

# Program Key

## Conference Topics

<b>AC</b>	Advanced Characterization Techniques
<b>BG</b>	Bulk Growth
<b>DI</b>	Dielectric Interfaces
<b>EG</b>	Epitaxial Growth
<b>EP</b>	Electronic and Photonic Devices, Circuits and Applications
<b>ET</b>	Electronic Transport and Breakdown Phenomena
<b>HM</b>	Heterogeneous Material Integration
<b>KEY</b>	Keynote Address
<b>MD</b>	Material and Device Processing and Fabrication Techniques
<b>PS</b>	Plenary Session
<b>TM</b>	Theory, Modeling and Simulation

## 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).

# Program Overview

Room /Time	Jefferson 1 & Atrium	Jefferson 2-3
MoM		KEY1: Keynote Address AC-MoM: Characterization & Modeling I BG-MoM: Bulk & Epitaxy I
MoA		MD-MoA: Process & Devices I TM-MoA: Characterization & Modelling II
MoP	Poster Sessions	
TuM		PS1-TuM: Plenary Session I TM-TuM: Characterization & Modelling III AC-TuM: Advanced Characterization & Microscopy
TuA		EG-TuA: Bulk & Epitaxy II DI-TuA: Processes & Devices II
TuP	Poster Sessions	
WeM		PS2-WeM: Plenary Session II EP1-WeM: Process & Devices III EP2-WeM: Process and Devices IV

# Monday Morning, August 8, 2022

Room Jefferson 2-3		
8:30am		<b>Keynote Address</b> <b>Session KEY1</b> <b>Keynote Address</b> <b>Moderator: Dr. Kelson Chabak, Air Force Research Laboratory</b>
8:45am	<b>INVITED: KEY1-2</b> Keynote Lecture: Ga <sub>2</sub> O <sub>3</sub> Device Technologies: Power Switching and High-Frequency Applications, and Beyond, <b>Masataka Higashiwaki</b> , Department of Physics and Electronics, Osaka Metropolitan University, Japan; <b>T. Kamimura, S. Kumar, Z. Wang</b> , National Institute of Information and Communications Technology, Japan; <b>T. Kitada, J. Liang, N. Shigekawa</b> , Department of Physics and Electronics, Osaka Metropolitan University, Japan; <b>H. Murakami, Y. Kumagai</b> , Department of Applied Chemistry, Tokyo University of Agriculture and Technology, Japan	
9:00am		
9:15am		
9:30am	<b>INVITED: AC-MoM-5</b> Characterization of Deep Acceptors in $\beta$ -Ga <sub>2</sub> O <sub>3</sub> by Deep Level Optical Spectroscopy, <b>H. Ghadi, J. McGlone, E. Cornuelle</b> , The Ohio State University; <b>A. Senckowski</b> , University of Massachusetts Lowell; <b>S. Sharma, U. Singiseti</b> , University of Buffalo; <b>M. Wong</b> , University of Massachusetts Lowell; <b>A. Arehart, Steven A Ringel</b> , The Ohio State University	<b>Advanced Characterization Techniques</b> <b>Session AC-MoM</b> <b>Characterization &amp; Modeling I</b> <b>Moderator: Kornelius Tetzner, Ferdinand-Braun-Institut, Leibniz-Institut für Höchstfrequenztechnik (FBH), Germany</b>
9:45am		
10:00am	<b>AC-MoM-7</b> Determination of Cation Vacancy and Al Diffusion Constants in B-(Al,Ga) <sub>2</sub> O <sub>3</sub> / Ga <sub>2</sub> O <sub>3</sub> Superlattices, <b>H. Yang, A. Levin, B. Eisner, A. Bhattacharyya, P. Ranga, S. Krishnamoorthy, Michael Scarpulla</b> , University of Utah	
10:15am	<b>AC-MoM-8</b> Defect Characterization in Gallium Oxide and Related Materials Using Terahertz Electron Paramagnetic Resonance Ellipsometry: Fe in Ga <sub>2</sub> O <sub>3</sub> , <b>Mathias Schubert</b> , University of Nebraska, Lincoln; <b>S. Richter</b> , Lund University, Sweden; <b>S. Knight, P. Kuehne</b> , Linköping University, Sweden; <b>M. Stokey, R. Karlacki</b> , University of Nebraska-Lincoln; <b>V. Stanishev</b> , Linköping University, Sweden; <b>Z. Galazka, K. Irmscher</b> , Leibniz-Institut fuer Kristallzuechtung, Germany; <b>S. Mu, C. Van de Walle</b> , University of California at Santa Barbara; <b>V. Ivády</b> , MPI Physics of Complex Systems, Germany; <b>O. Bulancea-Lindvall, I. Abrikosov</b> , Linköping University, Sweden; <b>V. Darakchieva</b> , Lund University, Sweden	
10:30am	BREAK	
10:45am	<b>INVITED: BG-MoM-10</b> $\beta$ -Ga <sub>2</sub> O <sub>3</sub> Growth and Wafer Fabrication, <b>A. Brady, G. Foundos, Chase Scott</b> , Northrop Grumman SYNOPTICS; <b>V. Gambin</b> , Northrop Grumman Corporation; <b>K. Stevens</b> , Northrop Grumman SYNOPTICS; <b>J. Blevins</b> , Air Force Research Laboratory, Afghanistan	<b>Bulk Growth</b> <b>Session BG-MoM</b> <b>Bulk &amp; Epitaxy I</b> <b>Moderator: John Blevins, Air Force Research Laboratory</b>
11:00am		
11:15am	<b>BG-MoM-12</b> Increasing the Bandgap of $\beta$ -Ga <sub>2</sub> O <sub>3</sub> via Alloying with Al <sub>2</sub> O <sub>3</sub> or Sc <sub>2</sub> O <sub>3</sub> in Czochralski-grown Crystals, <b>Benjamin Dutton, J. Jesenovc, B. Downing, J. McCloy</b> , Washington State University	
11:30am	<b>BG-MoM-13</b> Chemi-Mechanical Polishing and Subsurface Damage Characterization of 2-inch (010) Semi-Insulating $\beta$ -Ga <sub>2</sub> O <sub>3</sub> Substrates, <b>David Snyder</b> , Penn State Applied Research Laboratory	
11:45am	<b>BG-MoM-14</b> Ge-Delta Doped $\beta$ -Ga <sub>2</sub> O <sub>3</sub> Grown Via Plasma Assisted Molecular Beam Epitaxy, <b>Thaddeus Asel</b> , Air Force Research Laboratory, Materials and Manufacturing Directorate, USA; <b>E. Steinbrunner</b> , Wright State University, Department of Electrical Engineering; <b>J. Hendrick</b> , Air Force Institute of Technology, Department of Engineering Physics; <b>A. Neal, S. Mou</b> , Air Force Research Laboratory, Materials and Manufacturing Directorate, USA	
12:00pm	<b>BG-MoM-15</b> High Purity n-type $\beta$ -Ga <sub>2</sub> O <sub>3</sub> Films with 10 <sup>13</sup> cm <sup>-3</sup> Residual Acceptor Concentration by MOCVD, <b>Andrei Osinsky, F. Alema</b> , Agnitrion Technology	

