:</b> Simon Elliot, Schrödinger, Inc. Angel Yanguas-Gil, Argonne National Laboratory
1:45pm	<b>AF1-MoA2</b> Scalable Kinetic Monte-Carlo Model for Parasitic Reactions in Silicon Nitride Growth using 3DMAS Precursor, <i>Gem Shoute, T. Muneshwar</i> , Synthergy Inc., Canada; <i>D. Barlage, K. Cadien</i> , University of Alberta, Canada	
2:00pm	<b>INVITED: AF1-MoA3</b> Diffusion and Aggregation in Island-Growth and Area-Selective Deposition, <i>Fabio Grillo</i> , ETH Zurich, Switzerland	
2:15pm	Invited talk continues.	
2:30pm	<b>AF1-MoA5</b> Surface Kinetics in ALD and ALE: Computing the Cooperative Effect by Automated Enumeration of Reaction Pathways with Spectator Adsorbates, <i>Thomas Mustard</i> , Schrödinger, Inc.; <i>S. Elliot</i> , Schrödinger, Inc.; <i>T. Hughes, A. Bochevarov, L. Jacobson, S. Kwak</i> , Schrödinger, Inc.; <i>T. Morisato</i> , Schrödinger K.K., Japan; <i>J. Gavartin</i> , Schrödinger, Inc., UK; <i>S. Pandiyan</i> , Schrödinger, Inc., India; <i>M. Halls</i> , Schrödinger, Inc.	
2:45pm	<b>AF1-MoA6</b> An Immiscible Fluids Approach for Correctly Predicting Agglomerate Dynamics during Particle Atomic Layer Deposition (Particle ALD), <i>Julia Hartig, A. Weimer</i> , University of Colorado - Boulder	
3:00pm	<b>INVITED: AF1-MoA7</b> The Time-Resolved Interface between ALD and CVD, <i>Henrik Pedersen</i> , Linköping University, Sweden	
3:15pm	Invited talk continues.	
3:30pm	<b>Break &amp; Exhibits</b>	
3:45pm	<b>Break &amp; Exhibits</b>	
4:00pm		<b>ALD Fundamentals Session AF4-MoA</b>  <b>Growth Mechanisms II</b>  <b>Moderators:</b> Viljami Pore, ASM Mikko Ritala, University of Helsinki
4:15pm	<b>INVITED: AF4-MoA12</b> Monolithic Integration of Single Crystal Perovskites on Semiconductors with ALD, <i>John Ekerdt</i> , University of Texas at Austin	
4:30pm	Invited talk continues.	
4:45pm	<b>AF4-MoA14</b> Surface Enhanced Raman Spectroscopy Studies of Aluminum ALD Precursors for Al <sub>2</sub> O <sub>3</sub> Growth, <i>Michael Foody</i> , Illinois Institute of Technology	
5:00pm	<b>AF4-MoA15</b> Atomic Layer Deposition of Aluminum, Hafnium and Zirconium Oxyfluoride Films with Tunable Stoichiometry, <i>Neha Mahuli, J. Wallas, S.M. George</i> , University of Colorado - Boulder	
5:15pm	<b>AF4-MoA16</b> Fundamental Study on the SiO <sub>2</sub> Growth Mechanism of Electronegativity Difference of Metal-O in the High-k Underlayers by PE-ALD Method, <i>Erika Maeda</i> , Shibaura Institute of Technology, Japan; <i>T. Nabatame</i> , National Institute for Materials Science, Japan; <i>M. Hirose</i> , Shibaura Institute of Technology, Japan; <i>M. Inoue, A. Ohji, N. Ikeda</i> , National Institute for Materials Science, Japan; <i>M. Takahashi, K. Ito</i> , Osaka University, Japan; <i>H. Kiyono</i> , Shibaura Institute of Technology, Japan	
5:30pm	<b>AF4-MoA17</b> Low Temperature Aluminium Nitride Deposition: Comparing Hydrazine and Ammonia, <i>Aswin L.N. Kondusamy, S.M. Hwang, A.T. Lucero, Z. Qin, X. Meng</i> , The University of Texas at Dallas; <i>D. Alvarez, J. Spiegelman</i> , RASIRC; <i>J. Kim</i> , The University of Texas at Dallas	
5:45 pm	<b>Poster Session</b>	

# Monday Afternoon, July 22, 2019

Regency Ballroom A-C		
1:30pm	<b>INVITED: ALE1-MoA1</b> Atomic Layer Etching – Advancing Its Application with a New Regime, <i>Samantha Tan, W. Yang, K.J. Kanarik, Y. Pan, R. Gottscho</i> , Lam Research Corp.	<b>Atomic Layer Etching Session ALE1-MoA</b>  <b>Energy-enhanced ALE</b>  <b>Moderators:</b> Keren J. Kanarik, Lam Research Corp. Harm Knoops, Oxford Instruments Plasma Technology
1:45pm	Invited talk continues.	
2:00pm	<b>ALE1-MoA3</b> Control of the Interface Layer in ALE Process by Alternating O <sub>2</sub> Plasma with Fluorocarbon Deposition for High Selectivity Etching, <i>Takayoshi Tsutsumi, A. Kobayashi</i> , Nagoya University, Japan; <i>N. Kobayashi</i> , ASM Japan K.K., Japan; <i>M. Hori</i> , Nagoya University, Japan	
2:15pm	<b>ALE1-MoA4</b> Self-limiting Atomic Layer Etching of SiO <sub>2</sub> using Low Temperature Cyclic Ar/CHF <sub>3</sub> Plasma, <i>Stefano Dallorto</i> , Lawrence Berkeley National Laboratory; <i>A. Goodyear, M. Cooke</i> , Oxford Instruments Plasma Technology, UK; <i>S. Dhuey</i> , Lawrence Berkeley National Laboratory; <i>J. Szornel</i> , Lawrence Livermore National Laboratory; <i>I. Rangelow</i> , Ilmenau University of Technology, Germany; <i>S. Cabrini</i> , Lawrence Berkeley National Laboratory	
2:30pm	<b>ALE1-MoA5</b> Evolution of Photoresist Layer Structure and Surface Morphology in a Fluorocarbon-Plasma-Based Atomic Layer Etching Process, <i>Adam Pranda, K-Y. Lin, S. Gutierrez Razo, J. Fourkas, G.S. Oehrlein</i> , University of Maryland	
2:45pm	<b>ALE1-MoA6</b> Optimized Radical Composition of C4F8/Ar Plasma to Improve Atomic Layer Etching of SiO <sub>2</sub> , <i>Young-Seok Lee, J.-J. Lee, S.-W. Yoo, S.-H. Lee, I.-H. Seong, C.-H. Cho, S.-J. Kim, J.-P. Son, S.-J. You</i> , Chungnam National University, Korea	
3:00pm	<b>ALE1-MoA7</b> Atomic Layer Etching of Silicon Nitride with Ultrahigh Etching Selectivity over Silicon and Oxide Materials by Utilizing Novel Etch Gas Molecule, <i>Xiangyu Guo</i> , American Air Liquide; <i>N. Stafford</i> , Air Liquide; <i>V. Pallem</i> , American Air Liquide	
3:15pm	<b>ALE1-MoA8</b> Atomic Layer Etching at Low Substrate Temperature, <i>Gaëlle Antoun, T. Tillocher, P. Lefaucheux, R. Dussart</i> , GREMI Université d'Orléans/CNRS, France; <i>K. Yamazaki, K. Yatsuda</i> , Tokyo Electron Limited, Japan; <i>J. Faguet, K. Maekawa</i> , TEL Technology Center, America, LLC	
3:30pm	<b>Break &amp; Exhibits</b>	
3:45pm	<b>Break &amp; Exhibits</b>	
4:00pm	<b>INVITED: ALE2-MoA11</b> Developments of Atomic Layer Etch Processes and their Applications in Fabricating III-V Compound Semiconductor Devices, <i>Xu Li, Y.-C. Fu, S.-J. Cho, D. Hemakumara, K. Floras, D. Moran, I. Thayne</i> , University of Glasgow, UK	<b>Atomic Layer Etching Session ALE2-MoA</b>  <b>ALE of Compound Semiconductors</b>  <b>Moderators:</b> David Boris, U.S. Naval Research Laboratory Ishii Yohei, Hitachi High Technologies
4:15pm	Invited talk continues.	
4:30pm	<b>ALE2-MoA13</b> GaN and Ga <sub>2</sub> O <sub>3</sub> Thermal Atomic Layer Etching Using Sequential Surface Reactions, <i>N. Johnson, Y. Lee, Steven M. George</i> , University of Colorado - Boulder	
4:45pm	<b>ALE2-MoA14</b> Selective GaN Etching Process using Self-limiting Cyclic Approach for Power Device Applications, <i>Frédéric Le Roux, N. Posseme, P. Burtin, S. Barnola, A. Torres</i> , Univ. Grenoble Alpes, CEA, LETI, France	
5:00pm	<b>ALE2-MoA15</b> ALE of GaN (0001) by Sequential Oxidation and H <sub>2</sub> /N <sub>2</sub> Plasma, <i>Kevin Hatch, D. Messina, H. Fu, K. Fu, X. Wang, M. Hao, Y. Zhao, R. Nemanich</i> , Arizona State University	
5:15pm	<b>ALE2-MoA16</b> Comparative Study of Two Atomic Layer Etching Processes for GaN, <i>Cédric Mannequin, C. You</i> , University of Tsukuba, Japan; <i>G. Jacopin, T. Chevolleau, C. Durand</i> , University Grenoble-Alpes, France; <i>C. Vallée</i> , LTM-UGA, France; <i>C. Dussarat, T. Teramoto</i> , Air Liquide Laboratories, Japan; <i>H. Mariette</i> , University Grenoble-Alpes, France; <i>K. Akimoto, M. Sasaki</i> , University of Tsukuba, Japan; <i>E. Gheeraert</i> , University Grenoble-Alpes, France	
5:30pm	<b>ALE2-MoA17</b> Chlorinated Surface Layer of GaN in Quasi Atomic Layer Etching of Cyclic Processes of Chlorine Adsorption and Ion Irradiation, <i>Masaki Hasegawa, T. Tsutsumi</i> , Nagoya University, Japan; <i>A. Tanide</i> , SCREEN Holdings Co., Ltd.; <i>H. Kondo, M. Sekine, K. Ishikawa, M. Hori</i> , Nagoya University, Japan	
5:45pm	<b>Poster Session</b>	



## ALD Fundamentals

### Evergreen Ballroom & Foyer - Session AF1-MoP Precursor Synthesis and Process Development Poster Session 5:45pm

**AF1-MoP1** Atomic Layer Deposition of Molybdenum Films from Molybdenum Pentachloride Precursor, **Changwon Lee**, S.-W. Lee, M.-S. Kim, Versum Materials, Republic of Korea; S. Ivanov, Versum Materials, Inc.

**AF1-MoP2** Atomic Layer Deposition of Silver Metal Films: Synthesis and Characterization of Thermally Stable Silver Metal Precursors, **Harshani J. Arachchilage**, C.H. Winter, Wayne State University

**AF1-MoP3** Atomic Layer Deposition of Lanthanum Oxide Using Heteroleptic La Precursors, **Daehyeon Kim**, J. Lee, W. Noh, Air Liquide Laboratories Korea, South Korea

**AF1-MoP4** Synthesis and Thermal Characterization of New Molybdenum Precursors for Atomic Layer Deposition of Molybdenum Metal, **Michael Land**, Carleton University, Canada; K. Robertson, Saint Mary's University, Canada; S. Barry, Carleton University, Canada

**AF1-MoP6** A Novel Hf Precursor with Linked Cyclopentadienyl-Amido Ligand for Thermal Atomic Layer Deposition of HfO<sub>2</sub> Thin Film, **Jeong do Oh**, M.-H. Nim, J.-S. An, J.-H. Seok, J.-W. Park, Hansol Chemical, Republic of Korea

**AF1-MoP7** Atomic Layer Deposition of WS<sub>2</sub> using a New Metal-Organic Precursor and H<sub>2</sub>S Molecules, **Deok Hyun Kim**, D.K. Nandi, S.-H. Kim, Yeungnam University, Republic of Korea

**AF1-MoP8** Recent Advances in the Development of Metal Organic Precursors for Atomic Layer Deposition, **Anjana Devi**, L. Mai, D. Zywitzki, S.M.J. Beer, N. Boysen, D. Zanders, J.-L. Wree, M. Wilken, H. Parala, Ruhr University Bochum, Germany

**AF1-MoP9** Synthesis of Group VI Oxyhalide Adducts and Mo Metal Film Growth on TiN Surfaces, **David Ermert**, R. Wright Jr., T. Baum, Entegris, Inc.

**AF1-MoP10** Gallium Precursor Development for ALD Film Applications, **Atsushi Sakurai**, M. Hatase, N. Okada, A. Yamashita, ADEKA Corporation, Japan

**AF1-MoP11** Design and Optimization of Heteroleptic Zirconium Precursors by Density Function Theory Calculation, **Romel Hidayat**, Sejong University, Republic of Korea; J.-H. Cho, H.-D. Lim, B.-I. Yang, J.J. Park, W.-M. Chae, DNF Co. Ltd, Republic of Korea; H.-L. Kim, Sejong University, Republic of Korea; S.I. Lee, DNF Co. Ltd, Republic of Korea; W.-J. Lee, Sejong University, Republic of Korea

**AF1-MoP12** Low Temperature Plasma-Enhanced Atomic Layer Deposition of ZnO from a New Non-Pyrophoric Zn Precursor, **Lukas Mai**, F. Mitscher, P. Awakowicz, A. Devi, Ruhr University Bochum, Germany

**AF1-MoP13** Homoleptic and Heteroleptic Yttrium Precursor: Tuning of Volatility, Reactivity and Stability for ALD Applications, **Sebastian Markus Josef Beer**, A. Devi, Ruhr University Bochum, Germany

**AF1-MoP14** Gallium ALD Precursor Development based on Mechanistic Study, **M. Foody**, Y. Zhao, **Adam Hock**, Illinois Institute of Technology

**AF1-MoP15** Fluorine Doping of Aluminium Oxide Through In-situ Precursor Synthesis: Theory, Design and Application., **Ben Peek**, University of Liverpool, UK

## ALD Fundamentals

### Evergreen Ballroom & Foyer - Session AF2-MoP Precursor Selection and Growth Optimization Poster Session 5:45pm

**AF2-MoP1** Atomic Layer Deposition of Cyclopentadienyl Based Hf Precursor With Various Oxidants, **Jooho Lee**, D. Kim, W. Noh, Air Liquide Laboratories Korea, South Korea

**AF2-MoP2** Atomic Layer Deposition of Magnesium Oxide Thin Films by using Bis(ethylcyclopentadienyl)magnesium Precursor and H<sub>2</sub>O, O<sub>2</sub> Plasma and O<sub>3</sub> Reactants, **Moo-Sung Kim**, S.-W. Lee, Versum Materials Korea, Republic of Korea; S. Ivanov, Versum Materials, Inc.

**AF2-MoP3** Comparative Study between CpTi(OMe)<sub>3</sub> and CpTi(NMe<sub>2</sub>)<sub>3</sub> for Atomic Layer Deposition of Titanium Oxide, **Jaemin Kim**, S. Kim, R. Hidayat, Y. Choi, H.-L. Kim, W.-J. Lee, Sejong University, Republic of Korea

**AF2-MoP4** Tin Nitride Atomic Layer Deposition using Hydrazine, **Ann Greenaway**, A. Tamboli, S. Christensen, National Renewable Energy Laboratory

**AF2-MoP5** Growing Polycrystalline Indium Oxide Film by Atomic Layer Deposition, **Chien-Wei Chen**, ITRC, NARL, Republic of China

**AF2-MoP6** Low Temperature Tin Oxide by Atomic Layer Deposition, **Yu-Chiao Lin**, B.-H. Liu, Y.-S. Yu, C.-C. Kei, C.-L. Lin, National Applied Research Laboratories, Republic of China

**AF2-MoP7** Dielectric ALD with Hydrogen Peroxide: Comparative Study of Growth and Film Characteristics for Anhydrous H<sub>2</sub>O<sub>2</sub>, H<sub>2</sub>O<sub>2</sub>/H<sub>2</sub>O Mixtures and H<sub>2</sub>O, **Daniel Alvarez**, RASIRC; K. Andachi, G. Tsuchibuchi, K. Suzuki, Taiyo Nippon Sanso Corporation; J. Spiegelman, RASIRC

**AF2-MoP8** Atomic Layer Deposition of Carbon Doped Silicon Oxide and Effect of Thermal Treatment or Hydrogen Plasma Treatment on The Films, **Meiliang Wang**, H. Chandra, X. Lei, A. Mallikarjunan, K. Cuthill, M. Xiao, M. Rao, Versum Materials, Inc.

