

# MONDAY PRESENTATIONS

\* Invited Paper

## SESSION PL01: Plenary Session I

Session Chairs: Stacia Keller and Christian Wetzel  
Monday Morning, July 8, 2019  
Evergreen Ballroom E-I, Lobby Level

8:45 AM

**Welcome / Opening Ceremony by W. Alan Doolittle, Georgia Institute of Technology**

9:00 AM \*PL01.01

**Developments of Nonpolar/Semipolar Edge Emitting Laser Diodes and VCSELS** Shuji Nakamura; University of California Santa Barbara, United States.

9:45 AM \*PL01.02

**Development of Vertical GaN Power Devices** Jun Suda; Nagoya University, Japan.

10:30 AM BREAK

11:00 AM \*PL01.03

**Efficiency of Nitride LEDs—Impact of Point and Extended Defects** Nicolas Grandjean; École Polytechnique Fédérale de Lausanne (EPFL), Switzerland.

11:45 AM \*PL01.04

**Emerging Applications of III-Nitride Nanocrystals** Zetian Mi; University of Michigan, United States.

## SESSION A01: UVC LEDs

Session Chairs: Akira Hirano and Leo Schowalter  
Monday Afternoon, July 8, 2019  
Evergreen Ballroom E-F, Lobby Level

2:00 PM \*A01.01

**LEE Enhancement in AlGaIn UVC LED Using Photonic Crystal Reflector** Hideki Hirayama<sup>1</sup>, Yukio Kashima<sup>1,2</sup>, Yasuhiro Watanabe<sup>3</sup>, Tomohiko Shibata<sup>3</sup>, Noritoshi Maeda<sup>4</sup>, Masafumi Jo<sup>1</sup>, Eriko Matsuura<sup>1,2</sup>, Takeshi Iwai<sup>4</sup>, Mitsunori Kokubo<sup>5</sup>, Takaharu Tashiro<sup>5</sup>, Kanji Furuta<sup>6</sup>, Ryuichi Kurashima<sup>7</sup>, Yamato Osada<sup>6</sup>, Hideki Takagi<sup>7</sup>, Yuuichi Kurashima<sup>7</sup>, Yasushi Iwaisako<sup>8</sup> and Tugumu Nagano<sup>9</sup>; <sup>1</sup>RIKEN, Japan; <sup>2</sup>Marubun Co.Ltd., Japan; <sup>3</sup>DOWA Electronics Co. Ltd., Japan; <sup>4</sup>Tokyo Ohka Kogyo Co. Ltd, Japan; <sup>5</sup>Toshiba Machine Co. Ltd., Japan; <sup>6</sup>ULVAC Inc., Japan; <sup>7</sup>AIST, Japan; <sup>8</sup>Nippon Tungsten Co. Ltd, Japan; <sup>9</sup>Dai Nippon Printing Co. Ltd., Japan.

2:30 PM A01.02

**High Performance UVC LEDs Below 240 nm Fabricated with Pseudomorphic AlGaIn/AlN Technology** Leo Schowalter<sup>1,2</sup>, Akira Yoshikawa<sup>2</sup>, Satoshi Yamada<sup>1,2</sup>, Jonathan Mann<sup>1</sup>, Shyam Bharadwaj<sup>3</sup>, Josh Lederman<sup>3</sup>, Ryosuke Hasegawa<sup>2</sup>, Yuta Honma<sup>2</sup>, Tomohiro Morishita<sup>2</sup>, James Grandusky<sup>1</sup>, Amy Miller<sup>1</sup>, Kazuhiro Nagase<sup>2</sup>, Debdeep Jena<sup>3</sup> and Grace Xing<sup>3</sup>; <sup>1</sup>Crystal IS, United States; <sup>2</sup>Asahi Kasei, Japan; <sup>3</sup>Cornell University, United States.

2:45 PM A01.03

**Fully Transparent AlGaIn-Based UVC LEDs with MOVPE-Grown Tunnel Junctions** Luca Sulmoni<sup>1</sup>, Christian Kuhn<sup>1</sup>, Martin Guttman<sup>1</sup>, Johannes Glaab<sup>2</sup>, Frank Mehnke<sup>1</sup>, Norman Susilo<sup>1</sup>, Tim Wernicke<sup>1</sup>, Markus Weyers<sup>2</sup> and Michael Kneissl<sup>1,2</sup>; <sup>1</sup>Technische Universität Berlin, Germany; <sup>2</sup>Leibniz-Institut für Höchstfrequenztechnik, Germany.

3:00 PM A01.04

**Analysis and Control of Mg Diffusion Effect in III-Nitride UV Light-Emitting Devices** Theeradetch Detchprohm, Chuan-Wei Tsou, Hoon Jeong, Young Jae Park, Karan Mehta, Ping Chen, Doug Yoder, Shyh-Chiang Shen and Russell Dupuis; Georgia Institute of Technology, Georgia.

3:15 PM A01.05

**Impact of Mg Doping of the Electron Blocking Layer on the Reliability of UVC Light Emitting Diodes** Jan Ruschel<sup>1</sup>, Johannes Glaab<sup>1</sup>, Hyun Kyong Cho<sup>1</sup>, Jens C. Rass<sup>1</sup>, Neysha Lobo Ploch<sup>1</sup>, Norman Susilo<sup>2</sup>, Tim Wernicke<sup>2</sup>, Sven Einfeld<sup>1</sup>, Markus Weyers<sup>1</sup> and Michael Kneissl<sup>2</sup>; <sup>1</sup>Ferdinand-Braun-Institut, Germany; <sup>2</sup>Technische Universität Berlin, Germany.

3:30 PM A01.06

**Microscopic Nonuniform Structure of AlGaIn-Based 260 and 285 nm Light-Emitting Multiple Quantum Wells Grown on AlN Templates with Dense Macrosteps Analyzed by Cathodoluminescence Spectroscopy** Yosuke Nagasawa<sup>1</sup>, Ryuichi Sugie<sup>2</sup>, Kazunobu Kojima<sup>3</sup>, Akira Hirano<sup>1</sup>, Masamichi Ipponmatsu<sup>1</sup>, Yoshio Honda<sup>4</sup>, Hiroshi Amano<sup>4,5,6</sup>, Isamu Akasaki<sup>6,7</sup> and Shigefusa F. Chichibu<sup>3,4</sup>; <sup>1</sup>UV Craftory Co. Ltd., Japan; <sup>2</sup>Toray Research Center, Inc., Japan; <sup>3</sup>Tohoku University, Japan; <sup>4</sup>Nagoya University, Japan; <sup>5</sup>Nagoya University, Japan; <sup>6</sup>Nagoya University, Japan; <sup>7</sup>Meijo University, Japan.

3:45 PM BREAK

## SESSION A02: Vertical Cavity Lasers

Session Chairs: Theeradetch Detchprohm and Sven Einfeld  
Monday Afternoon, July 8, 2019  
Evergreen Ballroom E-F, Lobby Level

4:15 PM \*A02.01

**Epitaxy and Performance of VCSEL Structures** Tetsuya Takeuchi<sup>1</sup>, Satoshi Kamiyama<sup>1</sup>, Motoaki Iwaya<sup>1</sup> and Isamu Akasaki<sup>1,2</sup>; <sup>1</sup>Meijo University, Japan; <sup>2</sup>Nagoya University, Japan.

4:45 PM A02.02

**Blue-Green GaN-Based VCSEL with a Monolithic Curved Mirror Fabricated on a Free Standing Semi-Polar {20-21} GaN Substrate** Tatsuya Matou, Tatsushi Hamaguchi, Kentaro Hayashi, Tatsuro Jyokawa, Hiroshi Nakajima, Masayuki Tanaka, Noriko Kobayashi, Masamichi Ito, Maho Ohara, Hideki Watanabe, Rintaro Koda and Katsunori Yanashima; Sony Corporation, Japan.