# Monday Afternoon, August 8, 2022

Room Jefferson 2-3	
1:45pm	<b>INVITED: MD-MoA-1</b> High Aspect Ratio Ga <sub>2</sub> O <sub>3</sub> -based Homo and H0eterostructures by Plasma-free Metal-assisted Chemical Etching, <i>Xiuling Li</i> , University of Texas at Austin; <i>H. Huang, C. Chan, J. Michaels</i> , University of Illinois, Urbana-Champaign
2:00pm	
2:15pm	<b>MD-MoA-3</b> Blocking Behavior of N and Fe Ion Implanted $\beta$ -Ga <sub>2</sub> O <sub>3</sub> , <i>Bennett Cromer</i> , Cornell University; <i>W. Li</i> , University of California at Berkeley; <i>K. Smith</i> , Cornell University; <i>K. Gann</i> , Cornell University, Iceland; <i>K. Nomoto</i> , Cornell University; <i>N. Hendriks</i> , University of California at Santa Barbara; <i>A. Green, K. Chabak</i> , Air Force Research Laboratory; <i>M. Thompson, D. Jena, G. Xing</i> , Cornell University
2:30pm	<b>MD-MoA-4</b> Evolution and Recovery of Ion Implantation-Induced Damage Zone in $\beta$ -Ga <sub>2</sub> O <sub>3</sub> , <i>Elaf Anber, D. Foley, J. Nathaniel</i> , Johns Hopkins University; <i>A. Lang</i> , American Society for Engineering Education; <i>J. Hart</i> , Johns Hopkins University; <i>M. Tadjer, K. Hobart</i> , US Naval Research Laboratory; <i>S. Pearton</i> , University of Florida, Gainesville; <i>M. Taheri</i> , Johns Hopkins University
2:45pm	<b>MD-MoA-5</b> Heterogeneous Integration of Single-Crystal $\beta$ -Ga <sub>2</sub> O <sub>3</sub> and N-Polar GaN Substrates With ZnO Interlayer Deposited by Atomic Layer Deposition, <i>Zhe (Ashley) Jian</i> , University of Michigan, Ann Arbor; <i>C. Clymore</i> , University of California, Santa Barbara; <i>D. Agapiou</i> , University of Michigan, Ann Arbor; <i>U. Mishra</i> , University of California, Santa Barbara; <i>E. Ahmadi</i> , University of Michigan, Ann Arbor
3:00pm	<b>MD-MoA-6</b> Structural Transformation of $\beta$ -Ga <sub>2</sub> O <sub>3</sub> through Si-implantation, <i>Snorre Braathen Kjeldby, A. Azarov, P. Nguyen</i> , Centre for Materials Science and Nanotechnology, University of Oslo, Norway; <i>V. Venkatachalapathy</i> , Centre for Materials Science and Nanotechnology, University of Oslo and Department of Materials Science, National Research Nuclear University, "MEPhI", Norway; <i>R. Mikšová</i> , Nuclear Physics Institute of the Czech Academy of Sciences, Czechia; <i>A. Macková</i> , Nuclear Physics Institute of the Czech Academy of Sciences and Department of Physics, Faculty of Science, J.E. Purkyně University, Czechia; <i>J. García-Fernández, A. Kuznetsov, Ø. Prytz, L. Vines</i> , Centre for Materials Science and Nanotechnology, University of Oslo, Norway
3:15pm	<b>MD-MoA-7</b> Electrical Characteristics of <i>in Situ</i> Mg-Doped Ga <sub>2</sub> O <sub>3</sub> Current-Blocking Layer for Vertical Devices, <i>Sudipto Saha</i> , University at Buffalo-SUNY; <i>L. Meng, A. Bhuiyan, Z. Feng, H. Zhao</i> , Ohio State University; <i>U. Singiseti</i> , University at Buffalo-SUNY
3:30pm	BREAK
3:45pm	<b>INVITED: TM-MoA-9</b> Transport, Doping, and Defects in $\beta$ -Ga <sub>2</sub> O <sub>3</sub> , <i>Adam Neal</i> , Air Force Research Laboratory, Materials and Manufacturing Directorate, USA
4:00pm	
4:15pm	<b>TM-MoA-11</b> Structural Changes to Beta Gallium Oxide from Ion Irradiation Damage: Model and Relation to in-Situ Experiments, <i>Alexander Petkov, D. Cherns, D. Liu</i> , University of Bristol, UK; <i>W. Chen, M. Li</i> , Argonne National Laboratory, USA; <i>J. Blevins</i> , Air Force Research Laboratory, USA; <i>V. Gambin</i> , Northrop Grumman; <i>M. Kuball</i> , University of Bristol, UK
4:30pm	<b>TM-MoA-12</b> Band Structure Across $\kappa$ -(In <sub>x</sub> Ga <sub>1-x</sub> ) <sub>2</sub> O <sub>3</sub> / $\kappa$ -(Al <sub>y</sub> Ga <sub>1-y</sub> ) <sub>2</sub> O <sub>3</sub> Thin Film Interfaces, <i>Ingvild Julie Thue Jensen, A. Thøgersen, E. Fertitta, B. Belle</i> , SINTEF Materials Physics, Norway; <i>A. Langørgen, S. Cooil, Y. Hommedal, Ø. Prytz, J. Wells, L. Vines</i> , University of Oslo, Norway; <i>H. von Wenckstern</i> , University of Leipzig, Germany
4:45pm	<b>TM-MoA-13</b> Aluminum Incorporation Striations in (-201) $\beta$ -(Al <sub>x</sub> Ga <sub>1-x</sub> ) <sub>2</sub> O <sub>3</sub> Films Grown on C-Plane and Miscut Sapphire Substrates, <i>Kenny Huynh, Y. Wang, M. Liao</i> , University of California Los Angeles; <i>P. Ranga</i> , University of Utah; <i>S. Krishnamoorthy</i> , University of California at Santa Barbara; <i>M. Goorsky</i> , University of California, Los Angeles
5:00pm	<b>TM-MoA-14</b> Plasmon-phonon Coupling in Electrostatically Gated $\beta$ -Ga <sub>2</sub> O <sub>3</sub> Films with Mobility Exceeding 200 cm <sup>2</sup> V <sup>-1</sup> s <sup>-1</sup> , <i>A. Rajapitamahuni, A. Manjeshwar</i> , University of Minnesota, USA; <i>A. Kumar, A. Datta</i> , University at Buffalo; <i>P. Ranga</i> , University of California Santa Barbara; <i>L. Thoutam</i> , SR University, Warangal, India; <i>S. Krishnamoorthy</i> , University of California Santa Barbara; <i>Uttam Singiseti</i> , University at Buffalo; <i>B. Jalan</i> , University of Minnesota, USA