**AF2-MoP9** DFT Study on Atomic Layer Deposition of Al<sub>2</sub>O<sub>3</sub> with Various Oxidants, **Seunggi Seo**, T. Nam, Yonsei University, Republic of Korea; H.B.R. Lee, Incheon National University, Republic of Korea; B. Shong, Hongik University, Republic of Korea; H. Kim, Yonsei University, Republic of Korea

**AF2-MoP10** Effect of Heteroleptic Structure on Atomic Layer Deposited HfO<sub>2</sub> Using Hf(N(CH<sub>3</sub>)<sub>2</sub>)<sub>4</sub> and CpHf(N(CH<sub>3</sub>)<sub>2</sub>)<sub>3</sub> Precursors, **Sungmin Park**, B.-E. Park, S. Lee, H. Yoon, Yonsei University, Republic of Korea; M.Y. Lee, S.-H. Kim, Yeungnam University, Republic of Korea; H. Kim, Yonsei University, Republic of Korea

**AF2-MoP11** Effect of Co-Reactant on the Atomic Layer Deposition of Copper Oxide, **Jason Avila**, N. Nepal, V. Wheeler, U.S. Naval Research Laboratory

**AF2-MoP12** A Systematic Study on Atomic Layer Deposition of ZrO<sub>2</sub> Thin Films, **X. Wang**, J. Cai, **Xiangbo Meng**, University of Arkansas

**AF2-MoP13** Hydrophobic SiO<sub>x</sub> Thin Film Deposition using Low-Temperature Atomic Layer Deposition, **Taewook Nam**, H. Kim, Yonsei University, Republic of Korea

**AF2-MoP14** Characteristics of High-temperature ALD SiO<sub>2</sub> Thin Films Using a Si Precursor with Excellent Thermal Stability, **Jae-Seok An**, J.-R. Park, M.-H. Nim, Hansol Chemical, Republic of Korea; Y. Kim, J. Gu, S. Kim, Sejong University, Republic of Korea; J.-H. Seok, J.-W. Park, Hansol Chemical, Republic of Korea; W.-J. Lee, Sejong University, Republic of Korea

**AF2-MoP15** Developing Routes Toward Atomic Layer Deposition of Tungsten using Fluorine-Free W Precursor and Various Reactants with Density Functional Theory, **Tae Hyun Kim**, D.K. Nandi, M.Y. Lee, Yeungnam University, Republic of Korea; R. Hidayat, S. Kim, W.-J. Lee, Sejong University, Republic of Korea; S.-H. Kim, Yeungnam University, Republic of Korea

**AF2-MoP16** ALD HfO<sub>2</sub> with Anhydrous H<sub>2</sub>O<sub>2</sub> in a 300 mm Cross-flow Reactor – Comparison with H<sub>2</sub>O and O<sub>3</sub> Oxidants, **Steven Consiglio**, R. Clark, C. Wajda, G. Leusink, TEL Technology Center, America, LLC

**AF2-MoP17** Atomic Layer Deposition of Copper (I) Chloride using Liquid 1-Chlorobutane Precursor, **Richard Krumpolec**, D. Cameron, D. Bača, J. Humlíček, O. Caha, Masaryk University, Czech Republic

**AF2-MoP18** Number Effect of Si Atoms Contained in Precursor for SiN Atomic Layer Deposition, **Seungbae Park**, H. Ji, H. Yang, S. Yoon, DUKSAN Techopia company, Republic of Korea; I.-S. Park, Hanyang University, Republic of Korea

## ALD Fundamentals

### Evergreen Ballroom & Foyer - Session AF3-MoP Growth Mechanisms and In Situ Studies Poster Session 5:45pm

**AF3-MoP1** Langasite Crystal Microbalance (LCM) for In-situ Process Monitoring of ALD up to 440 °C, **Masafumi Kumano**, Tohoku University, Japan; K. Inoue, Piezo Studio, Japan; K. Hikichi, Technofine co. Ltd, Japan; M. Shimizu, S. Tanaka, Tohoku University, Japan

**AF3-MoP2** In-Situ Process Monitoring of Precursor Delivery Using Infra-Red Spectroscopic Method, **Robert Wright**, T. Baum, Entegris, Inc.

**AF3-MoP3** Quantitative Analysis of High-k ALD Precursors for Trace Elemental Impurities by Inductively Coupled Plasma – Mass Spectrometry (ICP-MS), **Jinjin Wang**, L. Mey-Ami, F. Li, Air Liquide Electronics – Balazs NanoAnalysis

# Monday Evening Poster Sessions, July 22, 2019

**AF3-MoP4** Numerical Studies of the Fluid Dynamics and Chemical Kinetics of Spatial Atomic Layer Deposition of Al<sub>2</sub>O<sub>3</sub>, **Dongqing Pan**, University of North Alabama

**AF3-MoP5** Mechanistic Understanding of Dicholosalane Thermal Decomposition during Atomic Layer Deposition of Silicon Nitride, **Gyeong Hwang**, **G. Hartmann**, University of Texas at Austin; **P. Ventzek**, Tokyo Electron America Inc.; **T. Iwao**, **K. Ishibashi**, Tokyo Electron Ltd.

**AF3-MoP6** New Challenges of the Channeled Spectroscopic Ellipsometry for ALD Applications, **Gai Chin**, ULVAC Inc., Japan

**AF3-MoP7** In-situ Ellipsometric Analysis of the Plasma Influence on Atomic Layer Deposited AlN Thin Films, **Necmi Biyikli**, **S. Ilhom**, **D. Shukla**, **A. Mohammad**, **B. Willis**, University of Connecticut

**AF3-MoP8** Reaction Mechanisms of Thermal and Plasma-Modified ALD Growth Studied by In-Situ Mass Spectrometry, **Thomas J. Larrabee**, **L.B. Ruppalt**, U.S. Naval Research Laboratory

**AF3-MoP10** In-situ Quartz Crystal Microbalance Study of Poly(3,4-ethylenedioxythiophene) (PEDOT) by Oxidative Molecular Layer Deposition (o-MLD), **Jungsik Kim**, **A. Volk**, North Carolina State University

## ALD Fundamentals

### Evergreen Ballroom & Foyer - Session AF4-MoP

#### Plasma Enhanced ALD Poster Session

5:45pm

**AF4-MoP1** Low-temperature Atomic Layer Deposition of Yttrium Oxide using tris(butylcyclopentadienyl)yttrium and a Plasma-Excited Humidified Argon, **Kentaro Saito**, **K. Yosida**, **K. Kanomata**, **M. Miura**, **B. Ahmmad**, **K. Shigeru**, **F. Hirose**, Yamagata University, Japan

**AF4-MoP2** Plasma Enhanced Atomic Layer Deposition of Silicon Nitride Thin Film by Organosilane Precursor and Process Engineering, **Se-Won Lee**, **C. Lee**, **M.-S. Kim**, Versum Materials Korea, Republic of Korea; **S. Yi**, **X. Lei**, Versum Materials, Inc.

**AF4-MoP3** Understanding the Effect of Plasma Gas Chemistry and Reactor Pressure on the Crystallinity of AlN Films Grown via Plasma-Assisted Atomic Layer Deposition, **Saidjafarzoda Ilhom**, **D. Shukla**, **A. Mohammad**, **N. Biyikli**, **B. Willis**, University of Connecticut

**AF4-MoP4** Plasma Enhanced Atomic Layer Deposition of Aluminum and Aluminum Fluoride, **Daniel Messina**, **Z. Haung**, **B. Eller**, **F. Koeck**, **P. Scowen**, **R. Nemanich**, Arizona State University

**AF4-MoP5** High-temperature Hollow Cathode Plasma Enhanced Atomic Layer Deposition of Silicon Nitride (SiN<sub>x</sub>) Thin Films using Hexachlorodisilane (HCDS), **Su Min Hwang**, **A.L.N. Kondusamy**, **Q. Zhiyang**, **H.S. Kim**, **J. Kim**, University of Texas at Dallas; **X. Zhou**, **B.K. Hwang**, Dow Chemicals

**AF4-MoP6** Effects of Ion Bombardment in Plasma Enhanced Atomic Layer Deposition Processes, **Hu Li**, Tokyo Electron Technology Solutions Ltd., Japan; **T. Ito**, Osaka University, Japan; **M. Kagaya**, **T. Moriya**, Tokyo Electron Technology Solutions Ltd., Japan; **K. Karahashi**, **S. Hamaguchi**, Osaka University, Japan; **M. Matsukuma**, Tokyo Electron Technology Solutions Ltd., Japan

**AF4-MoP8** Microwave Generated Plasma Enhanced Atomic Layer Deposition of Oxides, **Ji Hye Kim**, **Y.D. Tak**, **Y.B. Lee**, ISAC Research Inc., Republic of Korea; **A. Poruba**, **J. Dolak**, SVCS Process Innovation s.r.o., Czech Republic; **H.S. Park**, ISAC Research Inc., Republic of Korea

**AF4-MoP9** Epitaxial Growth of GaN by Plasma Enhanced Atomic Layer Deposition, **Sanjie Liu**, **X. Zheng**, University of Science and Technology Beijing, China

**AF4-MoP10** Improving Plasma Enhanced Atomic Layer Deposition of Silicon Nitride with A Halodisilane, **B.K. Hwang**, **C. Lee**, **Xiaobing Zhou**, **A.E. Foss**, DuPont; **T.L. Sunderland**, **A.R. Millward**, Dow Chemicals; **S.M. Hwang**, **J.Y. Kim**, **A.T. Lucero**, **A.L.N. Kondusamy**, University of Texas at Dallas

**AF4-MoP11** Characteristics of Silicon Nitride Film Deposited by Multi-electrode VHF (162 MHz)-PEALD, **Ki Hyun Kim**, **K.S. Kim**, **Y.J. Ji**, **J.Y. Byun**, Sungkyunkwan University, Republic of Korea; **A.R. Ellingboe**, Dublin City University; **G.Y. Yeom**, Sungkyunkwan University, Republic of Korea

**AF4-MoP12** Characteristics of Low Damage Cobalt Films Deposited by Very High Frequency Plasma Enhanced Atomic Layer Deposition, **Changhoon Song**, **W.K. Yeom**, **Y. Shin**, **G.W. Kim**, **G.Y. Yeom**, Sungkyunkwan University, Republic of Korea

## ALD Fundamentals

### Evergreen Ballroom & Foyer - Session AF5-MoP

#### Characterization of ALD Films Poster Session

5:45pm

**AF5-MoP1** Film Thickness and Trace Metal Analysis of Compound Semiconductor Stacks through Direct Film Stripping (DFS) followed by ICP-MS/OES, **Vijay (Jaya) Chowdhury**, **J. Huang**, ChemTrace; **P. Sun**, UCT - ChemTrace; **E. Appiah**, ChemTrace

**AF5-MoP2** Overview of Doctoral Theses on Atomic Layer Deposition Worldwide - Outcome of the Virtual Project on the History of ALD, **J. Aarik**, University of Tartu, Estonia; **J. Aav**, **E. Ahvenniemi**, Aalto University, Finland; **A.R. Akbashev**, Stanford University; **S. Ali**, Aalto University, Finland; **M. Bechelany**, Institut Européen des Membranes, France; **M. Berdova**, Aalto University, Finland; **I. Bodalyov**, St. Petersburg State Institute of Technology, Russian Federation; **S. Boyadjiev**, Bulgarian Academy of Sciences, Bulgaria; **D. Cameron**, Masaryk University, Czech Republic; **N. Chekurov**, Oxford Instruments Analytical Oy, Finland; **R. Cheng**, Huazhong University of Science and Technology, China; **M. Chubarov**, The Pennsylvania State University; **V. Cremers**, Ghent University, Belgium; **A. Devi**, Ruhr University Bochum, Germany; **V.E. Drozd**, St. Petersburg State Institute of Technology, Russian Federation; **L. Elnikova**, Institute for Theoretical and Experimental Physics, Russian Federation; **G. Gottardi**, Fondazione Bruno Kessler, Center for Materials and Microsystems, Italy; **J. Ruud van Ommen**, Delft University of Technology, Netherlands; **R. Puurunen**, Aalto University, Finland

**AF5-MoP3** Nanoscale Chemical Characterization of Ultrathin Films via PIFM, **Sung Park**, **D. Nowak**, **W. Morrison**, Molecular Vista

**AF5-MoP4** The Effect of Impurities on Film Properties in the Y(MeCp)<sub>3</sub>/O<sub>3</sub> Process, **J. Kalliomäki**, **T. Lehto**, **M. Kääriä**, **T. Sarnet**, **Jani Kivioja**, Picosun Oy, Finland

**AF5-MoP6** Internal Photoemission Spectroscopy Measurement of Barrier Heights between ALD Ru and Al<sub>2</sub>O<sub>3</sub>, **Melanie Jenkins**, **M.H. Hayes**, **K. Holden**, **J.F. Conley, Jr.**, Oregon State University

**AF5-MoP7** Growth and Characterization: Low Temperature ALD, **Biröl Kuyel**, **A. Alphonse**, **K.P. Hong**, **J. Marshall**, Nano-Master, Inc.

**AF5-MoP8** Etch Rate Characterization of Oxide ALD Films, **Martin M. Winterkorn**, **H.J. Kim**, **J. Provine**, **F. Prinz**, **T.W. Kenny**, Stanford University

**AF5-MoP10** Structural Aspects of Nanometer Size Amorphous Materials, **Yaël Etinger-Geller**, **A. Katsman**, **B. Pokroy**, Technion - Israel Institute of Technology, Israel

## ALD for Manufacturing

### Evergreen Ballroom & Foyer - Session AM-MoP

#### ALD for Manufacturing Poster Session

5:45pm

**AM-MoP1** Cobalt Precursor Supply Chain - Ethics and Risks, **Andreas Wilk**, **A. Frey**, **O. Briel**, Umicore AG & Co. KG, Germany; **D. Zeng**, Umicore AG & Co. KG

**AM-MoP2** Homogeneous and Stress Controlled PEALD Films for Large Optics, **Hassan Gargouri**, **F. Naumann**, **S. Galka**, SENTECH Instruments GmbH, Germany; **K. Pfeiffer**, Fraunhofer Institute for Applied Optics and Precision Engineering IOF, Germany; **V. Beladiya**, Friedrich Schiller University, Germany; **A. Szeghalmi**, Fraunhofer Institute for Applied Optics and Precision Engineering IOF, Germany

**AM-MoP3** Sensing Response of ZnO Nanotube Gas Sensor Synthesized on Porous Substrate by Atomic Layer Deposition, **Pengtao Lin**, **K. Zhang**, **H. Baumgart**, Old Dominion University

**AM-MoP4** Temperature-based Control of Liquid Precursor Delivery for ALD Processes, **Egbert Woelk**, CeeVeeTech; **K. Kimmerle**, **B. Kimmerle**, NSI; **J. Maslar**, National Institute of Standards and Technology

**AM-MoP5** Design and Manufacturing of ICP-Type Remote Plasma ALD, **Dohyun Go**, **J.W. Shin**, **B.C. Yang**, **H.J. Kim**, Seoul National University of Science and Technology, Republic of Korea

**AM-MoP6** ACS™ (Atomically Clean Surface™) Cleaning and Analytical Validation of Recycled ALD Chamber Parts for the Semiconductor Industry, **Russell Parise**, **I. Iordanov**, **B. Quinn**, UCT - QuantumClean; **P. Sun**, UCT - ChemTrace

**AM-MoP8** Process Control and Mass Delivery Optimization from Low Vapor Pressure Precursors, **Jeffrey Spiegelman**, **C. Ramos**, **D. Alvarez**, **Z. Shamsi**, RASIRC

**AM-MoP9** Scaling Low-temperature Thermal ALD of SiO<sub>2</sub> to Batch, **J. Kalliomäki**, **M. Mäntymäki**, **T. Lehto**, **S. Shukla**, **M. Kääriä**, **T. Sarnet**, **Juhana Kostamo**, Picosun Oy, Finland

## Emerging Materials

### Evergreen Ballroom & Foyer - Session EM-MoP

#### Emerging Materials Poster Session

5:45pm

Note: ALE Posters Will Remain Posted All Week

**EM-MoP1** Structure and Magnetism of Electrospun  $\alpha$ -Fe<sub>2</sub>O<sub>3</sub> Nanofibers SiO<sub>2</sub>-Coated by ALD, *F. Pantò*, CNR-Istituto di Tecnologie Avanzate per l'Energia (ITAE), Italy; *H. Raza*, Humboldt-Universität zu Berlin, Germany; *A.M. Ferretti*, CNR-Istituto di Scienze e Tecnologie Molecolari (ISTM), Italy; *C. Triolo*, Università di Messina, Italy; *A. Ponti*, CNR-Istituto di Scienze e Tecnologie Molecolari, Italy; *S. Patanè*, Università di Messina, Italy; *N. Pinna*, Humboldt-Universität zu Berlin, Germany; *Saveria Santangelo*, Università Mediterranea, Italy

**EM-MoP2** Fluidized Bed Molecular Layer Deposition of Ultrathin Poly(ethylene terephthalate) Films on TiO<sub>2</sub> P25 Nanoparticles, *Damiano La Zara*, *M. Bailey*, *D. Benz*, Delft University of Technology, Netherlands; *M.J. Quayle*, *G. Petersson*, *S. Folestad*, AstraZeneca, Sweden; *J.R. van Ommen*, Delft University of Technology, Netherlands

**EM-MoP3** Fabrication and Characterization of Organic-Inorganic Hybrid Thin Films, *Chu Huang*, Hanyang University, Republic of Korea

**EM-MoP4** High Performance Encapsulation Polymer-Al<sub>2</sub>O<sub>3</sub> Hybrid Thin Layer by Atomic Layer Infiltration, *Hong Rho Yoon*, *J. Park*, *N.V. Long*, *C. Huang*, Hanyang University, Republic of Korea

**EM-MoP5** ALD of Metal Oxides Fabricated by using La(NO<sub>3</sub>)<sub>3</sub>·6H<sub>2</sub>O Oxidant and their Applications, *In-Sung Park*, *S.Y. Kim*, *T. Lee*, *S. Seong*, *Y.C. Jung*, *J. Ahn*, Hanyang University, Republic of Korea