5:00 PM A02.03

**Room-Temperature Continuous-Wave Operations of GaIn-Based Vertical-Cavity Surface-Emitting Lasers with Buried GaInN Tunnel Junctions** Kazuki Kiyohara<sup>1,2</sup>, Ryota Fuwa<sup>1</sup>, Mahito Odawara<sup>1</sup>, Tetsuya Takeuchi<sup>1</sup>, Satoshi Kamiyama<sup>1</sup>, Motoaki Iwaya<sup>1</sup>, Isamu Akasaki<sup>1,3</sup> and Tatsumasa Saito<sup>2</sup>; <sup>1</sup>Meijo University, Japan; <sup>2</sup>Stanley Electric Co., Ltd., Japan; <sup>3</sup>Nagoya University, Japan.

5:15 PM A02.04

**Quality Factors of Vertical Cavities Based on Dislocation-Free and Atomically Flat III-Nitride Hexagonal Micro-Prisms** Filip Hjort<sup>1</sup>, Maryam Khalilian<sup>2</sup>, Filip Lenrick<sup>3</sup>, Olof Hultin<sup>2</sup>, Jovana Colvin<sup>4</sup>, Marcus Bengths<sup>1</sup>, Jörgen Bengtsson<sup>1</sup>, Johan Gustavsson<sup>1</sup>, Jonas Johansson<sup>2</sup>, Rainer Timm<sup>4</sup>, Reine Wallenberg<sup>5</sup>, Jonas Ohlsson<sup>2</sup>, Zhaoxia Bi<sup>2</sup>, Åsa Haglund<sup>1</sup>, Anders Gustafsson<sup>2</sup> and Lars Samuelson<sup>2</sup>; <sup>1</sup>Chalmers University of Technology, Sweden; <sup>2</sup>Lund University, Sweden; <sup>3</sup>Lund University, Sweden; <sup>4</sup>Lund University, Sweden.

5:30 PM A02.05

**Thermal Management Strategies for III-N VCSELS Using Electro-Opto-Thermal Numerical Simulations** Karan Mehta<sup>2</sup>, Yuh-Shiuan Liu<sup>2</sup>, Jialin Wang<sup>2</sup>, Hoon Jeong<sup>2</sup>, Theeradetch Detchprohm<sup>2</sup>, Shyh-Chiang Shen<sup>2</sup>, Russell Dupuis<sup>1</sup> and Doug Yoder<sup>2</sup>; <sup>2</sup>Georgia Institute of Technology, United States.

5:45 PM A02.06

**Electrically Injected Nonpolar GaN-Based VCSELS with Lattice-Matched Nanoporous Distributed Bragg Reflector Mirrors** Saadat Mishkat-Ul-Masabih<sup>1</sup>, Andrew A. Aragon<sup>1</sup>, Morteza Monavarian<sup>1</sup>, Ting Luk<sup>2</sup> and Daniel Feezell<sup>1</sup>; <sup>1</sup>University of New Mexico, United States; <sup>2</sup>Sandia National Laboratories, United States.

## SESSION B01: Vertical P-N Junctions

Session Chairs: Srabanti Chowdhury and Tetsu Kachi  
Monday Afternoon, July 8, 2019  
Cedar Ballroom, Second Floor

2:00 PM \*B01.01

**High Breakdown Voltage Vertical p-n Junction GaN Diodes** Tomoyoshi Mishima; Hosei University, Japan.

2:30 PM B01.02

**High Voltage Implantation-Free Vertical GaN Power P-N Diodes with a Novel Low-Temperature Plasma-Based Planar Edge Termination** Houqiang Fu, Kai Fu, Hanxiao Liu, Shanthan Reddy Alugubelli, Xuanqi Huang, Hong Chen, Tsung-Han Yang, Jossue Montes, Chen Yang, Jingan Zhou, Fernando Ponce and Yuji Zhao; Arizona State University, United States.

**2:45 PM B01.03**

**Achieving a Record High p-n Junction Breakdown Electric Field of 3.9 MV/cm in GaN Using Ion-Compensated Moat Etch Termination** Dong Ji<sup>1,2</sup>, Burcu Ercan<sup>2</sup> and Srabanti Chowdhury<sup>1,2</sup>; <sup>1</sup>Stanford University, United States; <sup>2</sup>University of California Davis, United States.

**3:00 PM B01.04**

**Avalanche Capability and Recoverable Breakdown Walkout in Polarization-Doped Vertical GaN pn Diodes** Elena Fabris<sup>1</sup>, Carlo De Santi<sup>1</sup>, Alessandro Caria<sup>1</sup>, Kazuki Nomoto<sup>2</sup>, Zongyang Hu<sup>2</sup>, Wenshen Li<sup>2</sup>, Xiang Gao<sup>3</sup>, Debdeep Jena<sup>2</sup>, Grace Xing<sup>2</sup>, Gaudenzio Meneghesso<sup>1</sup>, Enrico Zanoni<sup>1</sup> and Matteo Meneghini<sup>1</sup>; <sup>1</sup>University of Padova, Italy; <sup>2</sup>Cornell University, United States; <sup>3</sup>IQE, United States.

**3:15 PM B01.05**

**GaN-on-GaN PIN Diodes with a High Baliga's Figure-of-Merit of 29.7 GW/cm<sup>2</sup>** Cong Hu<sup>1</sup>, Jiale Wang<sup>1</sup>, Sung-Wen Huang Chen<sup>2</sup>, Hao-Yu Wang<sup>3</sup>, Hsien-Chin Chiu<sup>3</sup>, Hao-Chung Kuo<sup>2</sup>, Ke Xu<sup>4</sup>, Dabing Li<sup>5</sup> and Xinke Liu<sup>1</sup>; <sup>1</sup>Shenzhen University, China; <sup>2</sup>National Chiao Tung University, Taiwan; <sup>3</sup>Chang-Gung University, Taiwan; <sup>4</sup>Suzhou Institute of Nano-tech and Nano-bionics, China; <sup>5</sup>Changchun Institute of Optics, Fine Mechanics and Physics, China.

**3:30 PM B01.06**

**Threshold Switching and Memory Behaviors of GaN-on-GaN Regrown Vertical p-n Diodes with High Temperature Stability** Kai Fu, Houqiang Fu, Xuanqi Huang, Tsung-Han Yang, Hong Chen, Jossue Montes, Chen Yang, Jingan Zhou and Yuji Zhao; Arizona State University, United States.

**3:45 PM BREAK**

SESSION B02: Power Devices  
Session Chairs: Elison Matioli and Chang Soo Suh  
Monday Afternoon, July 8, 2019  
Cedar Ballroom, Second Floor

**4:15 PM \*B02.01**

**Enhancement-Mode p-GaN-HEMT Epitaxy Technology on 200 mm Si Substrates** Hu Liang<sup>1</sup>, Niels Posthuma<sup>2</sup>, Steve Stoffels<sup>2</sup>, Ming Zhao<sup>1</sup> and Stefaan Decoutere<sup>2</sup>; <sup>1</sup>imec vzw, Belgium; <sup>2</sup>imec vzw, Belgium.

**4:45 PM B02.02**

**200mm GaN Power—Technology Status on QST® Platform** Vladimir Odnoblyudov, Cem Basceri and Ozgun Aktas; QROMIS, Inc., United States.

**5:00 PM B02.03**

**High-Voltage Low-ON-Resistance p-GaN Gate HEMTs on Si with Suppressed Current Collapse Operations Up to 1000 V** Huaxing Jiang<sup>1</sup>, Renqiang Zhu<sup>1</sup>, Qifeng Lyu<sup>1</sup>, Peng Xiang<sup>2</sup>, Kai Cheng<sup>2</sup> and Kei May Lau<sup>1</sup>; <sup>1</sup>Hong Kong University of Science and Technology, Hong Kong; <sup>2</sup>Enkris Semiconductor, Inc., China.