**Material and Device Processing and Fabrication Techniques**  
**Session MD-MoA**  
**Process & Devices I**  
**Moderator: Man-Hoi Wong**, University of Massachusetts Lowell

**Theory, Modeling and Simulation**  
**Session TM-MoA**  
**Characterization & Modelling II**  
**Moderator: Mike Thompson**, Cornell University

## Advanced Characterization Techniques

### Room Jefferson 1 & Atrium - Session AC-MoP

#### Advanced Characterization Techniques Poster Session

5:15pm

**AC-MoP-1** Advanced Defect Characterization in  $\beta$ -Ga<sub>2</sub>O<sub>3</sub> Without the Arrhenius Plot, *J. Li*, NCKU, Taiwan; *Adam Neal*, *S. Mou*, Air Force Research Laboratory, Materials and Manufacturing Directorate, USA; *M. Wong*, University of Massachusetts Lowell

**AC-MoP-2** Infrared-Active Phonon Modes and Static Dielectric Constants of Orthorhombic LiGaO<sub>2</sub>, *Teresa Gramer*, *M. Stokey*, *R. Korlacki*, *M. Schubert*, University of Nebraska - Lincoln

**AC-MoP-3** Spectroscopic Ellipsometry Optical Analysis of Zinc Gallate at Elevated Temperatures, *Emma Williams*, University of Nebraska-Lincoln, USA; *M. Hilfiker*, *U. Kilic*, *Y. Traouli*, *N. Koeppe*, *J. Rivera*, *A. Abakar*, *M. Stokey*, *R. Korlacki*, University of Nebraska - Lincoln; *Z. Galazka*, Leibniz-Institut für Kristallzüchtung, Germany; *M. Schubert*, University of Nebraska - Lincoln

**AC-MoP-4** The Electron Spin Hamiltonian for Fe<sup>3+</sup> in Monoclinic  $\beta$ -Ga<sub>2</sub>O<sub>3</sub>, *S. Richter*, Lund University, Sweden; *S. Knight*, *P. Kühne*, Linköping University, Sweden; *Mathias Schubert*, University of Nebraska - Lincoln; *V. Darakchieva*, Lund University, Sweden

**AC-MoP-5** Characterization of (010)  $\beta$ -Ga<sub>2</sub>O<sub>3</sub> to Support Fabrication, Wafer Size Scaleup, and Epi Development, *David Snyder*, Penn State Applied Research Laboratory

**AC-MoP-6** Photoluminescence Spectroscopy of Cr<sup>3+</sup> in  $\beta$ -Ga<sub>2</sub>O<sub>3</sub> and (Al<sub>0.1</sub>Ga<sub>0.9</sub>)<sub>2</sub>O<sub>3</sub>, *Cassandra Remple*, *J. Jesenovc*, *B. Dutton*, *J. McCloy*, *M. McCluskey*, Washington State University

**AC-MoP-7** Surface Relaxation and Rumpling of Sn Doped  $\beta$ -Ga<sub>2</sub>O<sub>3</sub>(010), *Nick Barrett*, CEA Saclay, France; *A. Pancotti*, Universidade Federal de Jataí, Brazil; *T. Back*, AFRL; *W. Hamouda*, *M. Laccheb*, *C. Lubin*, *A. Boucly*, CEA Saclay, France; *P. Soukiasian*, Université Paris-Saclay, France; *J. Boeckl*, *D. Dorsey*, *S. Mou*, *T. Asel*, AFRL; *G. Geneste*, CEA, France

**AC-MoP-8** Probing Vacancies and Hydrogen Related Defects in  $\beta$ -Ga<sub>2</sub>O<sub>3</sub> with Positrons and FTIR, *Corey Halverson*, *M. Weber*, *J. Jesenovc*, *B. Dutton*, *C. Remple*, *M. McCluskey*, *J. McCloy*, Washington State University