**EM-MoP6** Bringing Higher Etch-resistance to Metal-infiltrated Polymer, *Norikatsu Sasao*, *K. Asakawa*, *S. Sugimura*, Toshiba Memory Corporation

**EM-MoP7** Magnetic and Electric Properties of Atomic Layer Deposited ZrO<sub>2</sub>-based Thin Films, *Kristjan Kalam*, *H. Seemen*, *P. Ritslaid*, *T. Jõgiaas*, *M. Rähn*, *A. Kasikov*, *A. Tamm*, *K. Kukli*, *M. Mikkor*, University of Tartu, Estonia; *J. Link*, *R. Stern*, National Institute of Chemical Physics and Biophysics, Estonia; *S. Dueñas*, *H. Castán*, University of Valladolid

**EM-MoP8** Vapor Phase Infiltration as a New Approach in the Fabrication of Advanced Hybrid Thermoelectric Materials, *Jaime DuMont*, *M. Knez*, CIC nanoGUNE, Spain

**EM-MoP9** Low-temperature Atomic Layer Deposition of Aluminum Oxide on Polymeric Powder Feedstocks for Improved Powder Rheology, *John Miller*, *C. Gillespie*, *J. Chesser*, Lawrence Livermore National Laboratory; *A. Scheppe*, United States Air Force Academy; *A. Nelson*, *N. Teslich*, *A. Lange*, *S. Elhadj*, *R. Reeves*, Lawrence Livermore National Laboratory

**EM-MoP10** Atomic Layer Deposition of Molybdenum Oxide Carbide and Molybdenum Carbide Films, *Michael D. Overbeek*, *C.H. Winter*, Wayne State University

**EM-MoP11** Solid Phase Epitaxy of ALD-Grown PrAlO<sub>3</sub> Films, *Navoda Jayakodiarachchi*, *W.L.I. Waduge*, Wayne State University; *Y. Chen*, *P. Zuo*, *T.F.T. Kuech*, *S.E. Babcock*, *P.G. Evans*, University of Wisconsin-Madison; *C.H. Winter*, Wayne State University

**EM-MoP12** Homogenous Distribution of Dopants in ALD Films: Tin-Doped Zinc Oxide (ZTO) Case Study, *Triratna Muneshwar*, *D. Barlage*, *K. Cadien*, University of Alberta, Canada

**EM-MoP13** Uniform, Thermal ALD of Al<sub>2</sub>O<sub>3</sub> and ZnO on Zirconia Particles, *Dhruv Shah*, *D. Patel*, *J. O'Tani*, *M. Linford*, Brigham Young University

**EM-MoP14** Composition Control of Ge-Sb-Te Film by Supercycles of ALD GeSb and ALD Sb Followed by Tellurization Annealing, *Yewon Kim*, *J. Lee*, Sejong University, Republic of Korea; *S.J. Baik*, Hankyong National University, Republic of Korea; *W. Koh*, UP Chemical Co., Ltd., Republic of Korea; *W.-J. Lee*, Sejong University, Republic of Korea

**EM-MoP15** Study on The Crystallinity and The Dielectric Constant of Zr<sub>x</sub>Ge<sub>1-x</sub>O<sub>2</sub> Films using Mixed Zr - Ge Precursor by Atomic Layer Deposition, *Ju Young Jeong*, *Y. Han*, *H. Sohn*, Yonsei University, Korea; *H. Noh*, *H. Park*, SK Hynix Inc

# Tuesday Morning, July 23, 2019

Grand Ballroom A-C		
8:00am	<b>AF1-TuM1</b> Surface Chemistry during ALD of Nickel Sulfide, <i>Xinwei Wang</i> , Peking University, China	<b>ALD Fundamentals Session AF1-TuM</b>  <b>In-Situ Characterization of ALD Processes</b>  <b>Moderators:</b> Christophe Vallée, LTM-UGA Erwin Kessels, Eindhoven University of Technology
8:15am	<b>AF1-TuM2</b> In situ and In vacuo Studies on Plasma Enhanced Atomic Layer Deposited Cobalt Films, <i>Johanna Reif</i> , <i>M. Knaut</i> , <i>S. Killge</i> , <i>N.A. Hampel</i> , <i>M. Albert</i> , <i>J.W. Bartha</i> , Technische Universität Dresden, Germany	
8:30am	<b>AF1-TuM3</b> Investigation of PEALD Grown HfO <sub>2</sub> Thin Films via Near Ambient Pressure XPS: Precursor Tuning, Process Design and a New In-situ Examination Approach for Studying Film Surfaces Exposed to Reactive Gases, <i>David Zanders</i> , Ruhr University Bochum, Germany; <i>E. Ciftiyurek</i> , Heinrich Heine University Düsseldorf, Germany; <i>C. Bock</i> , <i>A. Devi</i> , Ruhr University Bochum, Germany; <i>K.D. Schierbaum</i> , Heinrich Heine University Düsseldorf, Germany	
8:45am	<b>AF1-TuM4</b> Surface Science Studies of GaN Substrates Subjected to Plasma-Assisted Atomic Layer Processes, <i>Samantha G. Rosenberg</i> , ASEE; <i>D.J. Pennachio</i> , University of California, Santa Barbara; <i>E.C. Young</i> , <i>Y.H. Chang</i> , <i>H.S. Inbar</i> , University of California Santa Barbara; <i>J.M. Woodward</i> , U.S. Naval Research Laboratory; <i>Z.R. Robinson</i> , SUNY College at Brockport; <i>J. Grzeskowiak</i> , University at Albany-SUNY; <i>C.A. Ventrice, Jr.</i> , SUNY Polytechnic Institute; <i>C.J. Palmstrøm</i> , University of California Santa Barbara; <i>C.R. Eddy, Jr.</i> , U.S. Naval Research Laboratory	
9:00am	<b>AF1-TuM5</b> Infrared and Optical Emission Spectroscopy on Atmospheric-Pressure Plasma-Enhanced Spatial ALD of Al <sub>2</sub> O <sub>3</sub> , <i>Maria Antonietta Mione</i> , <i>R. Engeln</i> , <i>W.M.M. Kessels</i> , Eindhoven University of Technology, Netherlands; <i>F. Roozeboom</i> , Eindhoven University of Technology and TNO, Netherlands	
9:15am	<b>AF1-TuM6</b> Fingerprinting of ALD Reaction Products with Time-Resolved In situ Mass Spectrometry, <i>Andreas Werbrouck</i> , <i>F. Mattelaer</i> , <i>J. Dendooven</i> , <i>C. Detavernier</i> , Ghent University, Belgium	
9:30am	<b>INVITED: AF1-TuM7</b> Studying Pt and Pd Nanoparticle ALD through X-ray based In situ Characterization, <i>Jolien Dendooven</i> , <i>J.-Y. Feng</i> , Ghent University, Belgium; <i>E. Solano</i> , ALBA Synchrotron Light Source, Spain; <i>R. Ramachandran</i> , <i>M. Minjauw</i> , <i>M. Van Daele</i> , Ghent University, Belgium; <i>D. Hermida-Merino</i> , ESRF European Synchrotron, France; <i>A. Coati</i> , Synchrotron SOLEIL, France; <i>C. Detavernier</i> , Ghent University, Belgium	
9:45am	Invited talk continues.	
10:00am	<b>Break &amp; Exhibits</b>	
10:15am	<b>Break &amp; Exhibits</b>	
10:30am	<b>Break &amp; Exhibits</b>	
10:45am	<b>AF3-TuM12</b> Enabling Nucleation Phenomena Studies of ALD Deposited Films by In-situ High-Resolution TEM, <i>Stephanie Burgmann</i> , <i>A. Dadlani</i> , <i>A. Bin Afif</i> , Norwegian University of Science and Technology, Norway; <i>J. Provine</i> , Aligned Carbon; <i>A.T.J. van Helvoort</i> , <i>J. Torgesen</i> , Norwegian University of Science and Technology, Norway	<b>ALD Fundamentals Session AF3-TuM</b>  <b>Growth and Characterization II</b>  <b>Moderators:</b> Jolien Dendooven, Ghent University Henrik Pedersen, Linköping University
11:00am	<b>AF3-TuM13</b> In-situ ellipsometric analysis of plasma assisted ALD grown-stoichiometric and crystalline AlN films, <i>Adnan Mohammad</i> , <i>D. Shukla</i> , <i>S. Ilhom</i> , <i>B. Willis</i> , University of Connecticut; <i>B. Johs</i> , Film Sense LLC; <i>A.K. Okyay</i> , Stanford University; <i>N. Biyikli</i> , University of Connecticut	
11:15am	<b>AF3-TuM14</b> Film Properties of ALD SiNx Deposited by Trisilylamine and N <sub>2</sub> Plasma, <i>Markus Bosund</i> , <i>E. Salmi</i> , <i>K. Niiranan</i> , Beneq Oy, Finland	
11:30am	<b>AF3-TuM15</b> Comparison of Properties of Conductive Nitride Films Prepared by PEALD using Quartz and Sapphire Plasma Sources, <i>I. Krylov</i> , <i>X. Xu</i> , <i>K. Weinfeld</i> , <i>Valentina Korchnoy</i> , <i>D. Ritter</i> , <i>M. Eizenberg</i> , Technion - Israel Institute of Technology, Israel	
11:45am	<b>AF3-TuM16</b> Role of Hydrogen Radicals in the Surface Reactions of Trimethyl-Indium (TMI) with Ar/N <sub>2</sub> Plasma in Hollow-Cathode Plasma-Assisted ALD, <i>Saidjafarzoda Ilhom</i> , <i>A. Mohammad</i> , <i>D. Shukla</i> , <i>N. Biyikli</i> , <i>B. Willis</i> , University of Connecticut	
12:00pm	<b>Lunch &amp; Exhibits</b>	

# Tuesday Morning, July 23, 2019

Grand Ballroom E-G		
8:00am		<b>ALD Applications Session AA1-TuM</b>  <b>ALD for Catalysts, Electrocatalysts, and Photocatalysts</b>  <b>Moderators:</b> Jeffrey W. Elam, Argonne National Laboratory Parag Banerjee, University of Central Florida
8:15am		
8:30am	<b>AA1-TuM3</b> Plasma-Assisted ALD of Cobalt Phosphate: Process Development and Electro-Catalytic Activity Towards Oxygen Evolution Reaction, <i>V. Di Palma</i> , Eindhoven University of Technology, Netherlands; <i>G. Zafeiropoulos, R. van de Sanden</i> , Dutch Institute for Fundamental Energy Research; <i>W.M.M. Kessels</i> , Eindhoven University of Technology, Netherlands; <i>M. Tsampas</i> , Dutch Institute for Fundamental Energy Research; <i>Mariadriana Creatore</i> , Eindhoven University of Technology, Netherlands	
8:45am	<b>AA1-TuM4</b> Improved Electrochemical Activity of Pt Catalyst Fabricated by Vertical Forced-Flow Atomic Layer Deposition, <i>Tzu-Kang Chin, T.-P. Perng</i> , National Tsing Hua University, Republic of China	
9:00am	<b>AA1-TuM5</b> Improved Catalyst Selectivity and Longevity using Atomic Layer Deposition, <i>C. Marshall</i> , Argonne National Laboratory; <i>A. Dameron, R. Tracy</i> , Forge Nano; <i>C. Nicholas, L. Abrams, P. Barger</i> , Honeywell UOP; <i>T. Li, Lu Zheng</i> , Argonne National Laboratory	
9:15am	<b>AA1-TuM6</b> Enhancing CO <sub>2</sub> C Activity for C <sub>2+</sub> Oxygenate Production from Syngas using ALD Promoters, <i>Sindhu Nathan, J. Singh, A. Asundi, S.F. Bent</i> , Stanford University	
9:30am	<b>AA1-TuM7</b> Atomic Layer Deposition of Bismuth Vanadate Core-Shell Nanowire Photoanodes, <i>Ashley Bielinski, S. Lee, J. Brancho, S. Esarey, A. Gayle, E. Kazyak, K. Sun, B. Bartlett, N.P. Dasgupta</i> , University of Michigan	
9:45am	<b>AA1-TuM8</b> Improved Photocatalytic Efficiency by Depositing Pt and SiO <sub>2</sub> on TiO <sub>2</sub> (P25) using Atomic Layer Deposition in a Fluidized Bed, <i>Dominik Benz, H. Nugteren, H. Hintzen, M. Kreuzer, R. van Ommen</i> , Delft University of Technology, Netherlands	
10:00am	<b>Break &amp; Exhibits</b>	
10:15am	<b>Break &amp; Exhibits</b>	
10:30am	<b>Break &amp; Exhibits</b>	
10:45am	<b>AA2-TuM12</b> Atomic Layer Deposition of Glassy Lithium Borate-Carbonate Electrolytes for Solid-State Lithium Metal Batteries, <i>E. Kazyak, A. Davis, S. Yu, K.-H. Chen, A. Sanchez, J. Lasso, T. Thompson, A. Bielinski, D. Siegel, Neil P. Dasgupta</i> , University of Michigan	<b>ALD Applications Session AA2-TuM</b>  <b>ALD for Batteries I</b>  <b>Moderators:</b> Neil P. Dasgupta, University of Michigan Noemi Leick, National Renewable Energy Laboratory
11:00am	<b>AA2-TuM13</b> ALD Interlayers for Stabilization of Li <sub>10</sub> GeP <sub>2</sub> S <sub>12</sub> Solid Electrolytes Against Li Metal Anodes, <i>Andrew Davis</i> , University of Michigan; <i>K. Wood</i> , National Renewable Energy Laboratory; <i>R. Garcia-Mendez, E. Kazyak, K.-H. Chen, J. Sakamoto</i> , University of Michigan; <i>G. Teeter</i> , National Renewable Energy Laboratory; <i>N.P. Dasgupta</i> , University of Michigan	
11:15am	<b>AA2-TuM14</b> ALD and MLD on Lithium Metal – A Practical Approach Toward Enabling Safe, Long Lasting, High Energy Density Batteries, <i>Andrew Lushington</i> , Arradance; <i>Y. Zhao, L. Goncharova, Q. Sun, R. Li, X. Sun</i> , University of Western Ontario, Canada	
11:30am	<b>AA2-TuM15</b> Synergistic Effect of 3D Current Collectors and ALD Surface Modification for High Coulombic Efficiency Lithium Metal Anodes, <i>Kuan-Hung Chen, A. Sanchez, E. Kazyak, A. Davis, N.P. Dasgupta</i> , University of Michigan	
11:45am	<b>AA2-TuM16</b> Atomic Layer Deposition FeS@CNT from Elemental Sulfur as an Electrode for Lithium-Ion batteries, <i>Hongzheng Zhu, J. Liu</i> , University of British Columbia, Canada	
12:00pm	<b>Lunch &amp; Exhibits</b>	

# Tuesday Morning, July 23, 2019

Grand Ballroom H-K		
8:00am	<b>AF2-TuM1</b> Characterizing Water Delivery for ALD Processes, <i>James Maslar, B. Sperling, W. Kimes</i> , National Institute of Standards and Technology; <i>W. Kimmerle, K. Kimmerle</i> , NSI; <i>E. Woelk</i> , CeeVeeTech	<b>ALD Fundamentals Session AF2-TuM</b>
8:15am	<b>AF2-TuM2</b> A Nickel Chloride Adduct Complex as a Precursor for Low-Resistivity Nickel Nitride Thin Films with Tert-butylhydrazine as a Coreactant, <i>K. Väyrynen, T. Hatanpää, M. Mattinen, M.J. Heikkilä, K. Mizohata, J. Räisänen</i> , University of Helsinki, Finland; <i>J. Link, R. Stern</i> , National Institute of Chemical Physics and Biophysics, Estonia; <i>M. Leskelä, Mikko Ritala</i> , University of Helsinki, Finland	<b>ALD Precursors II</b>
8:30am	<b>AF2-TuM3</b> Simple, Rationally Designed Aluminum Precursors for the Deposition of Low-impurity AlN Films, <i>Sydney Buttera, S. Barry</i> , Carleton University, Canada; <i>H. Pedersen</i> , Linköping University, Sweden	<b>Moderators:</b> Jin-Seong Park, Hanyang University Seán Barry, Carleton University
8:45am	<b>AF2-TuM4</b> Atomic Layer Deposition of Lead(II) Sulfide at Temperatures Below 100 °C, <i>Georgi Popov</i> , University of Helsinki, Finland; <i>G. Bačić</i> , Carleton University, Canada; <i>M. Mattinen, M. Vehkamäki, K. Mizohata, M. Kemell</i> , University of Helsinki, Finland; <i>S. Barry</i> , Carleton University, Canada; <i>J. Räisänen, M. Leskelä, M. Ritala</i> , University of Helsinki, Finland	
9:00am	<b>AF2-TuM5</b> Development and Characterization of a Novel Atomic Layer Deposition Process for Transparent p-Type Semiconducting Nickel Oxide using Ni( <sup>t</sup> Bu <sup>2</sup> DAD) <sub>2</sub> and Ozone, <i>Kanner Holden</i> , Oregon State University; <i>C.L. Dezelah</i> , EMD Performance Materials; <i>J.F. Conley, Jr.</i> , Oregon State University	
9:15am	<b>AF2-TuM6</b> Blocking Thermolysis in Diamido Plumbylenes, <i>Goran Bacic</i> , Carleton University, Canada; <i>D. Zanders</i> , Ruhr University Bochum, Germany; <i>I. Frankel</i> , Carleton University, Canada; <i>J. Masuda</i> , Saint Mary's University, Canada; <i>T. Zeng</i> , Carleton University, Canada; <i>B. Mallick, A. Devi</i> , Ruhr University Bochum, Germany; <i>S. Barry</i> , Carleton University, Canada	
9:30am	<b>AF2-TuM7</b> ALD of Sc <sub>2</sub> O <sub>3</sub> with Sc(cp) <sub>3</sub> and a Novel Heteroleptic Precursors, <i>T. Ivanova, Perttu Sippola</i> , ASM, Finland; <i>G. Verni, Q. Xie</i> , ASM, Belgium; <i>M. Givens</i> , ASM, Finland	
9:45am	<b>AF2-TuM8</b> A Novel Self-limited Atomic Layer Deposition of WS <sub>2</sub> based on the Chemisorption and Reduction of bis(t-butylimido)bis(dimethylamino) Complexes, <i>Nicola Pinna</i> , Humboldt-Universität zu Berlin, Germany	
10:00am	<b>Break &amp; Exhibits</b>	
10:15am	<b>Break &amp; Exhibits</b>	
10:30am	<b>Break &amp; Exhibits</b>	
10:45am	<b>INVITED: AS1-TuM12</b> Overview of Wet And Dry Selective Processes Driven by Area Activation or Deactivation Down to Below 20nm Critical Dimensions, <i>Silvia Armini</i> , IMEC, Belgium	<b>Area Selective ALD Session AS1-TuM</b>
11:00am	Invited talk continues.	<b>Area-Selective ALD Techniques</b>
11:15am	<b>AS1-TuM14</b> Electron-Enhanced Atomic Layer Deposition (EE-ALD) of Cobalt Metal Films at Room Temperature, <i>Zach Sobell, A. Cavanagh, S.M. George</i> , University of Colorado - Boulder	<b>Moderator:</b> Adrie Mackus, Eindhoven University of Technology
11:30am	<b>AS1-TuM15</b> Area Selective Atomic Layer Deposition on Molecular Design, <i>Akihiro Nishida, T. Yoshino, N. Okada, A. Yamashita</i> , ADEKA Corporation, Japan	
11:45am	<b>AS1-TuM16</b> From Surface Dependence in Atomic Layer Deposition to Area-Selective Deposition of TiN in Nanoscale Patterns, <i>Annelies Delabie</i> , IMEC, Belgium; <i>D. Carbajal</i> , UNAM; <i>J. Soethoudt, B.T. Chan, E. Altamirano Sanchez, B. Meynaerts, J.-W. Clerix, S. Van Elshocht</i> , IMEC, Belgium	
12:00pm	<b>Lunch &amp; Exhibits</b>	