**5:15 PM B02.04**

**Low on-Resistance and Low Trapping Effects in 1200 V Superlattice GaN-on-Silicon Heterostructures** Riad Kabouche<sup>1</sup>, Idriss Abid<sup>1</sup>, Malek Zegaoui<sup>1</sup>, Roland Puesche<sup>2</sup>, Joff Derluyn<sup>2</sup>, Stefan Degroote<sup>2</sup>, Marianne Germain<sup>2</sup>, Alaleh Tajalli<sup>3</sup>, Matteo Meneghini<sup>3</sup>, Gaudenzio Meneghesso<sup>3</sup> and Farid Medjdoub<sup>1</sup>; <sup>1</sup>IEMN, France; <sup>2</sup>EpiGaN, Belgium; <sup>3</sup>University of Padova, Italy.

**5:30 PM B02.05**

**624V 5A All-GaN Integrated Cascode for Power Switching Applications** Sheng Jiang, Kean Boon Lee, Joseph Pinchbeck, Yidi Yin and Peter Houston; University of Sheffield, United Kingdom.

**5:45 PM LATE NEWS**

SESSION G01: Unconventional Growth and Substrates  
Session Chairs: Russell Dupuis and Jeehwan Kim  
Monday Afternoon, July 8, 2019  
Evergreen Ballroom A-C, Lobby Level

**2:00 PM \*G01.01**

**Sputtering of III-Nitrides and Device Performance of Sputtered Material** Hiroshi Fujioka<sup>1,2</sup>, Kohei Ueno<sup>1</sup> and Atsushi Kobayashi<sup>1</sup>; <sup>1</sup>The University of Tokyo, Japan; <sup>2</sup>Japan Science and Technology Agency, Japan.

**2:30 PM G01.02**

**Growth of InGaN LEDs Directly on Metal Foils** Vladimir Matias<sup>1</sup>, Christopher Sheehan<sup>1</sup> and Brendan P. Gunning<sup>2</sup>; <sup>1</sup>Beam Materials, United States; <sup>2</sup>Sandia National Laboratories, United States.

**2:45 PM G01.03**

**MOVPE Growth of AlGa<sub>1-x</sub>N on High-Temperature Annealed Sputter-Deposited AlN Templates** Kenjiro Uesugi<sup>1</sup>, Kanako Shojiki<sup>2</sup>, Yusuke Hayashi<sup>3</sup> and Hideto Miyake<sup>3,2</sup>; <sup>1</sup>Mie University, Japan; <sup>2</sup>Mie University, Japan; <sup>3</sup>Mie University, Japan.

**3:00 PM G01.04**

**MBE Growth and Epitaxial Characteristics of AlN on Tantalum Nitride Thin Films** Neeraj Nepal<sup>1</sup>, Scott Katzer<sup>1</sup>, Brian P. Downey<sup>1</sup>, Matthew T. Hardy<sup>1</sup>, David Storm<sup>1</sup>, Eric N. Jin<sup>2,1</sup> and David Meyer<sup>1</sup>; <sup>1</sup>U.S. Naval Research Laboratory, United States; <sup>2</sup>National Research Council (NRC), United States.

**3:15 PM G01.05**

**Optical Waveguiding in MEMOCVD-Grown AlGa<sub>1-x</sub>N for DUV Integrated Optoelectronic Devices** Richard Floyd, Fatima Asif, Mikhail Gaevski, Grigory Simin, MVS Chandrashekhar and Asif Khan; University of South Carolina, United States.

**3:30 PM G01.06**

**High-Q Aluminum Nitride Microring Resonators on Sapphire Grown by Ultrahigh Temperature Molecular Beam Epitaxy** Yi Sun<sup>1</sup>, David A. Laleyan<sup>1</sup>, Eric T. Reid<sup>1</sup>, Ping Wang<sup>1</sup>, Xianhe Liu<sup>1</sup>, Ayush Pandey<sup>1</sup>, Mohammad Soltani<sup>2</sup> and Zetian Mi<sup>1</sup>; <sup>1</sup>University of Michigan, United States; <sup>2</sup>Raytheon, United States.

**3:45 PM BREAK**

SESSION G02: Epitaxy for UV Devices  
Session Chairs: Hideto Miyake and Craig Moe  
Monday Afternoon, July 8, 2019  
Evergreen Ballroom A-C, Lobby Level

**4:15 PM \*G02.01**

**Controlling Defects in AlGa<sub>1-x</sub>N and AlN for High Efficiency Deep UV LEDs** Tim Wernicke<sup>1</sup>, Frank Mehnke<sup>1</sup>, Norman Susilo<sup>1</sup>, Martin Guttmann<sup>1</sup>, Eviathar Ziffer<sup>1</sup>, Felix Nippert<sup>1</sup>, Jonas Weinrich<sup>2</sup>, Anna Mogilatenco<sup>2</sup>, Bettina Belde<sup>1</sup>, Luca Sulmoni<sup>1</sup>, Sylvia Hagedorn<sup>2</sup>, Sebastian Walde<sup>2</sup>, Carsten Netzel<sup>2</sup>, Christian Kuhn<sup>1</sup>, Johannes Enslin<sup>1</sup>, Priti Gupta<sup>1</sup>, Axel Hoffmann<sup>1</sup>, Markus Weyers<sup>2</sup> and Michael Kneissl<sup>1,2</sup>; <sup>1</sup>Technische Universität Berlin, Germany; <sup>2</sup>Leibniz-Institut für Höchstfrequenztechnik, Germany.

**4:45 PM G02.02**

**Ultraviolet-B Band Lasers Fabricated on Highly Relaxed Al<sub>0.55</sub>Ga<sub>0.45</sub>N Thick Films Grown on Sputtered AlN Templates with High Temperature Annealed** Shohei Teramura<sup>1</sup>, Yusuke Sakuragi<sup>1</sup>, Shinji Yasue<sup>1</sup>, Shunya Tanaka<sup>1</sup>, Yuya Ogino<sup>1</sup>, Motoaki Iwaya<sup>1</sup>, Tetsuya Takeuchi<sup>1</sup>, Satoshi Kamiyama<sup>1</sup>, Sho Iwayama<sup>1,2</sup>, Isamu Akasaki<sup>1,3</sup> and Hideto Miyake<sup>2</sup>; <sup>1</sup>Meijo University, Japan; <sup>2</sup>Mie University, Japan; <sup>3</sup>Nagoya University, Japan.

**5:00 PM G02.03**

**Reducing Residual Stress and Dislocation Density in AlN/SiC by MOCVD for UV-C LEDs** Christian J. Zollner, Abdullah Almogbel, Feng Wu, Burhan SaifAddin, Michael Iza, James Speck, Steven P. DenBaars and Shuji Nakamura; University of California, Santa Barbara, United States.

**5:15 PM G02.04**

**Relaxation of AlGa<sub>1-x</sub>N Epitaxial Layers on Native GaN Substrates** Seiji Mita<sup>1</sup>, Ke Wang<sup>2</sup>, Ronny Kirste<sup>1</sup>, Shun Washiyama<sup>2</sup>, Dennis E. Szymanski<sup>2</sup>, Will Mecouch<sup>1</sup>, Yan Guan<sup>2</sup>, Ramón Collazo<sup>2</sup> and Zlatko Sitar<sup>1,2</sup>; <sup>1</sup>Adroit Materials, United States; <sup>2</sup>North Carolina State University, United States.

**5:30 PM G02.05**

**Nonpolar (10-10) M-Plane Al<sub>1-x</sub>Ga<sub>x</sub>N Layers Grown on M-Plane Sapphire by MOVPE** Duc V. Dinh<sup>1</sup>, Hiroshi Amano<sup>1,2</sup> and Markus Pristovsek<sup>1</sup>; <sup>1</sup>Nagoya University, Japan; <sup>2</sup>Nagoya University, Japan.