**AC-MoP-9** Evolution of Anisotropy and Order of Band-to-Band Transitions, Excitons, Phonons, Static and High Frequency Dielectric Constants Including Strain Dependencies in Alpha and Beta Phase (Al<sub>x</sub>Ga<sub>1-x</sub>)<sub>2</sub>O<sub>3</sub>, *Megan Stokey*, University of Nebraska-Lincoln; *R. Korlacki*, *M. Hilfiker*, *T. Gramer*, University of Nebraska - Lincoln; *J. Knudtson*, University of Nebraska-Lincoln; *S. Richter*, Lund University, Sweden; *S. Knight*, Linköping University, Sweden; *A. Mock*, Weber State University; *A. Mauze*, *Y. Zhang*, *J. Speck*, University of California Santa Barbara; *R. Jinno*, *Y. Cho*, *H. Xing*, *D. Jena*, Cornell University; *Y. Oshima*, National Institute for Materials Science, Japan; *E. Ahmadi*, University of Michigan; *V. Darakchieva*, Lund University, Sweden; *M. Schubert*, University of Nebraska - Lincoln

**AC-MoP-10** Photoluminescence Mapping of Gallium Oxide and Aluminum Gallium Oxide Epitaxial Films, *Jacqueline Cooke*, *P. Ranga*, University of Utah; *J. Jesenovc*, *J. McCloy*, Washington State University; *S. Krishnamoorthy*, University of California at Santa Barbara; *M. Scarpulla*, *B. Sensale-Rodriguez*, University of Utah

**AC-MoP-12** Non-Destructive Characterization of Annealed Si-Implanted Thin Film  $\beta$ -Ga<sub>2</sub>O<sub>3</sub>, *Aine Connolly*, *K. Gann*, Cornell University; *S. Tetlak*, Air Force Research Laboratory; *V. Protasenko*, Cornell University; *M. Slocum*, *S. Mou*, Air Force Research Laboratory; *M. Thompson*, Cornell University

## Dielectric Interfaces

### Room Jefferson 1 & Atrium - Session DI-MoP

#### Dielectric Interfaces Poster Session

5:15pm

**DI-MoP-1** Band Offsets of MOCVD Grown  $\beta$ -(Al<sub>0.21</sub>Ga<sub>0.79</sub>)<sub>2</sub>O<sub>3</sub>/ $\beta$ -Ga<sub>2</sub>O<sub>3</sub> (010) Heterojunctions, *T. Morgan*, *J. Rudie*, *M. Zamani-Alavijeh*, *A. Kuchuk*, University of Arkansas; *N. Orishchin*, *F. Alema*, Agnitron Technology Incorporated; *A. Osinsky*, Agnitron Technology Incorporated, United States Minor Outlying Islands (the); *R. Sleezer*, Minnesota State University at Mankato; *G. Salamo*, University of Arkansas, United States Minor Outlying Islands (the); *Morgan Ware*, University of Arkansas

**DI-MoP-2** Optimization of MOCVD Grown In-situ Dielectrics for  $\beta$ -Ga<sub>2</sub>O<sub>3</sub>, *G. Wang*, University of Wisconsin - Madison; *F. Alema*, Agnitron Technology Inc.; *J. Chen*, University of Wisconsin - Madison; *A. Osinsky*, Agnitron Technology Inc.; *C. Gupta*, University of Wisconsin-Madison; *Shubhra Pasayat*, University of Wisconsin - Madison

## Electronic and Photonic Devices, Circuits and Applications

### Room Jefferson 1 & Atrium - Session EP-MoP

#### Electronic and Photonic Devices, Circuits and Applications

#### Poster Session

5:15pm

**EP-MoP-2** Gate Effects of Channel and Sheet Resistance in  $\beta$ -Ga<sub>2</sub>O<sub>3</sub> Field-Effect Transistors using the TLM Method, *Ory Maimon*, Department of Electrical Engineering, George Mason University; *N. Moser*, Air Force Research Laboratory, Sensors Directorate; *K. Liddy*, *A. Green*, *K. Chabak*, Air Force Research Laboratory, Sensors Directorate, USA; *C. Richter*, *K. Cheung*, *S. Pookpanratana*, Nanoscale Device and Characterization Division, National Institute of Standards and Technology; *Q. Li*, Department of Electrical Engineering, George Mason University

**EP-MoP-3** Lateral  $\beta$ -Ga<sub>2</sub>O<sub>3</sub> Schottky Barrier Diodes With Interdigitated Contacts, *Jeremiah Williams*, Air Force Research Laboratory, Sensors Directorate; *A. Arias-Purdue*, Teledyne; *K. Liddy*, *A. Green*, Air Force Research Laboratory, Sensors Directorate; *D. Dryden*, *N. Sepelak*, KBR; *K. Singh*, Air Force Research Laboratory, Sensors Directorate; *F. Alema*, *A. Osinsky*, Agnitron Technology; *A. Islam*, *N. Moser*, *K. Chabak*, Air Force Research Laboratory, Sensors Directorate

**EP-MoP-4** Optimized Annealing for Activation of Implanted Si in  $\beta$ -Ga<sub>2</sub>O<sub>3</sub>, *Katie Gann*, *J. McCandless*, Cornell University; *T. Asel*, *S. Tetlak*, Air Force Research Laboratory; *D. Jena*, *M. Thompson*, Cornell University

## Electronic Transport and Breakdown Phenomena

### Room Jefferson 1 & Atrium - Session ET-MoP

#### Electronic Transport and Breakdown Phenomena Poster

#### Session

5:15pm

**ET-MoP-2** Electric Field Mapping in  $\beta$ -Ga<sub>2</sub>O<sub>3</sub> by Photocurrent Spectroscopy, *Darpan Verma*, *M. Adnan*, *S. Dhara*, Ohio State University; *C. Sturm*, Universität Leipzig, Germany; *S. Rajan*, *R. Myers*, Ohio State University

**ET-MoP-3** Activation of Si, Ge, and Sn Donors in High-Resistivity Halide Vapor Phase Epitaxial  $\beta$ -Ga<sub>2</sub>O<sub>3</sub>:N, *Joseph Spencer*, Naval Research Laboratory/Virginia Tech CPES; *M. Tadjer*, *A. Jacobs*, *M. Mastro*, *J. Gallagher*, *J. Freitas, Jr*, Naval Research Laboratory; *T. Tu*, *A. Kuramata*, *K. Sasaki*, Novel Crystal, Japan; *Y. Zhang*, Virginia Tech (CPES); *T. Anderson*, *K. Hobart*, Naval Research Laboratory