# Tuesday Morning, July 23, 2019

Regency Ballroom A-C		
8:00am	<b>INVITED: ALE1-TuM1</b> Analyses of Hexafluoroacetylacetone (Hfac) Adsorbed on Transition Metal Surfaces, <i>Tomoko Ito, K. Karahashi, S. Hamaguchi</i> , Osaka University, Japan	<b>Atomic Layer Etching Session ALE1-TuM</b>  <b>ALE: Gas-phase and/or Thermal ALE</b>  <b>Moderators:</b> Steven M. George, University of Colorado – Boulder Venkateswara Pallem, American Air Liquide
8:15am	Invited talk continues.	
8:30am	<b>ALE1-TuM3</b> Thermal Atomic Layer Etching of Silicon Nitride using an Oxidation and “Conversion-Etch” Mechanism, <i>Aziz Abdulagatov, S.M. George</i> , University of Colorado - Boulder	
8:45am	<b>ALE1-TuM4</b> Thermal Dry Atomic Layer Etching of Cobalt with Sequential Exposure to Molecular Chlorine and Diketones, <i>M. Konh, C. He, X. Lin</i> , University of Delaware; <i>X. Guo, V. Pallem</i> , American Air Liquide; <i>R. Opila, Andrew Teplyakov, Z. Wang, B. Yuan</i> , University of Delaware	
9:00am	<b>ALE1-TuM5</b> Spontaneous Etching of B <sub>2</sub> O <sub>3</sub> and TiO <sub>2</sub> by HF: Removal Reaction in WO <sub>3</sub> ALE and TiN ALE, <i>Austin Cano</i> , University of Colorado - Boulder; <i>S.K. Natarajan</i> , Tyndall National Institute, Ireland; <i>J. Clancey</i> , University of Colorado - Boulder; <i>S. Elliot</i> , Schrödinger Inc; <i>S.M. George</i> , University of Colorado - Boulder	
9:15am	<b>ALE1-TuM6</b> Thermal Based Atomic Layer Etching of Aluminum Oxide and Titanium Nitride, <i>Varun Sharma</i> , ASM, Finland; <i>T. Blomberg</i> , Picosun Oy/ASM, Finland; <i>M. Tuominen, S. Haukka</i> , ASM, Finland	
9:30am	<b>ALE1-TuM7</b> Thermal Atomic Layer Etching of Amorphous and Crystalline Hafnium Oxide, Zirconium Oxide and Hafnium Zirconium Oxide, <i>Jessica A. Murdzek, S.M. George</i> , University of Colorado - Boulder	
9:45am	<b>ALE1-TuM8</b> Isotropic Atomic Layer Etching of Cobalt with Smooth Etched Surfaces by using Cyclic Repetition of Plasma Oxidation and Organometallization, <i>Sumiko Fujisaki</i> , Hitachi R&D Group, Japan	
10:00am	<b>Break &amp; Exhibits</b>	
10:15am	<b>Break &amp; Exhibits</b>	
10:30am	<b>Break &amp; Exhibits</b>	
10:45am	<b>ALE2-TuM12</b> Atomic Layer Etching for Germanium using Halogen Neutral Beam =Comparison between Br and Cl Chemistry=, <i>T. Fujii, Daisuke Otori</i> , Tohoku University, Japan; <i>S. Noda</i> , National Institute of Advanced Industrial Science and Technology, Japan; <i>Y. Tanimoto, D. Sato, H. Kurihara</i> , Showa Denko K.k.; <i>W. Mizubayashi, K. Endo</i> , National Institute of Advanced Industrial Science and Technology, Japan; <i>Y. Li</i> , National Chiao Tung University; <i>Y.-J. Lee</i> , National Nano Device Laboratories; <i>T. Ozaki, S. Samukawa</i> , Tohoku University, Japan	<b>Atomic Layer Etching Session ALE2-TuM</b>  <b>Alternative Methods to ALE</b>  <b>Moderators:</b> Erwin Kessels, Eindhoven University of Technology Satoshi Hamaguchi, Osaka University
11:00am		
11:15am	<b>ALE2-TuM14</b> A New Etching / Passivation Process in Cyclic Mode for Spacer Etching in 3D CMOS Integrations, <i>O. Pollet</i> , CEA-LETI, France; <i>N. Posseme</i> , Univ. Grenoble Alpes, CEA, LETI, France; <i>V. Ah-Leung, Valentin Bacquie</i> , CEA-LETI, France	
11:30am	<b>ALE2-TuM15</b> Atomic Layer Etching of Transition Metals with Gas Cluster Ion Beam Irradiation and Acetylacetone, <i>Noriaki Toyoda, K. Uematsu</i> , University of Hyogo, Japan	
11:45am	<b>ALE2-TuM16</b> Atomic Layer Etching at Atmospheric Pressure, <i>Eugen Shkura, D. Theirich, K. Brinkmann, T. Haeger</i> , University of Wuppertal, Germany; <i>J. Schneidewind, M. Siebert</i> , SENTECH Instruments GmbH, Germany; <i>T. Riedl</i> , University of Wuppertal, Germany	
12:00pm	<b>Lunch &amp; Exhibits</b>	

# Tuesday Afternoon, July 23, 2019

Grand Ballroom A-C		
1:30pm	<b>AF-TuA1</b> Low Temperature High Quality Silicon Dioxide by Neutral Beam Enhanced Atomic Layer Deposition, <i>Hua-Hsuan Chen, D. Otori, T. Ozaki</i> , Tohoku University, Japan; <i>M. Utsuno, T. Kubota, T. Nozawa</i> , ASM Japan K.K., Japan; <i>S. Samukawa</i> , Tohoku University, Japan	<b>ALD Fundamentals Session AF-TuA</b>
1:45pm	<b>AF-TuA2</b> Radical Surface Recombination Probabilities during Plasma ALD of SiO <sub>2</sub> , TiO <sub>2</sub> and Al <sub>2</sub> O <sub>3</sub> Determined from Film Conformality, <i>Karsten Arts</i> , Eindhoven University of Technology, Netherlands; <i>M. Utraiainen</i> , VTT Technical Research Centre of Finland, Finland; <i>R. Puurunen</i> , Aalto University, Finland; <i>W.M.M. Kessels</i> , Eindhoven University of Technology, Netherlands; <i>H. Knoops</i> , Oxford Instruments Plasma Technology, UK	<b>Plasma ALD: Growth and Characterization</b>
2:00pm	<b>AF-TuA3</b> A Robust Method for In-situ Gas Monitoring of ALD Processes using Optical Emission Spectroscopy of a Pulsed Remote Plasma, <i>Joe Brindley, B. Daniel, V. Bellido-Gonzalez</i> , Gencoa Limited, UK; <i>R. Potter, B. Peek</i> , University of Liverpool, UK	<b>Moderators:</b> Hyeongtag Jeon, Hanyang University Jiyoung Kim, The University of Texas at Dallas
2:15pm	<b>AF-TuA4</b> Near Room Temperature Plasma Enhanced Atomic Layer Deposition of Gold Metal, <i>Michiel Van Daele</i> , Ghent University, Belgium; <i>M. Griffiths</i> , Carleton University, Canada; <i>A. Raza</i> , Ghent University - IMEC, Belgium; <i>M. Minjaaw</i> , Ghent University, Belgium; <i>S. Barry</i> , Carleton University, Canada; <i>R. Baets</i> , Ghent University - IMEC, Belgium; <i>C. Detavernier, J. Dendooven</i> , Ghent University, Belgium	
2:30pm	<b>AF-TuA5</b> Low-Temperature Deposition of Gallium Oxide and Aluminum Oxide with Arrays of Microcavity Plasma Enhanced Atomic Layer Deposition, <i>Jinhong Kim, A. Mironov, S.-J. Park, J.G. Eden</i> , University of Illinois at Urbana-Champaign	
2:45pm	<b>AF-TuA6</b> The Effects of Varying Plasma Conditions on Plasma Assisted Atomic Layer Epitaxy, <i>David Boris, V. Wheeler, N. Nepal, S.G. Rosenberg, J. Avila, J.M. Woodward, V. Anderson, S. Walton, C.R. Eddy, Jr.</i> , U.S. Naval Research Laboratory	
3:00pm	<b>INVITED: AF-TuA7</b> Plasma-Enhanced Atomic Layer Epitaxy of Ultra-wide Bandgap Ga <sub>2</sub> O <sub>3</sub> and (Al <sub>x</sub> Ga <sub>1-x</sub> ) <sub>2</sub> O <sub>3</sub> Films, <i>Virginia Wheeler, N. Nepal, D. Boris, S. Walton, S. Qadri, J. Avila, D. Meyer, B. Downey, V. Gokhale</i> , U.S. Naval Research Laboratory; <i>L. Nyakiti</i> , Texas A&M University; <i>M. Tadjer</i> , U.S. Naval Research Laboratory; <i>M. Goorsky</i> , University of California Los Angeles; <i>C.R. Eddy Jr.</i> , U.S. Naval Research Laboratory	
3:15pm	Invited talk continues.	
3:30pm	<b>Break &amp; Exhibits</b>	
3:45pm	<b>Break &amp; Exhibits</b>	
4:00pm	<b>INVITED: AA3-TuA11</b> Doped Hi-K ALD Films of HfO <sub>x</sub> and ZrO <sub>x</sub> for Advanced Ferroelectric and Anti-Ferroelectric Memory Device Applications; <i>Niloy Mukherjee, J. Mack, S. Rathi</i> , Eugenius, Inc.; <i>Z. Wang, A. Gaskell, N. Tasneem, A. Khan</i> , Georgia Institute of Technology; <i>M. Dopita, D. Kriegner</i> , Charles University	<b>ALD Applications Session AA3-TuA</b>
4:15pm	Invited talk continues.	<b>ALD for Memory Applications I</b>
4:30pm	<b>AA3-TuA13</b> ALD of La-Doped HfO <sub>2</sub> Films for Ferroelectric Applications, <i>Tatiana Ivanova, P. Sippola, M. Givens</i> , ASM, Finland; <i>H. Sprey</i> , ASM, Belgium; <i>T.M. Büttner, P. Polakowski, K. Seidel</i> , Fraunhofer IPMS-CNT, Germany	<b>Moderators:</b> Scott B. Clendenning, Intel Corp. Adrien LaVoie, Lam Research Corp.
4:45pm	<b>AA3-TuA14</b> Characterization of Multi-Domain Ferroelectric ZrO <sub>2</sub> Thin Films for Negative Capacitance and Inductive Responses, <i>Yu-Tung Yin, P.-H. Cheng, Y.-S. Jiang, J. Shieh, M.J. Chen</i> , National Taiwan University, Republic of China	
5:00pm	<b>AA3-TuA15</b> Scaling Ferroelectric Hf <sub>0.5</sub> Zr <sub>0.5</sub> O <sub>2</sub> on Metal-Ferroelectric-Metal (MFM) and Metal-Ferroelectric-Insulator-Semiconductor (MFIS) Structures, <i>Jaidah Mohan, H. Hernandez-Arriaga, H.S. Kim, A. Khosravi, A. Sahota</i> , The University of Texas at Dallas; <i>R. Wallace</i> , University of Texas at Dallas; <i>J. Kim</i> , The University of Texas at Dallas	
5:15pm	<b>AA3-TuA16</b> Interface Characteristics of MIM Capacitors using Vanadium Nitride Electrode and ALD-grown ZrO <sub>2</sub> High-k Dielectric Film, <i>Jae Hyoung Choi, Y. Kim, H.I. Lee, H.-J. Lim, K. Hwang, S.W. Nam, H.-K. Kang</i> , Samsung Electronics, Republic of Korea	
5:30pm	<b>Poster Session</b>	



# Tuesday Afternoon, July 23, 2019

Grand Ballroom E-G		
1:30pm	<b>INVITED: AA1-TuA1</b> Atomic Layer Deposition of Indium Gallium Zinc Oxide (IGZO) Semiconductor Thin Films: From Precursor to Thin Film Transistor Application, <i>Jin-Seong Park</i> , Hanyang University, Republic of Korea	<b>ALD Applications Session AA1-TuA</b>  <b>Emerging Applications I</b>  <b>Moderators:</b> Anjana Devi, Ruhr University Bochum Han-Bo-Ram Lee, Incheon National University
1:45pm	Invited talk continues.	
2:00pm	<b>AA1-TuA3</b> ALD Growth of Ultra-thin Co Layers on the Topological Insulator Sb <sub>2</sub> Te <sub>3</sub> , <i>Emanuele Longo</i> , R. Mantovan, R. Cecchini, CNR-IMM Unit of Agrate Brianza, Italy; M.D. Overbeek, Wayne State University; M. Longo, CNR-IMM Unit of Agrate Brianza, Italy; L. Lazzarini, CNR-IMEM, Italy; M. Fanciulli, Università degli Studi di Milano-Bicocca, Italy; C.H. Winter, Wayne State University; C. Wiemer, CNR-IMM Unit of Agrate Brianza, Italy	
2:15pm	<b>AA1-TuA4</b> Modifying Interfacial Chemistry of Cellulose-Reinforced Epoxy Resin Composites using Atomic Layer Deposition (ALD), <i>Jamie Wooding</i> , Y. Li, K. Kalaitzidou, M. Losego, Georgia Institute of Technology	
2:30pm	<b>AA1-TuA5</b> Atomic Layer Deposition of Au Nanoparticles on Titania, <i>Fatemeh S.M. Hashemi</i> , Delft University of Technology, Netherlands; F. Grillo, ETH Zurich, Switzerland; V. Ravikummar, D. Benz, A. Shekhar, Delft University of Technology, Netherlands; M. Griffiths, S. Barry, Carleton University, Canada; J.R. van Ommen, Delft University of Technology, Netherlands	
2:45pm	<b>AA1-TuA6</b> Multi-layer Protective Coatings on Silver for Protection of Historic Silver Artifacts, E. Breitung, Metropolitan Museum of Art; S. Creange, Rijks Museum, Netherlands; G. Pribil, J.A. Woollam; A. Bertuch, <i>Ritwik Bhatia</i> , Veeco-CNT	
3:00pm	<b>AA1-TuA7</b> Nonlinear Optical Properties of TiO <sub>2</sub> -Based ALD Thin Films, <i>Theodosia Gougousi</i> , R. Kuis, I. Basaldua, P. Burkins, J.A. Kropp, A. Johnson, University of Maryland, Baltimore County	
3:15pm	<b>AA1-TuA8</b> Atomic Layer Deposition to Alter the Wetting and Thermal Properties of Lumber, <i>Shawn Gregory</i> , C. McGettigan, E. McGuinness, D. Rodin, S. Yee, M. Losego, Georgia Institute of Technology	
3:30pm	<b>Break &amp; Exhibits</b>	
3:45pm	<b>Break &amp; Exhibits</b>	
4:00pm	<b>AA2-TuA11</b> Tunable Electrical Properties of Lithium Fluoride Thin Films using Different Fluorine Sources, <i>Devika Choudhury</i> , A. Mane, J.W. Elam, Argonne National Laboratory	<b>ALD Applications Session AA2-TuA</b>  <b>ALD for Batteries II</b>  <b>Moderator:</b> Yong Qin, Institute of Coal Chemistry, Chinese Academy of Sciences
4:15pm	<b>AA2-TuA12</b> The Role of Al <sub>2</sub> O <sub>3</sub> ALD Precursor Chemistry on the Electrochemical Performance of Lithium Ion Battery Cathode Materials, <i>Donghyeon Kang</i> , A. Mane, J.W. Elam, Argonne National Laboratory; R.F. Warburton, J.P. Greeley, Purdue University	
4:30pm	<b>AA2-TuA13</b> Spatial Atomic Layer Deposition of Hybrid Nanolaminates for High Capacity Li-ion Battery Electrodes, E. Balder, L. Haverkate, M. Tulodziecki, F. van den Bruele, S. Unnikrishnan, <i>Paul Poedt</i> , TNO/Holst Center, Netherlands	
4:45pm	<b>AA2-TuA14</b> Lithium Organic Thin Films for Various Battery Components, <i>Juho Heiska</i> , M. Karppinen, Aalto University, Finland	
5:00pm	<b>AA2-TuA15</b> ALD Infiltration of LiCoO <sub>2</sub> for High Rate Lithium Ion Batteries, <i>Ian Povey</i> , M. Modreanu, S. O'Brien, Tyndall National Institute, Ireland; T. Teranishi, Y. Yoshikawa, M. Yoneda, A. Kishimoto, Okayama University, Japan	
5:15pm	<b>AA2-TuA16</b> ALD Al <sub>2</sub> O <sub>3</sub> and MoS <sub>2</sub> Coated TiO <sub>2</sub> Nanotube Layers as Anodes for Lithium Ion Batteries, H. Sopha, University of Pardubice, Czech Republic; A. Tesfaye, Ecole Nationale Supérieure des Mines de Saint-Etienne, France; R. Zazpe, University of Pardubice, Czech Republic; T. Djenizian, Ecole Nationale Supérieure des Mines de Saint-Etienne, France; <i>Jan Macak</i> , University of Pardubice, Czech Republic	
5:30pm	<b>Poster Session</b>	