**5:45 PM G02.06**

**Interdiffusion in AlN/Al<sub>1-x</sub>Ga<sub>x</sub>N Distributed Bragg Reflectors Grown by Molecular Beam Epitaxy—Formation of Unintentional Interfacial Layers** Maud Nemoz<sup>1</sup>, Fabrice Semon<sup>1</sup>, Stéphanie Rennesson<sup>1</sup>, Mathieu Leroux<sup>1</sup>, Denis Lefebvre<sup>1</sup>, Sophie Bouchoule<sup>2</sup>, Gilles Patriarche<sup>2</sup>, Francois Réveret<sup>3</sup>, Tobias Schulli<sup>4</sup>, Jesus Zuniga-Perez<sup>1</sup> and Jean-Yves Duboz<sup>1</sup>; <sup>1</sup>CNRS, France; <sup>2</sup>CNRS, France; <sup>3</sup>Université Clermont Auvergne, France; <sup>4</sup>ESRF, France.

SESSION H01: Nano-LEDs  
Session Chair: Katsumi Kishino  
Monday Afternoon, July 8, 2019  
Regency Ballroom E-G, Second Floor

**2:00 PM \*H01.01**

**III-N Nanocolumn Visible LEDs** Katsumi Kishino<sup>1,2</sup>, K. Narita<sup>1</sup>, A. Yanagihara<sup>1</sup>, D. Hatakeyama<sup>1</sup>, K. Takimoto<sup>1</sup>, N. Sakakibara<sup>1</sup>, T. Oto<sup>3,2</sup> and R. Togashi<sup>1,2</sup>; <sup>1</sup>Sophia University, Japan; <sup>2</sup>Sophia University, Japan; <sup>3</sup>Yamagata University, Japan.

**2:30 PM H01.02**

**Electrically Injected GHz-Class GaN/InGaN Core-Shell Nanowire-Based  $\mu$ -LEDs—Carrier Dynamics and Nanoscale Homogeneity** Mohsen Nami, Morteza Monavarian, Arman Rashidi, Saadat Mishkat-UI-Masabih, Ashwin K. Rishinaramangalam, Steve Brueck and Daniel Feezell; Center for High-Technology Materials, The University of New Mexico, United States.

**2:45 PM H01.03**

**Dislocation-Free, Relaxed c-Oriented Platelets of InGaN as Templates for Visible nanoLEDs** Zhaoxia Bi<sup>1</sup>, Taiping Lu<sup>2</sup>, Olof Hultin<sup>2</sup>, Ali Nowzari<sup>1</sup>, Bo Monemar<sup>1</sup>, Kristian Storm<sup>3</sup>, Jonas Ohlsson<sup>3</sup>, Anders Gustafsson<sup>1</sup> and Lars Samuelson<sup>1</sup>; <sup>1</sup>Lund University, Sweden; <sup>2</sup>RISE Acreo AB, Sweden; <sup>3</sup>Hexagem AB, Sweden.

**3:00 PM H01.04**

**Towards Electrically-Injected Deep-UV Core-Shell Nanorod LEDs** Pierre-Marie Coulon<sup>1</sup>, Gunnar Kusch<sup>2</sup>, Norman Susilo<sup>3</sup>, Lucia Spasevski<sup>2</sup>, Tim Wernicke<sup>3</sup>, Michael Kneissl<sup>3</sup>, Robert Martin<sup>2</sup> and Philip Shields<sup>1</sup>; <sup>1</sup>University of Bath, United Kingdom; <sup>2</sup>University of Strathclyde, United Kingdom; <sup>3</sup>Technische Universität Berlin, Institute of Solid State Physics, Germany.

**3:15 PM H01.05**

**Top-Down Fabrication, Annealing and Regrowth of GaN Nanocolumns for Core-Shell LEDs and Advanced Structures for Power Electronics** Vitaly Z. Zubialevich<sup>1</sup>, Pietro Pampili<sup>1</sup> and Peter Parbrook<sup>1,2</sup>; <sup>1</sup>University College Cork, Ireland; <sup>2</sup>University College Cork, Ireland.

**3:30 PM H01.06**

**Site- and Polarity-Controlled MOVPE of InGaN/GaN Nanowires for High-Speed LEDs on Silicon Substrates** Christian Blumberg<sup>1</sup>, Fabian Wefers<sup>1</sup>, Johanna Meier<sup>2</sup>, Gerd Bacher<sup>2</sup>, Nils Weimann<sup>1</sup> and Werner Prost<sup>1</sup>; <sup>1</sup>University Duisburg-Essen, Germany; <sup>2</sup>University Duisburg-Essen, Germany.

**3:45 PM BREAK**

SESSION D01: Novel Device Concepts  
Session Chairs: Yvon Cordier and Charles R. Eddy Jr.  
Monday Afternoon, July 8, 2019  
Regency Ballroom E-G, Second Floor

**4:15 PM \*D01.01**

**GaN Nanowires Based Piezoelectric Generators** Noelle Gogneau<sup>1</sup>, Pascal Chretien<sup>2</sup>, Nicolas Jamond<sup>1</sup>, Lu Lu<sup>1</sup>, Nikoleta Jegenyess<sup>1</sup>, Martina Morassi<sup>1</sup>, Tanbir Sodhi<sup>1</sup>, Laurent Travers<sup>1</sup>, Jean-Christophe Harmand<sup>1</sup>, Francois H. Julien<sup>1</sup>, Elie Lefevre<sup>1</sup>, Frédéric Houze<sup>2</sup> and Maria Tchernycheva<sup>1</sup>; <sup>1</sup>Center for Nanosciences and Nanotechnologies C2N-CNRS, France; <sup>2</sup>Laboratoire de Génie Électrique et Électronique de Paris, France.

**4:45 PM D01.02**

**Aluminum Nitride-Based Flexible Surface Acoustic Wave Devices Fabricated on Transparent Polyethylene Naphthalate for Wearable Sensing** Leonardo Lamanna<sup>1,2</sup>, Francesco Rizzi<sup>1</sup>, Francesco Guido<sup>1</sup>, Luciana Algeri<sup>1</sup>, Sergio Marras<sup>1</sup>, Vincenzo M. Mastronardi<sup>1</sup>, Antonio Qualtieri<sup>1</sup> and Massimo De Vittorio<sup>1,2</sup>; <sup>1</sup>IIT - Istituto Italiano di Tecnologia, Italy; <sup>2</sup>Università del Salento, Italy.

**5:00 PM D01.03**

**Flexible Piezoelectric Generators and Pulse Sensors Using Single-Crystalline III-N Thin Film** Jie Chen<sup>1,2,3</sup>, Noor Nabulsi<sup>2</sup>, Weijie Wang<sup>2,3</sup>, Heidi Johnson<sup>4</sup>, Seung Kyu Oh<sup>2,3,5</sup>, Haoran Liu<sup>6</sup>, Shahab Shervin<sup>2</sup>, Sara Pouladi<sup>1,2,3</sup> and Jae-Hyun Ryou<sup>1,2,5</sup>; <sup>1</sup>University of Houston, United States; <sup>2</sup>University of Houston, United States; <sup>3</sup>University of Houston, United States; <sup>4</sup>Brigham Young University, United States; <sup>5</sup>University of Houston, United States; <sup>6</sup>Houston Methodist Research Institute, United States.

**5:15 PM D01.04**

**Flexible Capacitive Piezoelectric Sensor with Ultra-Long Vertical GaN Wires** Joël Eymery<sup>1</sup>, Amine El Kacimi<sup>2</sup> and Emmanuelle Pauliac-Vaujour<sup>2</sup>; <sup>1</sup>CEA, IRIG MEM NRS, France; <sup>2</sup>CEA, Leti, Minatec Campus, France.

**5:30 PM D01.05**

**Flexible Metal Foil Substrate with Transfer-Free Epitaxially Grown Single-Crystalline III-N Film for Bendable Inorganic Photonic and Electronic Devices** Jae-Hyun Ryou<sup>1</sup>, Shahab Shervin<sup>1</sup>, Kamrul Alam<sup>1</sup>, Mi-Hee Ji<sup>2</sup>, Kaveh Shervin<sup>1</sup>, Seung Kyu Oh<sup>1</sup>, Theeradetch Detchprohm<sup>2</sup>, Jiming Bao<sup>1</sup> and Russell Dupuis<sup>2</sup>; <sup>1</sup>University of Houston, United States; <sup>2</sup>Georgia Institute of Technology, United States.