## Heterogeneous Material Integration

### Room Jefferson 1 & Atrium - Session HM-MoP

#### Heterogeneous Material Integration Poster Session

5:15pm

**HM-MoP-1** Structural and Thermal Transport Analysis of Wafer Bonded  $\beta$ -Ga<sub>2</sub>O<sub>3</sub> |4H-SiC, *Michael Liao*, *K. Huynh*, *Y. Wang*, UCLA; *Z. Cheng*, UIUC; *J. Shi*, GaTech; *F. Mu*, IMECAS, China; *T. You*, *W. Xu*, *X. Ou*, ShanghaiTech, China; *T. Suga*, Meisei University, Japan; *S. Graham*, GaTech; *M. Goorsky*, UCLA

**HM-MoP-2** Advances in Plasma-Enhanced Atomic Layer Deposited (PEALD) Ga<sub>2</sub>O<sub>3</sub> Films, *Virginia Wheeler*, *A. Lang*, *N. Nepal*, *E. Jin*, *D. Katzer*, *V. Gokhale*, *B. Downey*, *D. Meyer*, US Naval Research Laboratory

**HM-MoP-3** Grafted Si/Ga<sub>2</sub>O<sub>3</sub> pn Diodes, *H. Jang*, *D. Kim*, University of Wisconsin - Madison; *J. Gong*, University of Wisconsin at Madison; *F. Alema*, *A. Osinsky*, Agnitron Technology Inc.; *K. Chabak*, Air Force Research Laboratory; *G. Jessen*, BAE Systems; *G. Vincent*, Northrup Grumman; *S. Pasayat*, *C. Gupta*, University of Wisconsin - Madison; *Zhenqiang Ma*, 1415 Engineering Drive

# Tuesday Morning, August 9, 2022

Room Jefferson 2-3		
8:30am		<b>Plenary Session</b> <b>Session PS1-TuM</b> <b>Plenary Session I</b> <b>Moderator: Dr. Kelson Chabak</b> , Air Force Research Laboratory
8:45am	<b>INVITED: PS1-TuM-2</b> Plenary Lecture: Gallium Oxide Electronics - Device Engineering Toward Ultimate Material Limits, <i>Siddharth Rajan</i> , The Ohio State University	
9:00am		
9:15am	<b>INVITED: TM-TuM-4</b> First-Principles Modeling of Ga <sub>2</sub> O <sub>3</sub> , <i>Hartwin Peelaers</i> , University of Kansas	<b>Theory, Modeling and Simulation</b> <b>Session TM-TuM</b> <b>Characterization &amp; Modelling III</b> <b>Moderator: Michael Scarpulla</b> , University of Utah
9:30am		
9:45am	<b>TM-TuM-6</b> Theory of Acceptor-Donor Complexes in Ga <sub>2</sub> O <sub>3</sub> , <i>I. Chatratin, F. Sabino</i> , University of Delaware; <i>P. Reunchan</i> , Kasetsart University, Thailand; <i>Anderson Janotti</i> , University of Delaware	
10:00am	<b>TM-TuM-7</b> Donor Doping of Monoclinic and Corundum (Al <sub>x</sub> Ga <sub>1-x</sub> ) <sub>2</sub> O <sub>3</sub> , <i>Darshana Wickramaratne</i> , US Naval Research Laboratory; <i>J. Varley</i> , Lawrence Livermore National Laboratory; <i>J. Lyons</i> , US Naval Research Laboratory	
10:15am	<b>TM-TuM-8</b> The Co-Design, Fabrication, and Characterization of a Ga <sub>2</sub> O <sub>3</sub> -on-SiC MOSFET, <i>Yiwen Song</i> , Pennsylvania State University; <i>A. Bhattacharyya</i> , University of Utah; <i>A. Karim, D. Shoemaker</i> , Pennsylvania State University; <i>H. Huang</i> , Ohio State University; <i>C. McGray</i> , Modern Microsystems, Inc.; <i>J. Leach</i> , Kyma Technologies, Inc.; <i>J. Hwang</i> , Ohio State University; <i>S. Krishnamoorthy</i> , University of California at Santa Barbara; <i>S. Choi</i> , Pennsylvania State University	
10:30am	BREAK	
10:45am	<b>INVITED: AC-TuM-10</b> Defects in Gallium Oxide – How We “See” and Understand Them, <i>Jinwoo Hwang</i> , The Ohio State University	
11:00am		<b>Advanced Characterization Techniques</b> <b>Session AC-TuM</b> <b>Advanced Characterization &amp; Microscopy</b> <b>Moderator: Ginger Wheeler</b> , Naval Research Laboratory
11:15am	<b>AC-TuM-12</b> Atomic-Scale Investigation of Point and Extended Defects in Ion Implanted β-Ga <sub>2</sub> O <sub>3</sub> , <i>Hsien-Lien Huang, C. Chae</i> , The Ohio State University; <i>A. Senckowski, M. Wong</i> , Penn State University; <i>J. Hwang</i> , The Ohio State University	
11:30am	<b>AC-TuM-13</b> Microscopic and Spectroscopic Analysis of (100), (-201) and (010) (Al <sub>x</sub> Ga <sub>1-x</sub> ) <sub>2</sub> O <sub>3</sub> Films Using Atom Probe Tomography, <i>J. Sarker</i> , University at Buffalo-SUNY; <i>A. Bhuiyan, Z. Feng, L. Meng, H. Zhao</i> , The Ohio State University; <i>Baishakhi Mazumder</i> , University at Buffalo-SUNY	
11:45am	<b>AC-TuM-14</b> Phase and Microstructure Evolution of κ-Ga <sub>2</sub> O <sub>3</sub> Thin Films Grown by MOCVD, <i>Jingyu Tang, K. Jiang</i> , Carnegie Mellon University, China; <i>M. Cabral, A. Park</i> , Carnegie Mellon University; <i>L. Gu</i> , Carnegie Mellon University, China; <i>R. Davis, L. Porter</i> , Carnegie Mellon University	
12:00pm	<b>AC-TuM-15</b> Investigation of Extended Defects in Ga <sub>2</sub> O <sub>3</sub> Substrates and Epitaxial Layers using X-ray Topography, <i>Nadeemullah A. Mahadik, M. Tadjer, T. Anderson, K. Hobart</i> , Naval Research Laboratory, USA; <i>K. Sasaki, A. Kuramata</i> , Novel Crystal Technology, Japan	