# Tuesday Afternoon, July 23, 2019

Grand Ballroom H-K		
1:30pm	<b>AS1-TuA1</b> Elucidating Mechanisms of Selective ALD of Al <sub>2</sub> O <sub>3</sub> by a Comparative Study of Precursors, <i>Il-Kwon Oh</i> , T.-L. Liu, Stanford University; T. Sandoval, Technical University Federico Santa Maria; R. Tonner, Philipps-Universität Marburg, Germany; S.F. Bent, Stanford University	<b>Area Selective ALD Session AS1-TuA</b>  <b>Area-Selective ALD by Area-Deactivation</b>  <b>Moderators:</b> Rong Chen, Huazhong University of Science and Tech Jessica Kachian, Intel Corp.
1:45pm	<b>AS1-TuA2</b> Area-Selective Atomic Layer Deposition using Dodecanethiols: Comparison of Monolayer versus Multilayer, <i>Tzu-Ling Liu</i> , Stanford University; K. Nardi, N. Draeger, D. Hausmann, Lam Research Corp.; S.F. Bent, Stanford University	
2:00pm	<b>AS1-TuA3</b> Mechanism for Breakdown in Selectivity During Area-Selective Atomic Layer Deposition of ZrO <sub>2</sub> on a SiO <sub>2</sub> Surface Functionalized with a Blocking Layer, <i>Wanxing Xu</i> , Colorado School of Mines; P.C. Lemaire, K. Sharma, D. Hausmann, Lam Research Corp.; S. Agarwal, Colorado School of Mines	
2:15pm	<b>AS1-TuA4</b> Area Selective Chemical Vapor Deposition of Co from the Co (CO) Precursor: Use of Ammonia to Afford Dielectric-Dielectric Selectivity, <i>Zhejun Zhang</i> , S. Liu, G. Girolami, J. Abelson, University of Illinois at Urbana-Champaign	
2:30pm	<b>AS1-TuA5</b> Area-Selective ALD of Silicon Oxide using Inhibitors in Four-step Cycles for Metal/Dielectric Selectivity, <i>Marc Merckx</i> , R. Jongen, Eindhoven University of Technology, Netherlands; A. Marnett, TNO/Holst Center, Netherlands; D. Hausmann, Lam Research Corp.; W.M.M. Kessels, A.J.M. Mackus, Eindhoven University of Technology, Netherlands	
2:45pm	<b>AS1-TuA6</b> Selective Area Growth of Deactivating Polymers, <i>Rudy Wojtecki</i> , IBM Research - Almaden; T. Pattison, University of Melbourne, Australia; A. Hess, N. Arellano, A. Friz, IBM Research - Almaden	
3:00pm	<b>AS1-TuA7</b> Area-Selective ALD of ZnO Films Patterned by Electrohydrodynamic Jet Printing of Polymers with Sub-Micron Resolution, <i>Tae Cho</i> , N. Farjam, C. Pannier, C. Huber, O. Trejo, C. Allemang, E. Kazyak, R. Peterson, K. Barton, N.P. Dasgupta, University of Michigan	
3:15pm	<b>AS1-TuA8</b> Selective Deposition of Silicon Nitride, <i>Han Wang</i> , B. Hendrix, T. Baum, Entegris Inc.	
3:30pm	<b>Break &amp; Exhibits</b>	
3:45pm	<b>Break &amp; Exhibits</b>	
4:00pm	<b>AS2-TuA111</b> Area-Selective Deposition and Smoothing of Ru by Combining Atomic Layer Deposition and Selective Etching, <i>Martijn Vos</i> , Eindhoven University of Technology, Netherlands; S. Chopra, University of Texas at Austin; M. Verheijen, Eindhoven University of Technology, Netherlands; J. Ekerdt, University of Texas at Austin; S. Agarwal, Colorado School of Mines; W.M.M. Kessels, A.J.M. Mackus, Eindhoven University of Technology, Netherlands	<b>Area Selective ALD Session AS2-TuA1</b>  <b>Area-Selective ALD: Combinations with Etching</b>  <b>Moderators:</b> Silvia Armini, IMEC Dennis Hausmann, Lam Research Corp.
4:15pm	<b>AS2-TuA112</b> Single Batch Strategies for the Development of an Area Selective Deposition Process with the Deposition/Etch Approach, <i>Christophe Vallée</i> , M. Bonvalot, LTM-UGA, France; R. Gassilloud, CEA-Leti, France; V. Pesce, A. Chaker, S. Belahcen, LTM-UGA, France; N. Passémé, CEA-Leti, France; B. Pelissier, P. Gonon, A. Bsiesy, LTM-UGA, France	
4:30pm	<b>AS2-TuA113</b> Surface Halogenation of Amorphous Carbon for Defect-free Area-Selective Deposition of Metal Oxides, <i>Mikhail Krystab</i> , KU Leuven, Belgium; S. Armini, IMEC, Belgium; S. De Gendt, KU Leuven/IMEC, Belgium; R. Ameloot, KU Leuven, Belgium	
4:45pm	<b>AS2-TuA214</b> Real-time Grazing Incidence Small-angle X-ray Scattering Studies of Indium Aluminum Nitride Growth, <i>Jeffrey M. Woodward</i> , S.G. Rosenberg, ASEE (residing at U.S. Naval Research Laboratory); S.D. Johnson, N. Nepal, U.S. Naval Research Laboratory; Z.R. Robinson, SUNY College at Brockport; K.F. Ludwig, Boston University; C.R. Eddy, U.S. Naval Research Laboratory	<b>Area Selective ALD Session AS2-TuA2</b>  <b>Late Breaking Abstracts</b>  <b>Moderators:</b> Silvia Armini, IMEC, Dennis Hausmann, Lam Research Corp.
5:00pm	<b>AS2-TuA215</b> Expanding the Materials Library of Sequential Infiltration Synthesis: Conductive Indium and Gallium Oxides Grown in Polymers, <i>Ruben Waldman</i> , University of Chicago; N. Jeon, D. Mandia, O. Heinonen, S. Darling, A. Martinson, Argonne National Laboratory	
5:15pm	<b>AS2-TuA216</b> Highly Efficient and Stable Organic – Inorganic Halide Perovskite Solar Cells with ALD-grown Charge Transport Layers, <i>Hyunjung Shin</i> , Sungkyunkwan University, Republic of Korea	
5:30pm	<b>Poster Session</b>	

# Tuesday Afternoon, July 23, 2019

Regency Ballroom A-C		
1:30pm	<b>INVITED: ALE1-TuA1</b> Atomic Layer Etching of Nanostructures, <i>Sabbir Khan</i> , Niels Bohr Institute, University of Copenhagen, Denmark; <i>D. Suyatin</i> , Lund University, Sweden; <i>J. Sundqvist</i> , Fraunhofer Institute for Ceramic Technologies and Systems IKTS, Germany	<b>Atomic Layer Etching Session ALE1-TuA</b>  <b>Modeling &amp; Instrumentation I</b>  <b>Moderators:</b> Ankur Agarwal, KLA-Tencor Angelique Raley, Tokyo Electron America Inc.
1:45pm	Invited talk continues.	
2:00pm	<b>ALE1-TuA3</b> Selectivity during Plasma ALE of Si-Compounds: Reaction Mechanism Studied by in-situ Surface Spectroscopy, <i>René Vervuurt</i> , ASM; <i>K. Nakane</i> , <i>T. Tsutsumi</i> , <i>M. Hori</i> , <i>N. Kobayashi</i> , Nagoya University, Japan	
2:15pm	<b>ALE1-TuA4</b> Chamber Vacuum Strategies to Enable High Productivity ALE, <i>Declan Scanlan</i> , <i>D. Stephenson</i> , <i>A. Stover</i> , Edwards Vacuum, Ireland	
2:30pm	<b>ALE1-TuA5</b> Mechanistic Study of the Thermal Atomic Layer Etch of Cobalt Metal Using Propene and CO, <i>S. Kondati Natarajan</i> , <i>M. Nolan</i> , Tyndall National Institute, Ireland; <i>Patrick Theofanis</i> , <i>C. Mokhtarzadeh</i> , <i>S.B. Clendinning</i> , Intel Corp.	
2:45pm	<b>ALE1-TuA6</b> Selective Quasi-ALE of SiO <sub>2</sub> over Si <sub>3</sub> N <sub>4</sub> via Bottom-up Si <sub>3</sub> N <sub>4</sub> Passivation: A Computational Study, <i>Du Zhang</i> , <i>Y. Tsai</i> , <i>Y. Shi</i> , <i>M. Wang</i> , TEL Technology Center, America, LLC	
3:00pm	<b>INVITED: ALE1-TuA7</b> Insights of Different Etching Properties between CW and ALE Processes using 3D Voxel-Slab Model, <i>Nobuyuki Kuboi</i> , <i>T. Tatsumi</i> , <i>J. Komachi</i> , <i>S. Yamakawa</i> , Sony Semiconductor Solutions Corp., Japan	
3:15pm	Invited talk continues.	
3:30pm	<b>Break &amp; Exhibits</b>	
3:45pm	<b>Break &amp; Exhibits</b>	
4:00pm	<b>ALE2-TuA11</b> First-principles Understanding of Atomic Layer Etching of Silicon Nitride using Hydrofluorocarbons, <i>Gyeong Hwang</i> , <i>E. Cheng</i> , University of Texas at Austin; <i>S. Sridhar</i> , TEL Technology Center, America; <i>P. Ventzek</i> , <i>A. Ranjan</i> , Tokyo Electron America Inc.	<b>Atomic Layer Etching Session ALE2-TuA</b>  <b>Modeling &amp; Instrumentation II</b>  <b>Moderators:</b> Dmitry Suyatin, Lund University Tetsuya Tatsumi, Sony Semiconductor Solutions Corp.
4:15pm	<b>ALE2-TuA12</b> An Extended Knudsen Diffusion Model for Aspect Ratio Dependent Atomic Layer Etching, <i>Luiz Felipe Aguinis</i> , <i>P. Manstetten</i> , TU Wien, Austria; <i>A. Hössinger</i> , Silvaco Europe Ltd., UK; <i>S. Selberherr</i> , <i>J. Weinbub</i> , TU Wien, Austria	
4:30pm	<b>ALE2-TuA13</b> Thermodynamics-Based Screening Approach for Atomic Layer Etching, <i>Nagraj Kulkarni</i> , Consultant	
4:45pm	<b>ALE2-TuA14</b> Always in Competition: Self-limiting Versus Continuous Reactions in ALD and ALEt, <i>Simon D. Elliott</i> , Schrödinger, Inc.; <i>S.K. Natarajan</i> , <i>R. Mullins</i> , <i>M. Nolan</i> , Tyndall National Institute, Ireland; <i>A. Cano</i> , <i>J. Clancey</i> , <i>S.M. George</i> , University of Colorado - Boulder	
5:00pm	<b>ALE2-TuA15</b> Variation of Etched Depth per Cycle and Removal of Reactive Species in Atomic-Layer Etching (ALE) : Molecular Dynamics Study, <i>Satoshi Hamaguchi</i> , <i>E.J. Tinacba</i> , <i>S. Shigeno</i> , <i>Y. Okada</i> , <i>M. Isobe</i> , <i>T. Ito</i> , <i>K. Karahashi</i> , Osaka University, Japan	
5:30 pm	<b>Poster Session</b>	

## ALD Applications

### Evergreen Ballroom & Foyer - Session AA1-TuP Energy Harvesting and Storage Poster Session 5:30pm

**AA1-TuP1** Study on Atomic Layer Deposited Al<sub>2</sub>O<sub>3</sub>, TiO<sub>2</sub> and ZnO for the Application in Silicon Photovoltaics, *Arun Haridas, M.G. Sreenivasan*, Hind High Vacuum Company Pvt. Ltd., India; *A. Antony*, Indian Institute of Technology Bombay, India

**AA1-TuP2** Nitrogen-Doped TiO<sub>2</sub> Film Deposited using Plasma-Enhanced Atomic Layer Deposition to Improve the Electrical Conductivity for Surface Passivation of Crystalline Silicon, *E.-J. Song*, Korea Institute of Materials Science, Republic of Korea; *J.-H. Ahn*, Korea Maritime and Ocean University, Republic of Korea; *Jung-Dae Kwon*, Korea Institute of Materials Science, Republic of Korea

**AA1-TuP3** Multilayer Encapsulation for Highly Stable Perovskite Solar Cells with Atomic Layer Deposited Al<sub>2</sub>O<sub>3</sub> and Chemical Vapor Deposited Flowable Oxide, *Jungwoo Kim, H. Hwangbo, S.J. Kim, J.H. Jang, H.C. Tran Vo, H. Chae*, Sungkyunkwan University (SKKU), Republic of Korea

**AA1-TuP5** Oxide Buffer Layers for Perovskite Solar Cells Grown with a 200 mm Commercial ALD System Using Low-Temperature Process, *P. Rajbhandari, Tara Dhakal*, Binghamton University

**AA1-TuP6** Ultra-thin Nickel Films for Energy Harvesting Applications, *Ken Bosnick, P. Motamedi*, National Research Council Canada, Canada; *K. Cadien*, University of Alberta, Canada; *K. Harris, J.-Y. Cho*, National Research Council Canada, Canada

**AA1-TuP7** MoNx-Deposited on High-surface N-doped Carbon Coated-Carbon Cloth Substrates: The Best Possible Option for ALD in View of Energy Storage Application, *S.Y. Sawant, D.K. Nandi, R. Rahul, S.-H. Kim, Moo Hwan Cho*, Yeungnam University, Republic of Korea

**AA1-TuP8** ALD Coatings for Nano Imprint Masks, *Thomas Seidel*, Seitek50

**AA1-TuP9** The Investigation of Al<sub>2</sub>O<sub>3</sub> Passivation Characteristics in the Condition of Growth Temperature and Ozone Concentration, *Young Joon Cho, H.S. Chang*, Chungnam National University, Republic of Korea

**AA1-TuP10** Effect of Al<sub>2</sub>O<sub>3</sub> Passivation on n-type Si Solar Cell with Passivated Emitter and Rear Cell (PERC), *Kiryun Kim, H.S. Chang*, Chungnam National University, Republic of Korea

**AA1-TuP11** High Quality CaF<sub>2</sub> from a New ALD Process: Enabling New Approaches in Battery Technology and Optical Applications, *Max Gebhard, A. Mane, J.W. Elam*, Argonne National Laboratory

**AA1-TuP12** Properties of Molybdenum Oxide Deposited by Plasma Enhanced Atomic Layer Deposition for High Efficiency Solar Cells, *Taewan Lim, H.S. Chang*, Chungnam National University, Republic of Korea

**AA1-TuP13** Understanding and Mitigating F Migration in ALD Nanocomposite Coatings, *Anil Mane, M. Gebhard, J.W. Elam*, Argonne National Laboratory; *M. Popecki, T. Cremer*, Incom Inc.; *M. Minot*, incom

**AA1-TuP14** Ultrathin Metal Oxide Passivation by Atomic Layer Deposition Enhances Stability and Performance of Visible Solar Water Splitting on Solution-Processed Organic Semiconductor Thin Films, *L. Wang, D. Yan*, Stony Brook University; *D. Shaffer*, Brookhaven National Laboratory; *X. Ye*, Stony Brook University; *B. Layne, J. Concepcion, M. Liu, Chang-Yong Nam*, Brookhaven National Laboratory

**AA1-TuP15** Enhancement of Photovoltaic Efficiency using a Novel Nickel-4 Mercaptophenol Hybrid Interfacial Layer, *Jinseon Park, N.V. Long, H. Thu*, Hanyang University, Republic of Korea