**5:45 PM D01.06**

**Demonstration of Transverse Quasi-Phase-Matched AlN Waveguide SHG Device Fabricated by Surface-Activated Bonding and Silicon Removal** Shuhei Yamaguchi<sup>1</sup>, Asahi Yamauchi<sup>1</sup>, Takuya Onodera<sup>1</sup>, Masahiro Uemukai<sup>1</sup>, Yusuke Hayashi<sup>2</sup>, Hideto Miyake<sup>2</sup>, Toshiaki Hikosaka<sup>3</sup>, Shinya Nunoue<sup>2</sup>, Keishi Shiomi<sup>1</sup>, Yasufumi Fujiwara<sup>1</sup> and Ryuji Katayama<sup>1</sup>; <sup>1</sup>Osaka University, Japan; <sup>2</sup>Mie University, Japan; <sup>3</sup>Toshiba Corporation, Japan.

SESSION I01: Advanced InGaN Characterization  
Session Chairs: Frank Bertram and Shigefusa Chichibu  
Monday Afternoon, July 8, 2019  
Regency Ballroom A-C, Second Floor

**2:00 PM \*I01.01**

**Quantitative Atom Probe Tomography of Ternary III-N Alloys—Accuracy Issues and Correlation with Optical Spectroscopy** Lorenzo Rigutti; Normandie University, France.

**2:30 PM I01.02**

**Impact of Indium Content on Carrier Localization Length and Wave Function Overlap in Polar InGaN Quantum Wells—Implications for the Green Gap Problem** Daniel S. Tanner<sup>1</sup>, Philip Dawson<sup>2</sup>, Menno Kappers<sup>3</sup>, Rachel Oliver<sup>3</sup> and Stefan Schulz<sup>1</sup>; <sup>1</sup>Tyndall National Institute, Ireland; <sup>2</sup>University of Manchester, United Kingdom; <sup>3</sup>University of Cambridge, United Kingdom.

**2:45 PM I01.03**

**Nanoscale Characterization of Indium Segregation in III-Nitride Thin Films by Tip-Enhanced Raman Spectroscopy** Emanuele Poliani<sup>1</sup>, Daniel Seidlitz<sup>1</sup>, Maximilian Ries<sup>1,2</sup>, Markus R. Wagner<sup>1</sup> and Axel Hoffmann<sup>1</sup>; <sup>1</sup>Technische Universität Berlin, Germany; <sup>2</sup>School for Analytical Sciences Adlershof, Germany.

**3:00 PM I01.04**

**Nanoscale Indium Homogeneity Analysis of an In-Rich InGaN Film by Cathodoluminescence** Bowen Sheng<sup>1,2</sup>, Xiantong Zheng<sup>1</sup>, Frank Bertram<sup>2</sup>, Ping Wang<sup>1</sup>, Gordon Schmidt<sup>2</sup>, Jürgen Bläsing<sup>2</sup>, Zhaoying Chen<sup>1</sup>, Peter Veit<sup>2</sup>, André Strittmatter<sup>2</sup>, Juergen Christen<sup>2</sup>, Bo Shen<sup>1</sup> and Xinqiang Wang<sup>1</sup>; <sup>1</sup>Peking University, China; <sup>2</sup>Otto-von-Guericke-University Magdeburg, Germany.

**3:15 PM \*I01.05**

**Challenges in Shifting the Emission of InGaN Quantum Wells towards the Red** Martin Albrecht; Leibniz-Institut für Kristallzüchtung, Germany.

**3:45 PM BREAK**

SESSION F01: Bulk Growth and P-Doping  
Session Chairs: Izabella Grzegory and Daisuke Tomida  
Monday Afternoon, July 8, 2019  
Regency Ballroom A-C, Second Floor

**4:15 PM \*F01.01**

**Acidic Ammonothermal Growth of Bulk GaN** Yutaka Mikawa, Takayuki Ishinabe, Yuji Kagamitani, Kirota Ikeda and Tae Mochizuki; Mitsubishi Chemical Corporation, Japan.

**4:45 PM F01.02**

**Effects of an Extra Al Metal Added During the Acidic Ammonothermal Growth of GaN Crystals** Daisuke Tomida<sup>1</sup>, Quanxi Bao<sup>1,3</sup>, Makoto Saito<sup>1,2</sup>, Kohei Kurimoto<sup>3</sup>, Mizuki Ito<sup>1</sup>, Tohru Ishiguro<sup>1</sup> and Shigefusa F. Chichibu<sup>1</sup>; <sup>1</sup>Tohoku University, Japan; <sup>2</sup>Mitsubishi Chemical Corporation, Japan; <sup>3</sup>Japan Steel Works, Ltd., Japan.

**5:00 PM F01.03**

**Thick GaN Crystals of High Purity Grown with an Increased Rate by Ammonobasic Method** Karolina Grabianska<sup>1</sup>, Robert Kucharski<sup>1</sup>, Marcin Zajac<sup>1</sup>, Damian Włodarczyk<sup>2</sup>, Mikolaj Amilusk<sup>1</sup>, Andrzej Suchocki<sup>2</sup>, Leszek Konczewicz<sup>1</sup>, Elzbieta Litwin-Staszewska<sup>1</sup>, Ryszard Piotrkowski<sup>1</sup> and Michal Boćkowski<sup>1,3</sup>; <sup>1</sup>Polish Academy of Sciences, Poland; <sup>2</sup>Polish Academy of Sciences, Poland; <sup>3</sup>Nagoya University, Japan.

#### 5:15 PM F01.04

**Defect Analysis of Ammonothermal GaN and HVPE-GaN Grown on Ammonothermal GaN Seeds Using Synchrotron X-Ray Rocking Curve Imaging** Lutz Kirste<sup>1</sup>, Tomasz Sochacki<sup>3</sup>, Marcin Zajac<sup>3</sup>, Thu Nhi Tran Thi<sup>2</sup>, Jose Baruchel<sup>2</sup> and Michal Boćkowski<sup>3</sup>; <sup>1</sup>Fraunhofer Institute for Applied Solid State Physics, Germany; <sup>2</sup>European Synchrotron Research Facility, France; <sup>3</sup>Institute of High Pressure Physics, Polish Academy of Sciences, Poland.

#### 5:30 PM F01.05

**Vertical GaN p-n Diodes on Low Dislocation and Low Resistive GaN Wafer Produced by OVPE Method** Junichi Takino<sup>1,2</sup>, Tomoaki Sumi<sup>1</sup>, Yoshio Okayama<sup>1</sup>, Masaki Nobuoka<sup>1</sup>, Akira Kitamoto<sup>2</sup>, Masayuki Imanishi<sup>2</sup>, Masashi Yoshimura<sup>2</sup>, Naomi Asai<sup>3</sup>, Hiroshi Ohta<sup>3</sup>, Tomoyoshi Mishima<sup>3</sup> and Yusuke Mori<sup>2</sup>; <sup>1</sup>Panasonic Corporation, Japan; <sup>2</sup>Osaka University, Japan; <sup>3</sup>Hosei University, Japan.

#### 5:45 PM F01.06

**Implantation of Beryllium into Thin Unintentionally Doped Layers of Gallium Nitride Crystallized by Halide Vapor Phase Epitaxy** Michal Boćkowski<sup>1</sup>, Malgorzata Iwinska<sup>1</sup>, Tomasz Sochacki<sup>1</sup>, Mikolaj Amilusik<sup>1</sup>, Boleslaw Lucznik<sup>1</sup>, Michal Fijalkowski<sup>1</sup>, Rafal Jakiela<sup>2</sup>, Adam Barcz<sup>2</sup>, Marek Oklej<sup>1</sup>, Aneta Sidor<sup>1</sup> and Izabella Grzegory<sup>1</sup>; <sup>1</sup>Institute of High Pressure Physics Polish Academy of Sciences (Unipress), Poland; <sup>2</sup>Institute of Physics Polish Academy of Sciences, Poland.