# Tuesday Afternoon, August 9, 2022

<b>Room Jefferson 2-3</b>	
1:45pm	<b>INVITED: EG-TuA-1</b> Progress in Beta-Gallium Oxide Materials and Properties, <i>James Speck</i> , University of California Santa Barbara
2:00pm	
2:15pm	<b>EG-TuA-3 (110)</b> $\beta$ -Ga <sub>2</sub> O <sub>3</sub> Epitaxial Films Grown by Plasma-Assisted Molecular Beam Epitaxy, <i>Takeki Itoh, A. Mauze, Y. Zhang, J. Speck</i> , University of California at Santa Barbara
2:30pm	<b>EG-TuA-4</b> Si-doped $\beta$ -Ga <sub>2</sub> O <sub>3</sub> Films Grown at 1 $\mu$ m/hr by Suboxide MBE, <i>Kathy Azizie, P. Vogt, F. Hensling, D. Schlom, J. McCandless, H. Xing, D. Jena</i> , Cornell University; <i>D. Dryden, A. Neal, S. Mou, T. Asef, A. Islam, A. Green, K. Chabak</i> , Air Force Research Laboratory
2:45pm	<b>INVITED: EG-TuA-5</b> MOCVD Growth of 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> , <i>Hongping Zhao</i> , The Ohio State University
3:00pm	
3:15pm	
3:30pm	BREAK
3:45pm	<b>DI-TuA-9</b> Dielectric Integration on (010) $\beta$ -Ga <sub>2</sub> O <sub>3</sub> : Al <sub>2</sub> O <sub>3</sub> , SiO <sub>2</sub> Interfaces and their Thermal Stability, <i>Ahmad Islam</i> , Air Force Research Laboratory; <i>A. Miesle</i> , University of Dayton; <i>M. Dietz</i> , Wright State University; <i>K. Leedy, S. Ganguli</i> , Air Force Research Laboratory; <i>G. Subramanyam</i> , University of Dayton; <i>W. Wang</i> , Wright State University; <i>N. Sepelak, D. Dryden</i> , KBR, Inc.; <i>T. Asef, A. Neal, S. Mou, S. Tetlak, K. Liddy, A. Green, K. Chabak</i> , Air Force Research Laboratory
4:00pm	<b>DI-TuA-10</b> Deep Etch Field-Terminated $\beta$ -Ga <sub>2</sub> O <sub>3</sub> Schottky Barrier Diodes With 4.2 MV/cm Parallel Plate Field Strength, <i>Sushovan Dhara, N. Kalarickala, A. Dheenan, C. Jaishi, S. Rajan</i> , The Ohio State University
4:15pm	<b>DI-TuA-11</b> Demonstration of Low Thermal Resistance in Ga <sub>2</sub> O <sub>3</sub> Schottky Diodes by Junction-Side-Cooled Packaging, <i>Boyan Wang, M. Xiao, J. Knall, Y. Qin</i> , Virginia Polytechnic Institute and State University; <i>J. Spencer, M. Tadjer</i> , U.S. Naval Research Laboratory; <i>C. Buttay</i> , Univ Lyon, CNRS, INSA Lyon, Université Claude Bernard Lyon 1, Ecole Centrale de Lyon, Ampère, France; <i>K. Sasaki</i> , Novel Crystal Technology, Japan; <i>G. Lu, C. DiMarino, Y. Zhang</i> , Virginia Polytechnic Institute and State University
4:30pm	<b>DI-TuA-12</b> High Temperature In-situ MOCVD-grown Al <sub>2</sub> O <sub>3</sub> Dielectric on (010) $\beta$ -Ga <sub>2</sub> O <sub>3</sub> with 10 MV/cm Breakdown Field, <i>Saurav Roy</i> , University of California Santa Barbara; <i>A. Bhattacharyya</i> , University of Utah; <i>C. Peterson, S. Krishnamoorthy</i> , University of California Santa Barbara
4:45pm	<b>DI-TuA-13</b> Metal Oxide (PtOX) Schottky Contact with High-k Dielectric Field Plate for Improved Field Management in Vertical $\beta$ -Ga <sub>2</sub> O <sub>3</sub> Devices, <i>Esmat Farzana</i> , University of California Santa Barbara; <i>A. Bhattacharyya</i> , The University of Utah; <i>T. Itoh, S. Krishnamoorthy, J. Speck</i> , University of California Santa Barbara
5:00pm	<b>DI-TuA-14</b> Field Plated $\beta$ -Ga <sub>2</sub> O <sub>3</sub> Mis Diodes with High-k TiO <sub>2</sub> Interlayer for Increased Breakdown and Reduced Leakage Current, <i>Nolan Hendricks</i> , Air Force Research Laboratory; UC Santa Barbara; <i>A. Green, A. Islam, K. Leedy, K. Liddy, J. Williams</i> , Air Force Research Lab; <i>E. Farzana, J. Speck</i> , UC Santa Barbara; <i>K. Chabak</i> , Air Force Research Lab

**Epitaxial Growth  
Session EG-TuA  
Bulk & Epitaxy II  
Moderator: Xiuling Li, University of Texas Austin**

**Dielectric Interfaces  
Session DI-TuA  
Processes & Devices II  
Moderator: Hongping Zhao, Ohio State University**

## Epitaxial Growth

### Room Jefferson 1 & Atrium - Session EG-TuP

#### Epitaxial Growth Poster Session

5:15pm

**EG-TuP-1**  $\alpha$ -phase Gallium Oxide Thin Films Stabilized on a-, r- and m-plane Sapphire Substrates via Reactive Magnetron Sputtering and Pulsed Laser Deposition, *Edgars Butanovs*, Institute of Solid State Physics University of Latvia