**AA1-TuP16** Enhancement of Photovoltaic Properties of Metal/III-V Schottky Solar Cells using Al<sub>2</sub>O<sub>3</sub> Anti-Reflection and Passivation Layer, *A. Ghods, V. Saravade, C. Zhou, Ian Ferguson*, Missouri University of Science and Technology

**AA1-TuP17** Investigation of ALD-grown i-ZnO Buffer Layer Properties for CIGS Solar Cell Application, *Jeha Kim, V. Arepalli*, Cheongju University, Republic of Korea; *W.-J. Lee, Y.-D. Chung*, Electronics and Telecommunications Research Institute, Republic of Korea

**AA1-TuP18** Atomic Layer Deposited Zirconium-doped ZnO Transparent Conductive Oxides for Silicon Solar Cells, *Geedhika Kallidil Poduval, M.A. Hossain, B. Hoex*, University of New South Wales, Australia

**AA1-TuP19** Atomic Layer Deposition of Few-Atom Cluster Arrays for Solar Fuel Catalysis, *David Mandia, N. Gusinger, A. Martinson*, Argonne National Laboratory

## ALD Applications

### Evergreen Ballroom & Foyer - Session AA2-TuP Microelectronics Poster Session 5:30pm

**AA2-TuP1** Chemically and Mechanically Activated Carbonaceous Materials for Supercapacitor, *D.V. Lam, J.-H. Kim, Seung-Mo Lee*, Korea Institute of Machinery and Materials, South Korea

**AA2-TuP2** Diamond Field Effect Transistors with Different Gate Lengths of HfO<sub>2</sub> Deposited by Atomic Layer Deposition, *Changzhi Gu*, Institute of Physics, Chinese Academy of Sciences, China

**AA2-TuP3** Atomic Layer Deposition of IGZO Thin Films for BEOL Applications, *Shóna Doyle*, Tyndall National Institute, Ireland

**AA2-TuP5** High Voltage MIM Capacitor based on ALD Deposited Crystalline HfAlO<sub>x</sub> Film, *Valentina Korchnoy*, Technion - Israel Institute of Technology, Israel; *M. Lisiansky*, Tower Semiconductor Ltd., Israel; *I. Popov, V. Uvarov*, The Hebrew University of Jerusalem, Israel; *B. Meyler*, Technion - Israel Institute of Technology, Israel

**AA2-TuP6** Improved Performance of GaN Metal-Oxide-Semiconductor Capacitors by Plasma ALD of AlN Interlayer, *Dilini Hemakumara, X. Li, K. Floros, S. Cho*, University of Glasgow, UK; *I. Guinney, C. Humphreys*, University of Cambridge, UK; *I. Thayne*, University of Glasgow, UK; *A. O'Mahony*, Oxford Instruments Plasma Technology; *H. Knoops*, Oxford Instruments Plasma Technology, UK; *D. Moran*, University of Glasgow, UK

**AA2-TuP7** 2-Dimensional Perovskite Oxide Thin Films Deposited by ALD for High-k Application, *Seung-Won Lee*, Korea Maritime and Ocean University, Republic of Korea; *C.-M. Kim, S.-H. Kwon*, Pusan National University, Republic of Korea

**AA2-TuP8** High Performance Atomic Layer Deposition (ALD) of Gate Dielectrics for 4H-SiC Power Device Application, *B. Lee, M. Kang*, North Carolina State University; *Adam Bertuch*, Veeco-CNT; *V. Misra*, North Carolina State University

**AA2-TuP9** Atomic Layer Deposited TiO<sub>2</sub>-Based Memristors using In-situ Fabricated Al Doped ZnO Thin Film as Electrodes, *Kai Zhang, P. Lin*, Old Dominion University; *A. Pradhan*, Advance Material Solution LLC; *H. Baumgart*, Old Dominion University

**AA2-TuP10** Homogeneously Doped Atomic Layer Deposition Zinc Tin Oxide Thin Films for Improving Contact Resistance in Semiconductor Device Applications, *Alex Ma*, University of Alberta, Canada; *T. Muneshwar*, Synthergy Inc., Canada; *D. Barlage, K. Cadien*, University of Alberta, Canada

**AA2-TuP11** AlGaIn/GaN Layers Obtained by Atomic Layer Deposition Targeting Thin Film HEMT, *Joaquin Alvarado, M. Chávez*, Benemérita Universidad Autónoma de Puebla, Mexico; *S. Gallardo*, CINVESTAV-IPN, Mexico; *Y. Sheng, D. Muenstermann*, Lancaster University, UK

**AA2-TuP12** High-Temperature Thermal Stability of ALD-TiN Metal Gate on In-situ Al<sub>2</sub>O<sub>3</sub>/Y<sub>2</sub>O<sub>3</sub>/(In)GaAs(001): Toward the Self-Aligned Gate-First Process, *Lawrence Boyu Young, H.-W. Wan, J.-H. Huang, K.-Y. Lin, J. Liu, Y.-H. Lin*, National Taiwan University, Republic of China; *J. Kwo*, National Tsing Hua University, Republic of China; *M. Hong*, National Taiwan University, Republic of China

**AA2-TuP13** Identification of Interfacial Defect in ALD Grown Al<sub>2</sub>O<sub>3</sub>/GeO<sub>2</sub>/Ge Gate Stack, *Jinjuan Xiang, L. Zhou, X. Wang, X. Ma, T. Li, W. Wang*, Institute of Microelectronics of Chinese Academy of Sciences, China

**AA2-TuP15** Effect of Metal-insulator Interface on Dielectric Properties of Ultrathin Al<sub>2</sub>O<sub>3</sub> and MgO Fabricated using In-situ Sputtering and Atomic Layer Deposition, *Jagaran Acharya, J. Wilt, R. Goul, B. Liu, J. Wu*, The University of Kansas

**AA2-TuP16** Thermal and Plasma ALD Al<sub>2</sub>O<sub>3</sub> Gate Insulator for GaN Electronic Devices Characterized by CV-Stress Measurements, *Nicole Bickel, E. Bahat Treidel, I. Ostermay, O. Hilt, O. Krüger*, Ferdinand-Braun-Institut, Germany; *F. Naumann, H. Gargouri*, SENTECH Instruments GmbH, Germany; *J. Würfl, G. Tränkle*, Ferdinand-Braun-Institut, Germany

**AA2-TuP17** Variable Morphology Highly-Conformal Diffusion Barriers for Advanced Memory and Logic Applications, *Hae Young Kim, S. Rathi, B. Nje, N. Naghibolashrafi, Y. Okuyama, S. Chugh, J. Heo, S.H. Jung, J. Mack, N. Mukherjee*, Eugenius, Inc.

**AA2-TuP18** Room Temperature Deposition of Hafnium Oxide by Atomic Layer Deposition for Gating Applications, *Pragya Shekhar, S. Shamim, S. Hartinger, J. Kleinlein, R. Schlereth, H. Buhmann, L. Molenkamp*, University of Wuerzburg, Germany

# Tuesday Evening Poster Sessions, July 23, 2019

**AA2-TuP19** Influence of Surface Cleaning Process on Initial Growth of ALD- $\text{Al}_2\text{O}_3$  and Electrical Properties of  $\text{Pt}/\text{Al}_2\text{O}_3/\beta\text{-Ga}_2\text{O}_3$  MOS Capacitors, **Masafumi Hirose**, Shibaura Institute of Technology, Japan; **T. Nabatame**, National Institute for Materials Science, Japan; **E. Maeda**, Shibaura Institute of Technology, Japan; **A. Ohi**, **N. Ikeda**, **Y. Irokawa**, **Y. Koide**, National Institute for Materials Science, Japan; **H. Kiyono**, Shibaura Institute of Technology, Japan

**AA2-TuP20** Reliable Gate Stack Development Employing Plasma Assisted Atomic Layer Deposited  $\text{HfO}_2/\text{N}_y$  on InGaAs Substrate, **Sukeun Eom**, **M. Kong**, **K. Seo**, Seoul National University, Republic of Korea

## ALD Applications

### Evergreen Ballroom & Foyer - Session AA3-TuP Catalysis and Sensor Applications Poster Session 5:30pm

**AA3-TuP1** Highly Dispersed Uniform Pt Catalysts on Carbon Support by Atomic Layer Deposition with Fluidized Bed Reactor(FBR), **Jung-Yeon Park**, **W.P. Hong**, **S.-J. Oh**, Hyundai Motor Group, Republic of Korea; **W.-J. Lee**, **S.-H. Kwon**, Pusan National University, Republic of Korea

**AA3-TuP3** Stabilizing Ultrasmall Colloidal Platinum Diphosphide ( $\text{PtP}_2$ ) Nanocrystals with Atomic Layer Deposition Oxide for Neutral  $\text{H}_2\text{O}_2$  Electrosynthesis, **Hui Li**, **S. Geyer**, Wake Forest University

**AA3-TuP5** Synthesis of Core Shell Nanocatalysts using Atomic Layer Deposition with Fluidized Bed Reactor for PEMFC, **Seung-Jeong Oh**, **W.P. Hong**, **J.Y. Park**, Hyundai Motor Group, Republic of Korea; **W.-J. Lee**, **S.-H. Kwon**, Pusan National University, Republic of Korea

**AA3-TuP6** Porous Nanomembranes Grown by Atomic Layer Deposition: Self-Rolling in Solvent and their Sensing Applications, **F. Ma**, **Y.T. Zhao**, **G. Huang**, **Yong Feng Mei**, Fudan University, China

**AA3-TuP7** Fabrication and Characterization of Atomic Layer Deposited ZnO-based Ultra-thin Films for Hydrogen Sensing, **Yan-Qiang Cao**, **A.-D. Li**, Nanjing University, China

## ALD Applications

### Evergreen Ballroom & Foyer - Session AA4-TuP Protective Coatings, Barrier Films, Membranes and Flexible Substrates Poster Session 5:30pm

**AA4-TuP1** ALD for Membrane Applications, **Mathieu Weber**, **M. Bechelany**, Institut Européen des Membranes, France

**AA4-TuP2** Nano-Hardness of ALD Films, **James Daubert**, **W. Sweet**, **J. Kelliher**, Northrop Grumman

**AA4-TuP3** High Acid Corrosion Resistance of  $\text{Nb}_2\text{O}_5$  Thin Film Deposited by Room Temperature ALD, **Kazuki Yoshida**, **K. Saito**, **M. Miura**, **K. Kanomata**, **B. Ahmmad**, **S. Kubota**, **F. Hirose**, Yamagata University, Japan

**AA4-TuP4** Effects of Composition Ratios on Mechanical and Electrical Properties of AZO – Zinc Oxide Composite Thin Film Deposited on Transparent Polyimide Film Using Atomic and Molecular Layer Depositions., **Seung Hak Song**, **B.-H. Choi**, Korea University, Republic of Korea

**AA4-TuP5** Room-temperature Atomic Layer Deposition of Aluminosilicate Thin Film on Flexible Films, **Yoshiharu Mori**, **K. Yoshida**, **K. Kanomata**, **M. Miura**, **B. Ahmmad**, **Arima**, **S. Kubota**, **F. Hirose**, Yamagata University, Japan

**AA4-TuP6** ALD Layers for Reduced Wear on Micro Cutting Tools, **T. Junghans**, **Hans-Dieter Schnabel**, Westsächsische Hochschule Zwickau, Germany

**AA4-TuP7** Fabrication of Atomic Layer Deposited Alumina as Protective Coating of Silver, **Gwan Deok Han**, **J.S. Park**, **J. Koo**, **J.H. Shim**, Korea University, Republic of Korea

**AA4-TuP8** Characterization of Laminated Thin Films for Encapsulation using Single Si Precursor by PEALD, **Joong Jin Park**, **S.D. Lee**, **H.-D. Lim**, **S.J. Jang**, **S.G. Kim**, **G.J. Park**, **S.I. Lee**, **M.W. Kim**, DNF Co. Ltd, Republic of Korea

**AA4-TuP9** Low-cost Fabrication of Flexible Transparent Electrodes based on Sprayed Nanocomposites Silver Nanowires and Al Doped ZnO Deposited by Spatial ALD, **V.H. Nguyen**, **J. Resende**, **D. Papanastasiou**, **C. Jimenez**, **D. Bellet**, LMGP Grenoble INP/CNRS, France; **S. Aghazadehchors**, LMGP, France; **N.D. Nguyen**, Université de Liège; **David Muñoz-Rojas**, LMGP Grenoble INP/CNRS, France

**AA4-TuP10** Nanomechanical Properties of Crystalline Anatase Titanium Oxide Films Synthesized using Atomic Layer Deposition, **Yousuf Mohammed**, **P. Lin**, **K. Zhang**, **H. Baumgart**, **A. Elmustafa**, Old Dominion University

**AA4-TuP11** Encapsulation of Magnetic Nanostructures by ALD for Improved Stability and Performance, **Devika Choudhury**, **Y. Zhang**, **K. Gao**, **A. Mane**, **J.W. Elam**, Argonne National Laboratory

**AA4-TuP12** Diffusion Barrier Properties of ALD TiSiN Films, **Jerry Mack**, **J. Heo**, **S. Chugh**, **H.Y. Kim**, **S. Rathi**, **N. Mukherjee**, Eugenius, Inc.

## ALD Applications

### Evergreen Ballroom & Foyer - Session AA5-TuP Emerging Applications Poster Session 5:30pm

**AA5-TuP1** Bottom up Stabilization of Perovskite Quantum Dots LED via Atomic Layer Deposition, **Rong Chen**, **K. Cao**, **Q. Xiang**, **B. Zhou**, Huazhong University of Science and Technology, China

**AA5-TuP2** ALD Bilayers for X-ray Windows with Long Lifetime, **Agnieszka Kurek**, **Y. Shu**, Oxford Instruments Plasma Technology; **H. Knoops**, Oxford Instruments Plasma Technology, UK; **A. O'Mahony**, **O. Thomas**, **R. Gunn**, Oxford Instruments Plasma Technology; **Y. Alivov**, **C. McKenzie**, **B. Grigsby**, **A. Degtyaryov**, Oxford Instruments X-ray Technology

**AA5-TuP3** ALD for 3D Nano MEMS Applications, **Dorothee Dietz**, Fraunhofer Institute for Microelectronic Circuits and Systems IMS, Germany

**AA5-TuP4** Tribological Properties of Plasma Enhanced Atomic Layer Deposition TiMoN, **Mark Sowa**, Veeco-CNT; **A. Kozen**, U.S. Naval Research Laboratory; **B. Krick**, **N. Strandwitz**, Lehigh University

**AA5-TuP5** Thickness Optimization of Alumina Thin Film for Microchannel Plate Detector, **Baojun Yan**, **S. Liu**, Institute of High Energy Physics, Chinese Academy of Sciences, China

**AA5-TuP6** Optical Coatings Deposited on Nonlinear Crystals by Atomic Layer Deposition, **Ramutis Drazdys**, **R. Buzelis**, **M. Drazdys**, Center for Physical Sciences and Technology, Lithuania

**AA5-TuP7** Atomic Layer Deposition of Nickel and Nickel Oxide Thin-Films for Astronomical X-ray Optics Applications, **Hossein Salami**, **A. Uy**, **A. Vadapalli**, University of Maryland; **V. Dwivedi**, NASA Goddard Space Flight Center; **R. Adamaitis**, University of Maryland

**AA5-TuP8** Atomic Layer Deposition and Chemical Vapor Deposition of Zirconium Boride for Various Applications: New Work Function, Barrier Metal, Hard Mask and Area Selective Deposition, **Jun-Hee Cho**, **J.J. Park**, **W.-M. Chae**, **J.-H. Park**, **S.I. Lee**, **M.W. Kim**, DNF Co. Ltd, Republic of Korea

**AA5-TuP9** Comparative Study of  $\text{Mo}_{1-x}\text{W}_x\text{S}_2$  Alloy Gas Sensor by Atomic Layer Deposition, **Minjoo Lee**, **Y. Kim**, **J. Park**, **H. Kim**, Yonsei University, Republic of Korea

**AA5-TuP10** Fabrication of High-Aspect-Ratio Nanometric Gold Gratings, **O. Makarova**, Creatv MicroTech Inc; **Ralu Divan**, **L. Stan**, Argonne National Laboratory; **C.-M. Tang**, Creatv MicroTech Inc

## Area Selective ALD

### Evergreen Ballroom & Foyer - Session AS-TuP Area Selective ALD Poster Session 5:30pm

**AS-TuP1** Laterally-Structured Dielectrics by Area-Selective Atomic-Layer-Deposition on 3D Substrates, **Philip Klement**, **D. Anders**, **F. Michel**, **J. Schörmann**, **S. Chatterjee**, Justus Liebig University Giessen, Germany

**AS-TuP2** Light Assisted Area Selective Atomic Layer Deposition on Plasmonic Nanoantennas, **Chengwu Zhang**, **T. Gao**, **B. Willis**, University of Connecticut

**AS-TuP3** Area-Specific Atomic Layer Deposition (ALD) of Cobalt As Mediated by Thermally Induced Dehydrocoupled Self-Assembled Monolayers (SAMs), **Barry Arkles**, **J. Goff**, **C. Brick**, Gelest, Inc.; **A. Kaloyeros**, SUNY Polytechnic Institute

**AS-TuP4** Investigation of *In-situ* Surface Cleaning of Cu Films using  $\text{O}_3/\text{O}_2$  and  $\text{N}_2\text{H}_4$ , **Su Min Hwang**, **A.L.N. Kondusamy**, **Q. Zhiyang**, **H.S. Kim**, **L.F. Peña**, **K. Tan**, **J. Veyan**, University of Texas at Dallas; **D. Alvarez**, **J. Spiegelman**, RASIRC; **J. Kim**, University of Texas at Dallas