## POSTER SESSIONS

SESSION AP01: Poster Session I: Light Emitting Devices

Monday Afternoon, July 8, 2019

6:30 PM - 8:30 PM

Grand Ballroom, Second Floor

#### AP01.01

**The Effect of Al(Ga)N Capping Layers in InGaN/GaN Quantum Wells Emitting from Green to Red** Stefano Vichi<sup>1,2</sup>, Yoann Robin<sup>1</sup>, Stefano Sanguinetti<sup>2</sup>, Markus Pristovsek<sup>1</sup> and Hiroshi Amano<sup>1</sup>; <sup>1</sup>Nagoya University, Japan; <sup>2</sup>Università degli Studi di Milano-Bicocca, Italy.

#### AP01.02

**MOVPE GaN Wires with m-Plane Core-Shell GaN/AlGaIn MQWs for UV Emission** Vincent Grenier<sup>1</sup>, Nicolas Mollard<sup>2</sup>, Catherine Bougerol<sup>1,3</sup>, Bruno Gayral<sup>1</sup>, Eva Monroy<sup>1</sup>, Joël Eymery<sup>4</sup>, Gwénoél Jacobin<sup>3</sup> and Christophe Durand<sup>1</sup>; <sup>1</sup>University Grenoble Alpes, CEA, IRIG-PHELIQS-NPSC, France; <sup>2</sup>University Grenoble Alpes, CEA IRIG-MEM-LEMMA, France; <sup>3</sup>University Grenoble Alpes, CNRS-NPSC, Institut Néel, France; <sup>4</sup>University Grenoble Alpes, CEA IRIG-MEM-NRS, France.

#### AP01.03

**Monolithic Two Color Array of InGaN LEDs with Galvanic Isolation Provided by p-n-p Junction** Szymon Grzanka<sup>1,2</sup>, Dario Schiavon<sup>1,2</sup>, Krzysztof Gibasiewicz<sup>1</sup>, Jacek Kacperski<sup>1,2</sup>, Anna Kafar<sup>1,2</sup> and Piotr Perlin<sup>1,2</sup>; <sup>1</sup>Institute of High Pressure Physics, Polish Academy of Sciences, Poland; <sup>2</sup>TopGaN Laser Ltd., Poland.

#### AP01.04

**Electrically-Tunable Monolithic Broadband InGaIn-GaN Light-Emitting Diodes—A Consequence of Transient Quantum Confined Stark Effect in Strained Quantum Wells** Vikas Pendem, Pratin K. Saha, Shonal Choksey, Tarni Aggarwal, Ankit Udai, Swaroop Ganguly and Dipankar Saha; Indian Institute of Technology Bombay, India.

#### AP01.05

**Fabrication Process Development on III-Nitride Based Three-Dimensional Light Emitting Diodes for High Electrical Efficiency** Kie Young Woo, Hwan-Seop Yeo, Yong Chul Sim, Kwanjae Lee, Seung-Hyuk Lim and Yong-Hoon Cho; Korea Advanced Institute of Science and Technology, Korea (the Republic of).

#### AP01.06

**Recent Progress in AlGaIn UV-C LEDs Grown on SiC** Abdullah s. Almogbel<sup>1,2</sup>, Burhan SaifAddin<sup>1</sup>, Christian J. Zollner<sup>1</sup>, Michael Iza<sup>1</sup>, Hamad Albraithen<sup>2</sup>, Ahmed Y. Alyamani<sup>2</sup>, Abdulrahman M. Albadri<sup>2</sup>, Shuji Nakamura<sup>1</sup>, Steven P. DenBaars<sup>1</sup> and James Speck<sup>1</sup>; <sup>1</sup>University of California, Santa Barbara, United States; <sup>2</sup>KACST, Saudi Arabia.

#### AP01.07

**Strain Free GaN/InAlN Chirped Short Period Superlattice Reduced Thickness Top Cladding for 450 nm InGaIn Laser Diode** Avinash S. Paliwal<sup>1,2</sup>, Kuldip Singh<sup>1</sup> and Manish Mathew<sup>2,1</sup>; <sup>1</sup>CSIR-Central Electronics Engineering Research Institute, Pilani, India, India; <sup>2</sup>Academy of Scientific and Innovative Research (AcSIR), CSIR-CEERI Campus, Pilani, India.

#### AP01.08

**Arrays of Nitride MicroLEDs with Tunnel Junctions Grown by Plasma Assisted Molecular Beam Epitaxy** Julia Slawinska, Marcin Siekacz, Grzegorz Muziol, Henryk Turski, Krzesimir Nowakowski-Szkudlarek, Mikolaj Zak, Mikolaj Chlipala, Anna Feduniewicz-Zmuda, Marta Sawicka and Czeslaw Skierbiszewski; Institute of High Pressure Physics, Polish Academy of Sciences, Poland.

#### AP01.09

**High-Temperature Optical Characterization of GaN-Based LEDs for Future Power Electronic Modules** Syam Madhusoodhanan<sup>1</sup>, Abbas Sabbar<sup>1</sup>, Jiangbo Wang<sup>2</sup>, Binzhong Dong<sup>2</sup>, Stanley Ateitty<sup>3</sup>, Robert Kaplar<sup>3</sup>, Alan Mantooth<sup>1</sup>, Shui-Qing Yu<sup>1</sup> and Zhong Chen<sup>1</sup>; <sup>1</sup>University of Arkansas, United States; <sup>2</sup>HCSemitek, China; <sup>3</sup>Sandia National Lab, United States.

#### AP01.10

**Disorder-Induced Broadband Omnidirectional Distributed Bragg Reflectors Using Dielectric and Nanoporous GaN Systems** Morteza Monavarian, Behnam Abaie, Saadat Mishkat-UI-Masabih, Arash Mafi and Daniel Feezell; The University of New Mexico, United States.

#### AP01.11

**Achieving High Uniformity of 200 mm GaN-on-Si LED Epiwafers for Micro LED Applications with Precise Strain-Engineering** Atsushi Nishikawa, Alexander Loesing and Burkhard Slischka; ALLOS Semiconductors GmbH, Germany.

#### AP01.12

**AlGaIn LED Degradation Control Method** Oleg Rabinovich<sup>1</sup>, Sergey Nikiforov<sup>2</sup>, Sergey Didenko<sup>1</sup>, Marina Orlova<sup>1</sup>, Sergey Marenkin<sup>1</sup>, Alexey Ri<sup>1</sup> and Svetlana Podgornaya<sup>1</sup>; <sup>1</sup>NUST MISIS, Russian Federation; <sup>2</sup>Arhighlight, Russian Federation.

#### AP01.14

**High Quality AlN and AlGaIn Grown on NPSS by MOCVD** Jianzheng Hu<sup>1</sup>, Shangfeng Liu<sup>2,1</sup>, Vincent Wang<sup>1</sup>, Xinqiang Wang<sup>2</sup> and Shiping Guo<sup>1</sup>; <sup>1</sup>Advanced Microfabrication Equipment Inc., China; <sup>2</sup>Peking University, China.

#### AP01.15

**Low-Efficiency-Droop InGaIn Quantum Dot Green Light-Emitting Diodes** Chunyu Zhao<sup>1,2</sup>, Chak Wah Tang<sup>1</sup>, Billy Lai<sup>1</sup>, Guanghui Cheng<sup>1</sup>, Jiannong Wang<sup>2</sup> and Kei May Lau<sup>1</sup>; <sup>1</sup>Hong Kong University of Science and Technology, Hong Kong; <sup>2</sup>Hong Kong University of Science and Technology, Hong Kong.

#### AP01.16

**Application of UV-A and UV-B LEDs for Advanced Semiconductor Metrology and Process Control** Kamau Prince; LayTec, Germany.

#### AP01.17

**Development and Temperature-Dependent Characterizations of Resonant Cavity Light Emitting Diodes Using Airgap/AlGaIn Distributed Bragg Mirrors** Chuan-Wei Tsou, Theeradetch Detchprohm, Young Jae Park, Karan Mehta, Ping Chen, Hoon Jeong, Doug Yoder, Russell Dupuis and Shyh-Chiang Shen; Georgia Institute of Technology, Georgia.