**EG-TuP-2** Epitaxial Growth of  $(Al_xGa_{1-x})_2O_3$  by Suboxide MBE, *Jacob Steele, K. Azizie, J. McCandless*, Cornell University; *T. Asef*, Air Force Research Lab; *H. Xing, D. Jena, D. Schlom*, Cornell University

**EG-TuP-5** Free Carrier Control in Homoepitaxial  $\beta$ -Ga<sub>2</sub>O<sub>3</sub> Thin Films by Tin Impurity Doping, *Neeraj Nepal, B. Downey, V. Wheeler, D. Katzer, E. Jin, M. Hardy, V. Gokhale, T. Growden*, US Naval Research Laboratory; *K. Chabak*, Air Force Research Laboratory; *D. Meyer*, US Naval Research Laboratory

**EG-TuP-6** MBE Growth of Doped and Insulating Homoepitaxial  $\beta$ -Ga<sub>2</sub>O<sub>3</sub>, *Jon McCandless, V. Protasenko, B. Morell*, Cornell University; *E. Steinbrunner, A. Neal*, Air Force Research Laboratory, Materials and Manufacturing Directorate, USA; *Y. Cho, N. Tanen, H. Xing, D. Jena*, Cornell University

**EG-TuP-7** High Conductivity Homoepitaxial  $\beta$ -Ga<sub>2</sub>O<sub>3</sub> Regrowth Layers by Pulsed Laser Deposition, *Hyung Min Jeon*, KBR; *K. Leedy*, Air Force Research Laboratory

**EG-TuP-9** Highly conductive  $\beta$ -Ga<sub>2</sub>O<sub>3</sub> and  $(Al_xGa_{1-x})_2O_3$  epitaxial films by MOCVD, *Fikadu Alema*, Agnitron Technology; *T. Itoh, J. Speck*, Materials Department, University of California, Santa Barbara; *A. Osinsky*, Agnitron Technology

## Material and Device Processing and Fabrication Techniques

### Room Jefferson 1 & Atrium - Session MD-TuP

#### Material and Device Processing and Fabrication Techniques

#### Poster Session

5:15pm

**MD-TuP-1** Record Low Specific Resistance Ohmic Contacts to Highly Doped MOVPE-Grown  $\beta$ -Ga<sub>2</sub>O<sub>3</sub> and  $\beta$ - $(Al_xGa_{1-x})_2O_3$  Epitaxial Films, *Carl Peterson*, University of California Santa Barbara; *F. Alema*, Agnitron Technology; *S. Roy*, University of California Santa Barbara; *A. Bhattacharyya*, University of Utah; *A. Osinsky*, Agnitron Technology; *S. Krishnamoorthy*, University of California Santa Barbara

**MD-TuP-3** MOCVD  $\beta$ -Ga<sub>2</sub>O<sub>3</sub> Gate-recessed MESFET, *Hannah Masten, J. Lundh, J. Spencer*, US Naval Research Laboratory; *F. Alema, A. Osinsky*, Agnitron Technology; *A. Jacobs, K. Hobart, M. Tadjer*, US Naval Research Laboratory

**MD-TuP-4** Subsurface Damage Analysis of Chemical Mechanical Polished (010)  $\beta$ -Ga<sub>2</sub>O<sub>3</sub> Substrates, *Michael Liao, K. Huynh, L. Matto, D. Luccioni, M. Goorsky*, UCLA

**MD-TuP-5** Diffusion of Zn in  $\beta$ -Ga<sub>2</sub>O<sub>3</sub>, *Ylva Knausgård Hommedal, Y. Frodason, L. Vines, K. Johansen*, Centre for Materials Science and Nanotechnology/Dep. of Physics, University of Oslo, Norway

**MD-TuP-6** Initial Nucleation of Metastable  $\gamma$ -Ga<sub>2</sub>O<sub>3</sub> During sub-Millisecond Thermal Anneals of Amorphous Ga<sub>2</sub>O<sub>3</sub>, *Katie Gann, C. Chang, M. Chang, D. Sutherland, A. Connolly, D. Muller, R. van Dover, M. Thompson*, Cornell University

**MD-TuP-7** Heavily Doped  $\beta$ -Ga<sub>2</sub>O<sub>3</sub> Deposited by Magnetron Sputtering, *Adetayo Adedeji*, Elizabeth City State University; *J. Lawson, C. Ebbing*, University of Dayton Research Institute; *J. Merrett*, Air Force Research Laboratory

**MD-TuP-8** Point Defect Distributions in Ultrafast Laser Induced Periodic Surface Structures on  $\beta$ -Ga<sub>2</sub>O<sub>3</sub>, *D. Ramdin, E. DeAngelis, M. Noor, M. Haseman, E. Chowdhury, Leonard Brillson*, Ohio State University

## Theory, Modeling and Simulation

### Room Jefferson 1 & Atrium - Session TM-TuP

#### Theory, Modeling and Simulation Poster Session

5:15pm

**TM-TuP-1** Simulation Study of Single Event Effects in Ga<sub>2</sub>O<sub>3</sub> Schottky Diodes, *Animesh Datta, U. Singiseti*, University at Buffalo

**TM-TuP-2** Anisotropic Photoresponsivity and Deviation from Beer-Lambert Law in Beta Gallium Oxide, *Md Mohsinur Rahman Adnan, D. Verma, S. Dhara*, The Ohio State University; *C. Sturm*, Universitat Leipzig, Germany; *S. Rajan, R. Myers*, The Ohio State University

**TM-TuP-4** Self-Trapped Holes and Polaronic Acceptors in Ultrawide Bandgap Oxides, *John Lyons*, US Naval Research Laboratory

**TM-TuP-5** Modeling for a High-Temperature Ultra-Wide Bandgap Gallium Oxide Power Module, *Benjamin Albano*, Virginia Tech Center for Power Electronics Systems; *B. Wang, C. DiMarino, Y. Zhang*, Virginia Tech Center for Power Electronics