**AS-TuP5** Area-Selective Deposition of  $\text{SiO}_2$  based on Spatial ALD with Interleaved Etching Steps to Obtain High Selectivity, **Alfredo Marneli**, TNO/Holst Center, Netherlands; **F. Roozeboom**, Eindhoven University of Technology and TNO, Netherlands; **P. Poedt**, TNO/Holst Center, Netherlands

# Tuesday Evening Poster Sessions, July 23, 2019

**AS-TuP6** Defect Mitigation Solution for Area-Selective Atomic Layer Deposition of Ru on TiN/SiO<sub>2</sub> Nanopatterns, *J. Soethoudt*, KU Leuven – University of Leuven/IMEC, Belgium; *F. Grillo*, ETH Zurich, Switzerland; *E. Marques*, *R. van Ommen*, Delft University of Technology, Netherlands; *B. Briggs*, *H. Hody*, *V. Spampinato*, *A. Franquet*, *B.T. Chan*, **Annelies Delabie**, IMEC, Belgium

Note: ALE Posters Will Remain Posted All Week

## Nanostructure Synthesis and Fabrication

### Evergreen Ballroom & Foyer - Session NS-TuP

#### Nanostructures Synthesis and Fabrication Poster Session

5:30pm

**NS-TuP1** Molybdenum Disulfides and Diselenides by Atomic Layer Deposition, **Raul Zazpe**, *J. Prikryl*, *M. Krbal*, *J. Charvot*, *F. Dvorak*, *F. Bures*, *J. Macak*, University of Pardubice, Czech Republic

**NS-TuP2** Wafer-scale MoS<sub>2</sub> Thin Film Deposition via H<sub>2</sub>S Plasma Sulfurization of ALD-grown MoO<sub>3</sub> at Low Temperature, **Jeong-Hun Choi**, Korea Maritime and Ocean University, Republic of Korea

**NS-TuP3** ALD-based Synthesis of Few-layer Transition Metal Disulfides with Wafer-scale Uniformity for Device Integration, **Tao Chen**, *Y. Wang*, *H. Zhu*, *L. Chen*, *Q.Q. Sun*, *D.W. Zhang*, Fudan University, China

**NS-TuP4** Overcoming Agglomeration and Adhesion in Particle ALD, **Benjamin Greenberg**, *J. Wollmershauser*, *B. Feigelson*, U.S. Naval Research Laboratory

**NS-TuP5** Density Function Theory for Nucleation of MoF<sub>6</sub> with Oxide Surfaces in Atomic Layer Deposition of MoS<sub>2</sub>, **Matthew Lawson**, Boise State University

# Wednesday Morning, July 24, 2019

Grand Ballroom A-C	
8:00am	<b>EM1-WeM1</b> Molecular Layer Deposition of Titanicene Films using TiCl and Fumaric or Maleic Acid: Growth Mechanism and Ambient Stability, <i>Yan-Qiang Cao, A.-D. Li</i> , Nanjing University, China
8:15am	<b>EM1-WeM2</b> Temperature Dependent Surface Chemistry in Molecular Layer Deposition of Polyimide on Cu and Si, <i>Chao Zhang, M. Leskelä, M. Ritala</i> , University of Helsinki, Finland
8:30am	<b>EM1-WeM3</b> Integrated MLD Supercycle for the Direct Deposition of Zeolitic Imidazolate Framework Films, <i>Alexander John Cruz, I. Stassen, R. Ameloot</i> , KU Leuven, Belgium
8:45am	<b>EM1-WeM4</b> Understanding Molecular Layer Deposition Nucleation Mechanisms in Polyurea via Time Domain Thermoreflectance, <i>Rachel Nye, M. Fusco</i> , North Carolina State University; <i>E. Radue, A. Kelliher, P. Hopkins</i> , University of Virginia; <i>G.N. Parsons</i> , North Carolina State University
9:00am	<b>EM1-WeM5</b> Molecular Layer Deposition of Indicene Thin film using Indium Precursor and Hydroquinone, <i>Seung-Hwan Lee, G.H. Baek, J.-H. Lee</i> , Hanyang University, Republic of Korea; <i>T.T. Ngoc Van, B. Shong</i> , Hongik University, Republic of Korea; <i>J.-S. Park</i> , Hanyang University, Republic of Korea
9:15am	<b>EM1-WeM6</b> Air Stable Alucone Thin Film Deposited by Molecular Layer Deposition using Hetero Bifunctional Organic Reactant, <i>GeonHo Baek, S.-H. Lee, J.-H. Lee, J.-S. Park</i> , Hanyang University, Republic of Korea
9:30am	<b>EM1-WeM7</b> Molecular Layer Deposition of "Magnesicone", a Magnesium-based Hybrid Material, as a Matrix Material for Solid Composite Electrolytes, <i>Jeroen Kint, F. Mattelaer, M. Minjauw</i> , Ghent University, Belgium; <i>P. Vereecken</i> , IMEC, Belgium; <i>J. Dendooven, C. Detavernier</i> , Ghent University, Belgium
9:45am	<b>EM1-WeM8</b> Molecular Layer Deposition of Polyamide Films on Particles Using a Rotating Cylinder Reactor, <i>Tyler Myers, S.M. George</i> , University of Colorado - Boulder
10:00am	<b>Break &amp; Exhibits</b>
10:15am	<b>Break &amp; Exhibits</b>
10:30am	<b>Break &amp; Exhibits</b>
10:45am	<b>EM2-WeM12</b> Vapor Phase Infiltration: A Route for Making Insulating Polymer Fibers Conductive, <i>Mato Knez</i> , CIC nanoGUNE, Spain; <i>I. Azpitarte</i> , CTECHnano, Spain
11:00am	<b>EM2-WeM13</b> Vapor Phase Infiltration of Metal Oxides into Microporous Polymers for Organic Solvent Separation Membranes, <i>Emily McGuinness, F. Zhang, Y. Ma, R. Lively, M. Losego</i> , Georgia Institute of Technology
11:15am	<b>EM2-WeM14</b> ZnO-Infiltrated Hybrid Polymer Thin Films with Enhanced Gravimetric Water and Oxygen Vapor Sensing Properties, <i>E. Muckley, L. Collins, A. Ievlev</i> , Oak Ridge National Laboratory; <i>X. Ye, K. Kisslinger</i> , Brookhaven National Laboratory; <i>B. Sumpter, N. Lavrik</i> , Oak Ridge National Laboratory; <i>Chang-Yong Nam</i> , Brookhaven National Laboratory; <i>I. Ivanov</i> , Oak Ridge National Laboratory
11:30am	<b>EM2-WeM15</b> Physically Interpenetrated Organic-Inorganic Sub-Surface Layers Created via Vapor Phase Infiltration for Improved Film Adhesion, <i>Mark Losego, S. Dwarakanath, R. Tummala</i> , Georgia Institute of Technology
11:45am	<b>EM2-WeM16</b> Inorganic-Organic Thin Film Layer-Structures and Thermal Conductivity, <i>Fabian Krahl</i> , Aalto University, Finland; <i>A. Giri, P. Hopkins</i> , University of Virginia; <i>M. Karppinen</i> , Aalto University, Finland
12:00pm	<b>Lunch &amp; Exhibits</b>

## Emerging Materials Session EM1-WeM

### Molecular Layer Deposition

#### Moderators:

Stacey F. Bent, Stanford University  
Charles L. Dezelah, ASM

## Emerging Materials Session EM2-WeM

### Organic-Inorganic Hybrid Materials

#### Moderators:

Gregory N. Parsons, North Carolina State University  
Jonas Sundqvist, Fraunhofer Institute for Ceramic Technologies and Systems IKTS

# Wednesday Morning, July 24, 2019

<b>Grand Ballroom E-G</b>		
8:00am	<b>AM1-WeM1</b> Impact of Operating Parameters on Precursor Separation in “Air Hockey” Spatial Atomic Layer Deposition Reactor, <i>John Grasso, B. Willis</i> , University of Connecticut	<b>ALD for Manufacturing Session AM1-WeM</b>  <b>Spatial ALD, Fast ALD, and Large-Area ALD</b>  <b>Moderators:</b> John F. Conley, Jr., Oregon State University Paul Poodt, TNO/Holst Center
8:15am	<b>AM1-WeM2</b> Plasma Enhanced Spatial ALD of Silver Thin Films at Atmospheric Pressure, <i>Tim Hasselmann</i> , University of Wuppertal, Germany; <i>N. Boysen</i> , Ruhr University Bochum, Germany; <i>D. Theirich</i> , University of Wuppertal, Germany; <i>A. Devi</i> , Ruhr University Bochum, Germany; <i>T. Riedl</i> , University of Wuppertal, Germany	
8:30am	<b>INVITED: AM1-WeM3</b> Low Temperature Spatial PEALD of Silicon Nitride Films from Aminosilane Precursors and DC Direct Plasma, <i>Eric Dickey</i> , Lotus Applied Technology	
8:45am	Invited talk continues.	
9:00am	<b>AM1-WeM5</b> Development and Characterization of an Atmospheric Pressure Plasma Reactor Compatible with Open-Air Spatial ALD, <i>H. Rabat, F. Zoubian, O. Aubry, N. Dumuis, S. Dozias</i> , GREMI Université d'Orléans/CNRS, France; <i>C. Masse de la Huerta, A. Sekkat, V.H. Nguyen</i> , LMGP Grenoble INP/CNRS, France; <i>M. Bonvalot, C. Vallée</i> , LTM-UGA, France; <i>D. Hong</i> , GREMI Université d'Orléans/CNRS, France; <i>David Muñoz-Rojas</i> , LMGP Grenoble INP/CNRS, France	
9:15am	<b>AM1-WeM6</b> Fast Plasma ALD Employing de Laval Nozzles for High Velocity Precursor Injection, <i>Abhishekkumar Thakur, J. Sundqvist</i> , Fraunhofer Institute for Ceramic Technologies and Systems IKTS, Germany; <i>S. Wege</i> , Plasway Technologies GmbH, Germany	
9:30am	<b>AM1-WeM7</b> Development of a Meter Scale ALD Optical Coating Tool for Astronomical Mirror (and other) Applications, <i>D. Fryauf</i> , University of California Santa Cruz; <i>A. Phillips</i> , University of California Observatories; <i>A. Feldman</i> , Structured Material Industries, Inc.; <i>N. Kobayashi</i> , University of California Santa Cruz; <i>Gary Tompa</i> , Structured Material Industries, Inc.	
9:45am	<b>AM1-WeM8</b> From Wet-lab to Cleanroom: An Integrated ALD-CVD Process for the Large-area Deposition of Ultrathin Zeolitic Imidazolate Framework Films, <i>Ivo Stassen, A.J. Cruz, R. Ameloot</i> , KU Leuven, Belgium	
10:00am	<b>Break &amp; Exhibits</b>	
10:15am	<b>Break &amp; Exhibits</b>	
10:30am	<b>Break &amp; Exhibits</b>	
10:45am	<b>EM3-WeM12</b> Atomic Layer Epitaxy of Zinc Oxide on C-plane Sapphire from Diethylzinc and Water using Pulsed-Heating Atomic Layer Deposition, <i>Brandon Piercy, M. Losego</i> , Georgia Institute of Technology	<b>Emerging Materials Session EM3-WeM</b>  <b>Epitaxial Growth and III-V Materials</b>  <b>Moderator:</b> John Ekerdt, University of Texas at Austin
11:00am	<b>EM3-WeM13</b> Growth of AlN Barriers in Al/AlN/Al SIS Josephson Junctions by Low Temperature Atomic Layer Epitaxy, <i>Charles Eddy, Jr.</i> , U.S. Naval Research Laboratory; <i>D.J. Pennachio, J. Lee, A. McFadden</i> , University of California, Santa Barbara; <i>S.G. Rosenberg</i> , U.S. Naval Research Laboratory; <i>Y.H. Chang, C.J. Palmstrom</i> , University of California, Santa Barbara	
11:15am	<b>EM3-WeM14</b> Investigating Plasma Parameters and Influence of Argon to the Crystallinity of GaN Films Grown by Plasma-Assisted ALD, <i>Deepa Shukla, I. Saidjafarzoda, A. Mohammad, B. Brian Willis, N. Biyikli</i> , University of Connecticut	
11:30am	<b>EM3-WeM15</b> Ultrathin GaN Epilayer by Low-temperature Atomic Layer Annealing and Epitaxy, <i>Wei-Chung Kao, W.-H. Lee, Y.-T. Yin</i> , National Taiwan University, Republic of China; <i>J.-J. Shyue</i> , Academia Sinica; <i>H.-C. Lin, M.J. Chen</i> , National Taiwan University, Republic of China	
11:45am	<b>EM3-WeM16</b> High Quality ALD Formation of Group-III Nitrides and their Applications in FTO-based Thin Film Solar Cells, <i>Xinhe Zheng, H. Wei, P. Qiu, M. Peng, S. Liu, Y. He, Y. Song, Y. An</i> , University of Science and Technology Beijing, China	
12:00pm	<b>Lunch &amp; Exhibits</b>	



# Wednesday Morning, July 24, 2019

Grand Ballroom H-K		
8:00am	<b>INVITED: AA1-WeM1</b> ALD/ALE Process in Commercially Available Leading-Edge Logic and Memory Devices, <i>Rajesh Krishnamurthy</i> , TechInsights	<b>ALD Applications Session AA1-WeM</b>  <b>ALD for Memory Applications II</b>  <b>Moderators:</b> Seung Wook Ryu, SK Hynix
8:15am	Invited talk continues.	
8:30am	<b>AA1-WeM3</b> Atomic Layer Deposited Crystalline Zinc Oxide for Silver-based Ultra-Steep Threshold Switching Selector, <i>Harrison Sejoon Kim, A. Sahota, J. Mohan, H. Hernandez-Arriaga, J. Kim</i> , The University of Texas at Dallas	
8:45am	<b>AA1-WeM4</b> ALD Ge-Se-Te OTS Selectors with Controlled Composition for PCM Applications, <i>Valerio Adinolfi, L. Cheng, R. Clarke, S. Balatti, K. Littau</i> , Intermolecular, Inc.	
9:00am	<b>AA1-WeM5</b> Pulsed CVD of Amorphous GeSe for Application as OTS Selector, <i>A. Haider</i> , IMEC, Belgium; <i>Shaoren Deng</i> , ASM, Belgium; <i>E. Schapmans</i> , IMEC, Belgium; <i>J.W. Maes</i> , ASM, Belgium; <i>J.-M. Girard</i> , Air Liquide Advanced Materials, France; <i>G. Khalil</i> , imec; <i>G.S. Kar, L. Goux, R. Delhougne</i> , IMEC; <i>M. Caymax</i> , IMEC, Belgium	
9:15am	<b>INVITED: AA1-WeM6</b> Thin Film Challenges in 3D NAND Scaling, <i>Jessica Kachian, D. Pavlopoulos, D. Kioussis</i> , Intel Corporation	
9:30am	Invited talk continues.	
9:45am		
10:00am	<b>Break &amp; Exhibits</b>	
10:15am	<b>Break &amp; Exhibits</b>	
10:30am	<b>Break &amp; Exhibits</b>	
10:45am	<b>INVITED: AA2-WeM12</b> The Journey of ALD High-k Metal Gate from Research to High Volume Manufacturing, <i>Dina Triyoso, R. Clark, S. Consiglio, K. Tapily, C. Wajda, G. Leusink</i> , TEL Technology Center, America, LLC	<b>ALD Applications Session AA2-WeM</b>  <b>ALD for ULSI Applications I</b>  <b>Moderators:</b> Ravindra Kanjolia, EMD Performance Materials Jae Hyung Choi, Samsung Electronics
11:00am	Invited talk continues.	
11:15am	<b>AA2-WeM14</b> Effects of Er Doping on Structural and Electrical Properties of HfO <sub>2</sub> Grown by Atomic Layer Deposition., <i>Soo Hwan Min, B.-E. Park, C.W. Lee</i> , Yonsei University, Republic of Korea; <i>W. Noh</i> , Air Liquide Laboratories Korea, South Korea; <i>I.-K. Oh</i> , Yonsei University, Republic of Korea; <i>W.-H. Kim</i> , Hanyang University, Republic of Korea; <i>H. Kim</i> , Yonsei University, Republic of Korea	
11:30am	<b>AA2-WeM15</b> Improvement of Electrical Performances of Atomic Layer Deposited ZrO <sub>2</sub> MIM Capacitors with Ru Bottom Electrode, <i>Jaehwan Lee, B.-E. Park</i> , Yonsei University, Republic of Korea; <i>W. Noh</i> , Air Liquide Laboratories Korea, South Korea; <i>I.-K. Oh</i> , Yonsei University, Republic of Korea; <i>W.-H. Kim</i> , Hanyang University, Republic of Korea; <i>H. Kim</i> , Yonsei University, Republic of Korea	
11:45am	<b>AA2-WeM16</b> Perfecting ALD-Y <sub>2</sub> O <sub>3</sub> /GaAs(001) Interface with Ultra-High Vacuum Annealing, <i>Keng-Yung Lin, Y.-H. Lin, W.-S. Chen, H.-W. Wan, L.B. Young</i> , National Taiwan University, Republic of China; <i>C.-P. Cheng</i> , National Chia-Yi University, Republic of China; <i>T.-W. Pi</i> , National Synchrotron Radiation Research Center, Republic of China; <i>J. Kwo</i> , National Tsing Hua University, Republic of China; <i>M. Hong</i> , National Taiwan University, Republic of China	
12:00pm	<b>Lunch &amp; Exhibits</b>	