#### AP01.18

**Fabrication of Dielectric Distributed Bragg Reflector Mirror in UV Laser Fabricated on Sapphire Substrate** Shinji Yasue<sup>1</sup>, Kosuke Sato<sup>1,3</sup>, Yusuke Sakuragi<sup>1</sup>, Yuya Ogino<sup>1</sup>, Shunya Tanaka<sup>1</sup>, Shohei Teramura<sup>1</sup>, Sho Iwayama<sup>1</sup>, Motoaki Iwaya<sup>1</sup>, Satoshi Kamiyama<sup>1</sup>, Tetsuya Takeuchi<sup>1</sup> and Isamu Akasaki<sup>1,2</sup>; <sup>1</sup>Meijo University, Japan; <sup>2</sup>Akasaki Research Center, Nagoya University, Japan; <sup>3</sup>Asahi-Kasei Corporation, Japan.

#### AP01.19

**Controlled, Scalable and Facile Growth of GaN Nanowire-Based LEDs on Variety of Functional Substrates by MOCVD** Muhammad A. Johar<sup>1</sup>, Aakil Waseem<sup>1</sup>, Hyun-Gyu Song<sup>2</sup>, Cho Yong-Hoon<sup>2</sup> and Sang-Wan Ryu<sup>1</sup>; <sup>1</sup>Chonnam National University, Korea (the Republic of); <sup>2</sup>Korea Advanced Institute of Science and Technology, Korea (the Republic of).

#### AP01.20

**Optimization of m-Plane Core-Shell InGaIn/GaN Nanowires for Flexible Visible LEDs** Akanksha Kapoor<sup>1</sup>, Vincent Grenier<sup>1</sup>, Nan Guan<sup>2</sup>, Catherine Bougerol<sup>3</sup>, Bruno Gayral<sup>1</sup>, Gwénoél Jacobin<sup>3</sup>, Francois H. Julien<sup>2</sup>, Maria Tchernycheva<sup>2</sup>, Christophe Durand<sup>1</sup> and Joël Eymery<sup>4</sup>; <sup>1</sup>University Grenoble Alpes, CEA,IRIG-PHELIQS-NPSC, France; <sup>2</sup>Center of Nanoscience and Nanotechnologies (C2N), France; <sup>3</sup>University Grenoble Alpes, CNRS, Institut Néel, France; <sup>4</sup>University Grenoble Alpes, CEA, IRIG-MEM-NRS, France.

**AP01.21**

**Toward Quantitative Measurement of Sub-Nanometer In Fluctuations in InGaN Quantum Well** Govindo J. Syaranamual<sup>1</sup>, Tara P. Mishra<sup>1,2</sup>, Jing Yang Chung<sup>1,2</sup>, Zhang Li<sup>1</sup>, Sarah A. Goodman<sup>3</sup>, Soo Jin Chua<sup>4</sup>, Eugene A. Fitzgerald<sup>3</sup>, Stephen J. Pennycook<sup>2</sup> and Silviya Gradecak<sup>3</sup>; <sup>1</sup>Singapore-MIT Alliance for Research and Technology, Singapore; <sup>2</sup>National University of Singapore, Singapore; <sup>3</sup>Massachusetts Institute of Technology, United States; <sup>4</sup>National University of Singapore, Singapore.

**AP01.22**

**Recent Advances in Underwater Wireless Optical Communications Using Micro-LEDs** Georgios Arvanitakis<sup>1</sup>, Rui Bian<sup>2</sup>, Jonathan McKendry<sup>1</sup>, Chen Cheng<sup>2</sup>, Enyuan Xie<sup>1</sup>, Xiangyu He<sup>1</sup>, Gang Yang<sup>1,3</sup>, Johannes Hermsdorf<sup>1</sup>, Mohamed Islam<sup>2</sup>, Ardimas Purwita<sup>2</sup>, Erdan Gu<sup>1</sup>, Harald Haas<sup>2</sup> and Martin Dawson<sup>1</sup>; <sup>1</sup>University of Strathclyde, United Kingdom; <sup>2</sup>University of Edinburgh, United Kingdom; <sup>3</sup>Harbin Institute of Technology at Weihai, China.

**AP01.23**

**AlGaIn UVC LEDs Directly Grown on DC-Sputtered and High Temperature Annealed AlN Templates** Shunsuke Kuwaba<sup>1,2</sup>, Yuri Itokazu<sup>1,2</sup>, Shogo Motegi<sup>2</sup>, Yosuke Mogami<sup>1,2</sup>, Atsushi Osawa<sup>3</sup>, Kazuto Osaki<sup>1</sup>, Yukiitake Tanioka<sup>3</sup>, Atsushi Maoka<sup>3</sup>, Masafumi Jo<sup>1</sup>, Norihiko Kamata<sup>2</sup> and Hideki Hirayama<sup>1</sup>; <sup>1</sup>RIKEN, Japan; <sup>2</sup>Saitama University, Japan; <sup>3</sup>SCREEN Finetech Solutions Co. Ltd., Japan.

**AP01.24**

**A Core-Shell-Like High-Efficiency Micro-LED Array Grown on Sapphire Nano-Membrane** Seungmin Lee<sup>1</sup>, Jongmyeong Kim<sup>1</sup>, Jehong Oh<sup>1</sup>, Jungel Ryu<sup>1</sup>, Yongjo Park<sup>1</sup> and Euijoon Yoon<sup>1,2,3</sup>; <sup>1</sup>Seoul National University, Korea (the Republic of); <sup>2</sup>Seoul National University, Korea (the Republic of); <sup>3</sup>Seoul National University, Korea (the Republic of).

**AP01.25**

**Demonstration of Band-to-Band Tunneling and Avalanche Regime in InGaN LEDs** Nicola Renzo<sup>1</sup>, Carlo De Santi<sup>1</sup>, Pradip Dalapati<sup>1</sup>, Desiree Monti<sup>1</sup>, Michael Binder<sup>2</sup>, Bastian Galler<sup>2</sup>, Roland Zeisel<sup>2</sup>, Gaudenzio Meneghesso<sup>1</sup>, Enrico Zanoni<sup>1</sup> and Matteo Meneghini<sup>1</sup>; <sup>1</sup>University of Padova, Italy; <sup>2</sup>Osram Opto Semiconductors GmbH, Germany.

**AP01.26**

**Fabrication and Characterization of Multi-Quantum-Shell LEDs with Tunnel Junction** Hideki Murakami<sup>1</sup>, Atsushi Suzuki<sup>1</sup>, Kyohei Nokimura<sup>1</sup>, Minoru Takebayashi<sup>1</sup>, Nanami Goto<sup>1</sup>, Mizuki Terazawa<sup>1</sup>, Weifang Lu<sup>1</sup>, Naoki Sone<sup>1,3</sup>, Kazuyoshi Iida<sup>1,4</sup>, Masaki Ohya<sup>1,4</sup>, Satoshi Kamiyama<sup>1</sup>, Tetsuya Takeuchi<sup>1</sup>, Motoaki Iwaya<sup>1</sup> and Isamu Akasaki<sup>1,2</sup>; <sup>1</sup>Meijo University, Japan; <sup>2</sup>Akasaki Research Center, Nagoya University, Japan; <sup>3</sup>Koito Manufacturing CO., LTD, Japan; <sup>4</sup>Toyoda Gosei, Japan.

**AP01.27**

**Color Conversion Enhancement of Light-Emitting Diode with Chemical Synthesized Metal Nanoparticles Through Surface Plasmon Coupling** Wen-Yen Chang<sup>1</sup>, Chun-Han Lin<sup>1</sup>, Hsin-Chun Chiang<sup>1</sup>, Yao-Tseng Wang<sup>1</sup>, Chia-Chun Ni<sup>1</sup>, Chien-Yu Chen<sup>1</sup>, Cheng-Jin Cai<sup>1</sup>, Wai Fong Tse<sup>1</sup>, Yang Kuo<sup>2</sup>, Yean-Woei Kiang<sup>1</sup> and Chih Chung Yang<sup>1</sup>; <sup>1</sup>National Taiwan University, Taiwan; <sup>2</sup>Tung Nan University, Taiwan.