**TM-TuP-6** Atomic Surface Structure of Sn doped  $\beta$ -Ga<sub>2</sub>O<sub>3</sub>(010) Studied by Low-energy Electron Diffraction, *Alexandre Pancotti*, Universidade Federal de Jataí, Brazil; *J. T. Sadowski*, Center for Functional Nanomaterials, Brookhaven National Laboratory; *A. Sandre Kilian*, Universidade Federal de Jataí, Brazil; *D. Duarte dos Reis*, Universidade Federal do Mato Grosso do Sul, Brazil; *C. Lubin*, SPEC, CEA, CNRS, Université Paris-Saclay, CEA Saclay, France; *A. Boucly*, SPEC, CEA, CNRS, Université Paris-Saclay, France; *P. Soukiasian*, SPEC, CEA, CNRS, Université Paris-Saclay, CEA Saclay, France; *J. Boeckl, D. Dorsey*, Air Force Research Laboratory; *M. Shin, T. ASEL*, Air Force Research Lab; *J. Brown, N. Barrett*, SPEC, CEA, CNRS, Université Paris-Saclay, CEA Saclay, France; *T. Back*, SPEC, CEA, CNRS, Université Paris-Saclay, CEA Saclay

# Wednesday Morning, August 10, 2022

Room Jefferson 2-3		
8:30am		<b>Plenary Session</b> <b>Session PS2-WeM</b> <b>Plenary Session II</b> <b>Moderator: Dr. Kelson Chabak</b> , Air Force Research Laboratory
8:45am	<b>INVITED: PS2-WeM-2</b> Plenary Lecture: Fundamental Limits of Ga <sub>2</sub> O <sub>3</sub> Power Devices and How to Get There, <b>Huili Grace Xing</b> , Cornell University	
9:00am		
9:15am	<b>EP1-WeM-4</b> Remarkable Improvement of Conductivity in B-Ga <sub>2</sub> O <sub>3</sub> by High-Temperature Si Ion Implantation, <b>Arka Sardar</b> , T. Isaacs-Smith, S. Dhar, Auburn University; J. Lawson, N. Merrett, Air Force Research Laboratory, USA	<b>Electronic and Photonic Devices, Circuits and Applications</b> <b>Session EP1-WeM</b> <b>Process &amp; Devices III</b> <b>Moderator: Uttam Singiseti</b> , University of Buffalo, SUNY
9:30am	<b>INVITED: EP1-WeM-5</b> Towards Lateral and Vertical Ga <sub>2</sub> O <sub>3</sub> Transistors for High Voltage Power Switching, <b>Kornelius Tetzner</b> , J. Würfl, E. Bahat-Treidel, O. Hilt, Ferdinand-Braun-Institut, Leibniz-Institut für Höchstfrequenztechnik (FBH), Germany; Z. Galazka, S. Bin Anooz, A. Popp, Leibniz-Institut für Kristallzüchtung (IKZ), Germany	
9:45am		
10:00am	<b>EP1-WeM-7</b> Comparison of β-Ga <sub>2</sub> O <sub>3</sub> Mosfets With TiW and NiAu Metal Gates for High-Temperature Operation, <b>Nicholas Sepelak</b> , KBR, Wright State University; D. Dryden, KBR; R. Kahler, University of Texas at Dallas; J. William, Air Force Research Lab, Sensors Directorate; T. Asef, Air Force Research Laboratory, Materials and Manufacturing Directorate; H. Lee, University of Illinois at Urbana-Champaign; K. Gann, Cornell University; A. Popp, Leibniz-Institut für Kristallzüchtung, Germany; K. Liddy, Air Force Research Lab, Sensors Directorate; K. Leedy, Air Force Research Laboratory, Sensors Directorate; W. Wang, Wright State University; W. Zhu, University of Illinois at Urbana-Champaign; M. Thompson, Cornell University; S. Mou, Air Force Research Laboratory, Materials and Manufacturing Directorate, USA; K. Chabak, A. Green, Air Force Research Laboratory, Sensors Directorate; A. Islam, Air Force Research Laboratory, Sensors Directorate	
10:15am	<b>EP1-WeM-8</b> High Electron Mobility Si-doped β-Ga <sub>2</sub> O <sub>3</sub> MESFETs, <b>Arkka Bhattacharyya</b> , University of Utah; S. Roy, University of California at Santa Barbara; P. Ranga, University of Utah; S. Krishnamoorthy, University of California at Santa Barbara	
10:30am	BREAK	
10:45am	<b>EP2-WeM-10</b> β-Ga <sub>2</sub> O <sub>3</sub> Lateral FinFETs Formed by Atomic Ga Flux Etching, <b>Ashok Dheenan</b> , N. Kalarickal, Z. Feng, L. Meng, The Ohio State University; A. Fiedler, IKZ Berlin, Germany; C. Joishi, A. Price, J. McGlone, S. Dhara, S. Ringel, H. Zhao, S. Rajan, The Ohio State University	<b>Electronic and Photonic Devices, Circuits and Applications</b> <b>Session EP2-WeM</b> <b>Process and Devices IV</b> <b>Moderator: Christina DiMarino</b> , Virginia Tech
11:00am	<b>EP2-WeM-11</b> Insights Into the Behaviour of Leakage Current in Lateral Ga <sub>2</sub> O <sub>3</sub> Transistors on Semi-Insulating Substrates, Z. Chen, A. Mishra, M. Smith, T. Moule, University of Bristol, UK; M. Uren, University of Bristol, UK; S. Kumar, <b>Masataka Higashiwaki</b> , National Institute of Information and Communications Technology, Japan; M. Kuball, University of Bristol, UK	
11:15am	<b>EP2-WeM-12</b> Device Figure of Merit Performance of Scaled Gamma-Gate β-Ga <sub>2</sub> O <sub>3</sub> MOSFETs, <b>Kyle Liddy</b> , A. Islam, J. Williams, D. Walker, N. Moser, D. Dryden, N. Sepelak, K. Chabak, A. Green, AFRL	
11:30am	<b>EP2-WeM-13</b> Electromigration of Native Point Defects and Breakdown in Ga <sub>2</sub> O <sub>3</sub> Vertical Devices, M. Haseaman, D. Ramdin, Ohio State University; W. Li, K. Nomoto, D. Jena, G. Xing, Cornell University; <b>Leonard Brillson</b> , Ohio State University	

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