# Wednesday Morning, July 24, 2019

Regency Ballroom A-C	
8:00am	<b>INVITED: ALE1-WeM1</b> ALD and Etch Synergy to Enable the Next Scaling Innovations, <i>Angelique Raley, K.L. Lee, X. Sun, Q. Lou, Y.T. Lu, M. Edley, S. Oyola-Reynoso, P. Ventzek, R. Clark, P. Biolsi, H. Masanobu, A. Ranjan</i> , TEL Technology Center, America, LLC
8:15am	Invited talk continues.
8:30am	<b>INVITED: ALE1-WeM3</b> On the Role of Individual Etching Components in Selective Atomic Layer Processing: Etch and Deposit to Obtain High Selectivity, <i>Alfredo Mameli</i> , TNO/Holst Center, Netherlands; <i>F. Roozeboom</i> , Eindhoven University of Technology and TNO, Netherlands; <i>P. Poodt</i> , TNO/Holst Center, Netherlands
8:45am	Invited talk continues.
9:00am	<b>ALE1-WeM5</b> Area-Selective Deposition of TiO <sub>2</sub> on Various Surfaces by Isothermal Integration of Thermal TiO <sub>2</sub> ALD and ALE, <i>Seung Keun Song, G.N. Parsons</i> , North Carolina State University
9:15am	<b>ALE1-WeM6</b> Limited Dose ALE and ALD Processes for Local Film Coatings on 3D Structures, <i>Thomas Seidel</i> , Seitek50; <i>M. Current</i> , Current Scientific
9:30am	<b>ALE1-WeM7</b> Formation of Ohmic Contacts to Si using In-situ Chemical Cleaning of the Substrate, <i>Sara Iacopetti</i> , Technion - Israel Institute of Technology, Israel; <i>R. Tarafdar, S. Lai, M. Danek</i> , Lam Research Corp.; <i>M. Eizenberg</i> , Technion - Israel Institute of Technology, Israel
9:45am	<b>ALE1-WeM8</b> SADP Spacer Profile Engineering by Quasi-Atomic Layer Etching, <i>Tsai Wen (Maggie) Sung, C. Yan, H. Chung, J. Lo, D. Desai, P. Lembesis, R. Pakulski, M. Yang</i> , Mattson Technology, Inc.
10:00am	<b>Break &amp; Exhibits</b>
10:15am	<b>Break &amp; Exhibits</b>
10:30am	<b>Break &amp; Exhibits</b>
10:45am	<b>ALE2-WeM12</b> Dynamic Temperature Control Enabled Atomic Layer Etching of Titanium Nitride, <i>He Zhang, Y.S. Kim, D. Paeng</i> , Lam Research Corp.
11:00am	<b>INVITED: ALE2-WeM13</b> Rapid Thermal-Cyclic Atomic Layer Etching of Thin Films with Highly Selective, Self-Limiting, and Conformal Characteristics, <i>Kazunori Shinoda</i> , Hitachi, Japan; <i>H. Kobayashi</i> , Hitachi; <i>N. Miyoshi, M. Izawa</i> , Hitachi High-Technologies; <i>K. Ishikawa, M. Hori</i> , Nagoya University, Japan
11:15am	Invited talk continues.
11:30am	<b>ALE2-WeM15</b> Atomic Layer Etching of HfO <sub>2</sub> with Selectivity to Si by Utilizing Material-Selective Deposition Phenomena, <i>Kang-Yi Lin, C. Li</i> , University of Maryland; <i>S. Engelmann, R.L. Bruce, E.A. Joseph</i> , IBM T.J. Watson Research Center; <i>D. Metzler</i> , IBM Research - Albany; <i>G.S. Oehrlein</i> , University of Maryland
11:45am	<b>ALE2-WeM16</b> Enhancing Etch Selectivity in Plasma-Assisted ALE of Silicon-Based Dielectrics using Surface Functionalization, <i>Ryan Gasvoda</i> , Colorado School of Mines; <i>S. Wang, E. Hudson</i> , Lam Research Corp.; <i>S. Agarwal</i> , Colorado School of Mines
12:00pm	<b>Lunch &amp; Exhibits</b>

## Atomic Layer Etching Session ALE1-WeM

### Integration & Application of ALE

#### Moderators:

Wei Tian, Applied Materials

## Atomic Layer Etching Session ALE2-WeM

### Materials Selective ALE

#### Moderators:

Fred Roozeboom, Eindhoven University of Technology and TNO

Geun Young Yeom, Sungkyunkwan University

# Wednesday Afternoon, July 24, 2019

	<b>ALD Applications</b> <b>Grand Ballroom A-C - Session AA1-WeA</b> <b>Emerging Applications II</b> <b>Moderators:</b> Arrelaine Dameron, Forge Nano, Han-Bo-Ram Lee, Incheon National University	<b>ALD Applications</b> <b>Grand Ballroom H-K - Session AA2-WeA</b> <b>ALD for ULSI Applications II</b> <b>Moderators:</b> Haripin Chandra, Versum Materials, Inc., Robert Clark, TEL Technology Center, America, LLC
1:30pm	<b>AA1-WeA1</b> Atomic Layer Deposited Nano-Coatings to Protect SrAl <sub>2</sub> O <sub>4</sub> Based Long-Life Phosphors from Environmental Degradation, <b>Erkul Karacaoglu</b> , Georgia Institute of Technology; <b>E. Ozturk</b> , Karamanoglu Mehmetbey University, Turkey; <b>M. Uyaner</b> , Necmettin Erbakan University, Turkey; <b>M. Losego</b> , Georgia Institute of Technology	<b>INVITED: AA2-WeA1</b> Silicon-Based Low k Dielectric Materials with Remote Plasma ALD, <b>Hyeongtag Jeon</b> , Hanyang University, Republic of Korea
1:45pm	<b>AA1-WeA2</b> Enhanced Interfacial Fracture Toughness of Polymer-Epoxy Interfaces using ALD Surface Treatments, <b>Yuxin Chen</b> , <b>N. Ginga</b> , <b>W. LePage</b> , <b>E. Kazyak</b> , <b>A. Gayle</b> , <b>J. Wang</b> , <b>M.D. Thouless</b> , <b>N.P. Dasgupta</b> , University of Michigan	Invited talk continues.
2:00pm	<b>AA1-WeA3</b> Atomic Layer Deposition of Pd on ZnO Nanorods for High Performance Photocatalysts, <b>Jong Seon Park</b> , <b>B.J. Kim</b> , <b>G.D. Han</b> , <b>K.-H. Park</b> , <b>E.H. Kang</b> , <b>H.-D. Park</b> , <b>J.H. Shim</b> , Korea University, Republic of Korea	<b>AA2-WeA3</b> SiOC Films by PEALD with Excellent Conformality and Wet Etch Resistance, <b>Young Chol Byun</b> , <b>E. Shero</b> , ASM
2:15pm	<b>AA1-WeA4</b> Accelerating Light Beam (ALB) Generation through Dielectric Optical Device Fabricated by Low Temperature Atomic Layer Deposition (ALD), <b>W. Zhu</b> , <b>C. Zhang</b> , <b>A. Agrawal</b> , <b>H. Lezec</b> , National Institute of Standards and Technology; <b>Huazhi Li</b> , Arradance LLC	<b>AA2-WeA4</b> ALD TiN for Superconducting Through-Silicon Vias, <b>Kestutis Grigoras</b> , <b>S. Simbierowicz</b> , <b>L. Grönberg</b> , <b>J. Govenius</b> , <b>V. Vesterinen</b> , <b>M. Prunnila</b> , <b>J. Hassel</b> , VTT Technical Research Centre of Finland Ltd, Finland
2:30pm	<b>AA1-WeA5</b> Tunable Plasmonic Colours Preserved and Modified by Atomic Layer Deposition of Alumina, <b>J-M. Guay</b> , <b>A. Lesina</b> , <b>G. Killaire</b> , University of Ottawa, Canada; <b>Peter Gordon</b> , Carleton University, Canada; <b>C. Hahn</b> , University of Ottawa, Canada; <b>S. Barry</b> , Carleton University, Canada; <b>L. Ramunno</b> , <b>P. Berini</b> , <b>A. Weck</b> , University of Ottawa, Canada	<b>AA2-WeA5</b> Physical and Electronic Properties of Annealed ALD-deposited Ru from Ru(DMBD)(CO) <sub>3</sub> and Oxygen, <b>Michael H. Hayes</b> , Oregon State University; <b>C.L. Dezelah</b> , <b>J.H. Woodruff</b> , EMD Performance Materials; <b>J.F. Conley, Jr.</b> , Oregon State University
2:45pm	<b>AA1-WeA6</b> TFE of OLED Displays by Time-Space-Divided (TSD) PE-ALD and PE-CVD Hybrid System, <b>Bongsik Kim</b> , JUSUNG Engineering, Republic of Korea	<b>AA2-WeA6</b> Fluorine Free Boron-Containing Composite Layers for Shallow Dopant Source Applications, <b>Anil Mane</b> , <b>D. Choudhury</b> , <b>K. Pupek</b> , <b>R. Langeslay</b> , <b>M. Delferro</b> , <b>J.W. Elam</b> , Argonne National Laboratory
3:00pm	<b>AA1-WeA7</b> Tailoring the Ferroelectricity of ZrO <sub>2</sub> Thin Films using Ultrathin Interfacial Layers Prepared by Plasma-Enhanced Atomic Layer Deposition, <b>Sheng-Han Yi</b> , <b>B.-T. Lin</b> , <b>T.-Y. Hsu</b> , <b>J. Shieh</b> , <b>M.J. Chen</b> , National Taiwan University, Republic of China	<b>AA2-WeA7</b> Impact of Medium Energy Ions on the Microstructure and Physical Properties of TiN Thin Layers Grown by Plasma Enhanced Atomic Layer Deposition (PE-ALD), <b>S. Belahcen</b> , <b>C. Vallée</b> , <b>A. Bsiesy</b> , <b>Marceline Bonvalot</b> , LTM-UGA, France
3:15pm	<b>AA1-WeA8</b> Spin-Hall-Active Platinum Thin Films Grown Via Atomic Layer Deposition, <b>Michaela Lammel</b> , IFW Dresden, Germany; <b>R. Schlitz</b> , Technische Universität Dresden, Germany; <b>A.A. Amusan</b> , IFW Dresden, Germany; <b>S. Schlicht</b> , FAU Erlangen, Germany; <b>T. Tynell</b> , IFW Dresden, Germany; <b>J. Bachmann</b> , FAU Erlangen, Germany; <b>G. Woltersdorf</b> , Martin-Luther-Universität Halle-Wittenberg, Germany; <b>K. Nielsch</b> , IFW Dresden, Germany; <b>S.T.B. Goennenwein</b> , Technische Universität Dresden, Germany; <b>A. Thomas</b> , IFW Dresden, Germany	<b>AA2-WeA8</b> ALD Process Monitoring for 3D Device Structures, <b>Jiangtao Hu</b> , Lam Research Corp.
3:30pm		<b>ALD/ALE 2019 Closing Remarks and Student Awards</b>

# Wednesday Afternoon, July 24, 2019

<b>Emerging Materials</b> <b>Regency Ballroom A-C - Session EM1-WeA</b> <b>Ternary and Quaternary Oxide Materials</b> <b>Moderator: Bart Macco, Eindhoven University of Technology</b>		<b>Nanostructure Synthesis and Fabrication</b> <b>Grand Ballroom E-G - Session NS-WeA</b> <b>2D Nanomaterials by ALD (including Transition Metal Dichalcogenides)</b> <b>Moderators: Annelies Delabie, IMEC, Harm Knoops, Oxford Instruments Plasma Technology</b>
1:30pm	<b>EM1-WeA1</b> Rhenium(III)-based Ternary Oxides: Novel Materials from Straightforward Synthesis <i>via</i> ALD Comprising Uncommon Reaction Pathways, <b>Max Gebhard</b> , <i>S. Letourneau, D. Mandia, D. Choudhury, A. Yanguas-Gil, A. Mane, A. Sattelberger, J.W. Elam</i> , Argonne National Laboratory	<b>NS-WeA1</b> Modified ALD Process to Achieve Crystalline MoS <sub>2</sub> Thin Films, <b>Li Zeng</b> , <i>C. Maclsaac, J. Shi, N. Ricky, I.-K. Oh, S.F. Bent</i> , Stanford University
1:45pm	<b>EM1-WeA2</b> Growth Behavior and Electronic Characterization of PbZrO <sub>3</sub> and PbZr <sub>x</sub> Ti <sub>1-x</sub> O <sub>3</sub> Grown by Atomic Layer Deposition with Several Zr Precursors, <b>Nicholas Strnad</b> , University of Maryland; <i>D. Potrepka</i> , U.S. Army Research Laboratory; <i>A. Leff</i> , General Technical Services, LLC; <i>J. Pulskamp</i> , U.S. Army Research Laboratory; <i>R. Phaneuf</i> , University of Maryland; <i>R. Polcawich</i> , U.S. Army Research Laboratory	<b>NS-WeA2</b> Nucleation and Growth of ALD MoS <sub>2</sub> Films on Dielectric Surfaces, <i>S. Letourneau</i> , <b>Anil Mane</b> , <i>J.W. Elam</i> , Argonne National Laboratory
2:00pm	<b>EM1-WeA3</b> Understanding Growth Characteristics of ALD NiAl <sub>2</sub> O <sub>4</sub> : The Role of Ozone, <b>Jonathan Baker</b> , <i>J. Schneider, S.F. Bent</i> , Stanford University	<b>INVITED: NS-WeA3</b> Plasma-Enhanced Atomic Layer Deposition of Transition Metal Dichalcogenides: From 2D Monolayers to 3D Vertical Nanofins, <b>Ageeth Bol</b> , Eindhoven University of Technology, Netherlands
2:15pm	<b>EM1-WeA4</b> Atomic Layer Deposition of B <sub>x</sub> Mg <sub>1-x</sub> O Films: Progress Towards Shallow Boron Doping, <b>David Mandia</b> , <i>D. Choudhury, M. Gebhard</i> , Argonne National Laboratory; <i>J. Liu</i> , Northwestern University; <i>A. Yanguas-Gil, A.U. Mane, A. Nassiri, J.W. Elam</i> , Argonne National Laboratory	Invited talk continues.
2:30pm	<b>EM1-WeA5</b> Enhanced Doping Control of Metal Oxide Thin Films Using a Modified ALD Process, <i>E. Levrau</i> , IBM TJ Watson Research Center; <b>Yohei Ogawa</b> , ULVAC, Japan; <i>M. Frank, M. Hopstaken, E. Cartier</i> , IBM T.J. Watson Research Center; <i>K. Schmidt</i> , IBM Research - Almaden; <i>M. Hatanaka</i> , ULVAC, Japan; <i>J. Rozen</i> , IBM T.J. Watson Research Center	<b>NS-WeA5</b> Atomic Layer Deposition of Emerging 2D Semiconductors HfS <sub>2</sub> and ZrS <sub>2</sub> , <b>Miika Mattinen</b> , <i>G. Popov, M. Vehkamäki, P. King, K. Mizohata, P. Jalkanen, J. Räsänen, M. Leskelä, M. Ritala</i> , University of Helsinki, Finland
2:45pm	<b>EM1-WeA6</b> As Deposited Epitaxial LaNiO <sub>3</sub> and La(Ni,Cu)O <sub>3</sub> with Controllable Electric Properties, <b>Henrik Hovde Sønsteby</b> , University of Oslo / Argonne Natl. Labs, Norway; <i>O. Nilsen, H. Fjellvåg</i> , University of Oslo, Norway	<b>NS-WeA6</b> Low Temperature ALD for Phase-controlled Synthesis of 2D Transition Metal (M=Ti, Nb) <i>di-</i> (MX <sub>2</sub> ) and <i>Tri-</i> (MX <sub>3</sub> ) Sulfides, <b>Saravana Balaji Basuvalingam</b> , <i>M. Verheijen, W.M.M. Kessels, A. Bol</i> , Eindhoven University of Technology, Netherlands
3:00pm	<b>EM1-WeA7</b> Time Dependence of Pyroelectric Response in Ferroelectric Hf <sub>0.58</sub> Zr <sub>0.42</sub> O <sub>2</sub> Films, <b>Sean Smith</b> , <i>M.D. Henry, M. Rodriguez</i> , Sandia National Laboratories; <i>J. Ihlefeld</i> , University of Virginia	<b>NS-WeA7</b> ALD Boron Nitride Coated and Infiltrated Carbon Materials for Environmental Applications, <i>W. Hao, C. Journet, A. Brioude</i> , Université Lyon, France; <i>H. Okuno</i> , Université Grenoble-Alpes, France; <b>Catherine Marichy</b> , Université Lyon, France
3:15pm	<b>EM1-WeA8</b> Tailoring Nickel Oxide Conductivity by Introducing Transition Metals: From First-principles to Experimental Demonstration, <b>Md. Anower Hossain</b> , <i>T. Zhang, D. Lambert</i> , University of New South Wales, Australia; <i>Y. Zakaria</i> , Hamad Bin Khalifa University, Qatar; <i>P. Burr</i> , University of New South Wales, Australia; <i>S. Rashkeev, A. Abdallah</i> , Hamad Bin Khalifa University, Qatar; <i>B. Hoex</i> , University of New South Wales, Australia	

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