**AP01.28**

**Monolithic InGaN RGB LEDs for Full Color Micro-Displays by Jet Printing of Nanospheres** Wai Yuen Fu, Hao Lyu and Hoi Wai Choi; The University of Hong Kong, Hong Kong.

**AP01.29**

**Anisotropic Dependence of Light Extraction Behavior on Propagation Path in AlGaIn-Based Deep-Ultraviolet Light-Emitting Diodes** Hui Wang<sup>1</sup>, Tongjun Yu<sup>1</sup>, Lei Fu<sup>1</sup>, Huimin Lu<sup>2</sup> and Jiejun Wu<sup>1</sup>; <sup>1</sup>Peking University, China; <sup>2</sup>University of Science and Technology Beijing, China.

**AP01.30**

**FDTD Modeling of Light Extraction in Realistic Flip-Chip InGaN microLEDs** Jordan M. Smith<sup>1</sup> and Steven P. DenBaars<sup>1,2</sup>; <sup>1</sup>University of California, Santa Barbara, United States; <sup>2</sup>University of California Santa Barbara, United States.

**AP01.31**

**Bulk nGaIn/InGaIn/pGaIn Nanostructures for High Resolution and Brightness 10x10µm<sup>2</sup> Micro-LEDs Pixels** Soufiane Karrakchou<sup>2,1</sup>, Yacine Halfaya<sup>1</sup>, Suresh Sundaram<sup>1</sup>, Adama Mballo<sup>1</sup>, Taha Ayari<sup>2,1</sup>, Walid El Huni<sup>1</sup>, Renaud Puybaret<sup>1</sup>, Youssef El Gmili<sup>1</sup>, Simon Gautier<sup>3</sup>, Paul Voss<sup>2,1</sup>, Jean Paul Salvestrini<sup>2,1</sup> and Abdallah Ougazzaden<sup>2,1</sup>; <sup>1</sup>UMI 2958 Georgia Tech - CNRS, France; <sup>2</sup>Georgia Institute of Technology, United States; <sup>3</sup>Institut Lafayette, France.

**AP01.32**

**Behavior of AlGaIn/AlGaIn MQWs Emission by Improving Underlying Layer** Kengo Nagata<sup>1,2</sup>, Hiroaki Makino<sup>1,2</sup>, Keita Kataoka<sup>3</sup>, Tetsuo Narita<sup>3</sup> and Yoshiki Saito<sup>1,2</sup>; <sup>1</sup>Toyoda Gosei, Japan; <sup>2</sup>TS Opto, Japan; <sup>3</sup>Toyota Central R&D Labs, Japan.

**AP01.33**

**Gain Modeling in InGaIn/GaN Microdisk Lasers** Christelle Brimont<sup>1</sup>, François Chiaruttini<sup>1</sup>, Laetitia Doyennette<sup>1</sup>, Farsane Tabataba-Vakil<sup>2,3</sup>, Iannis Roland<sup>2</sup>, Moustafa El Kurdi<sup>2</sup>, Xavier Checoury<sup>2</sup>, Sébastien Sauvage<sup>2</sup>, Stéphanie Rennesson<sup>4</sup>, Eric Frayssinet<sup>4</sup>, Julien Brault<sup>4</sup>, Benjamin Damilano<sup>4</sup>, Jean-Yves Duboz<sup>4</sup>, Fabrice Semon<sup>4</sup>, Bruno Gayral<sup>3</sup>, Philippe Boucaud<sup>4</sup> and Thierry Guillet<sup>1</sup>; <sup>1</sup>Laboratoire Charles Coulomb (L2C), Université de Montpellier, CNRS, France; <sup>2</sup>C2N, CNRS, University Paris Sud, France; <sup>3</sup>CEA, INAC PHELIQS University Grenoble Alpes, France; <sup>4</sup>Université Côte d'Azur, CRHEA-CNRS, France.

**AP01.34**

**Color Conversion of GaN Blue LEDs Using QDs Embedded in Nanoporous GaN** Bingjun Li<sup>1</sup>, Zachary Fishman<sup>2</sup>, Shu Hu<sup>2</sup> and Jung Han<sup>1</sup>; <sup>1</sup>Yale University, United States; <sup>2</sup>Yale University, United States.

**AP01.35**

**Improvement of DUV LED Efficiencies by Ultra-Thick AlN Epilayer and Moth-Eye Microstructure** Changqing Chen, Hanling Long, Shuai Wang, Jun Zhang, Yi Zhang, Maocheng Shan and Jiangnan Dai; Huazhong University of Science and Technology, China.

**AP01.36**

**Lattice Matched InAlN/GaN 1D Photonic Band Gap Crystal (PBC) Structures for Single Mode High-Power Laser Diodes** Prabha Sana<sup>1</sup>, Christoph Berger<sup>1</sup>, Armin Dadgar<sup>1</sup>, Marc Peter Schmidt<sup>2</sup>, Jürgen Blasing<sup>1</sup>, Gordon Schmidt<sup>1</sup>, Hartmut Witte<sup>1</sup>, Sebastian Metzner<sup>1</sup>, Frank Bertram<sup>1</sup>, Juergen Christen<sup>1</sup> and André Strittmatter<sup>1</sup>; <sup>1</sup>Otto-von-Guericke Universität Magdeburg, Germany; <sup>2</sup>Otto-von-Guericke Universität Magdeburg, Germany.

SESSION BP01: Poster Session I: Electronic Devices

Monday Afternoon, July 8, 2019

6:30 PM - 8:30 PM

Grand Ballroom, Second Floor

**BP01.01**

**Defect Investigation of Regrown, Vertical GaN p-n Diodes Using Deep-Level Optical Spectroscopy** Gregory Pickrell<sup>1</sup>, Andrew Armstrong<sup>1</sup>, Andrew Allerman<sup>1</sup>, Mary Crawford<sup>1</sup>, Daniel Feezell<sup>2</sup>, Morteza Monavarian<sup>2</sup>, Andrew A. Aragon<sup>2</sup>, Alec Talin<sup>3</sup>, Francois Leonard<sup>3</sup>, Kimberlee Celio<sup>3</sup>, Caleb Glaser<sup>1</sup>, Jeffrey Kempisty<sup>1</sup> and Vincent Abate<sup>1</sup>; <sup>1</sup>Sandia National Laboratories (NM), United States; <sup>2</sup>University of New Mexico, United States; <sup>3</sup>Sandia National Laboratories (CA), United States.

**BP01.02**

**Effects of P-GaN Capping Layer on AlGaIn/GaN HEMT** Wonho Jang, Hyun-Seop Kim and Ho-Young Cha; Hongik University, Korea (the Republic of).

**BP01.03**

**Monolithically Integrated GaN Power ICs Design Facilitated by the MVSG Compact Model Applied to Enhancement-Mode p-GaN Gate HEMTs** Shuzhen You<sup>1</sup>, Xiangdong Li<sup>1,3</sup>, Bertrand Parvais<sup>1,2</sup>, Niels Posthuma<sup>1</sup>, Karen Geens<sup>1</sup>, Steve Stoffels<sup>1</sup> and Stefaan Decoutere<sup>1</sup>; <sup>1</sup>imec, Belgium; <sup>2</sup>Vrije Universiteit Brussels, Belgium; <sup>3</sup>KU Leuven, Belgium.

**BP01.04**

**Impact of Interfacial Impurities on the Electrical Performance of Regrown Nonpolar (10-10) GaN Vertical p-n Diodes** Andrew A. Aragon<sup>1</sup>, Morteza Monavarian<sup>1</sup>, Isaac Stricklin<sup>1</sup>, Gregory Pickrell<sup>2</sup>, Mary Crawford<sup>2</sup>, Andrew Allerman<sup>2</sup>, Andrew Armstrong<sup>2</sup> and Daniel Feezell<sup>1</sup>; <sup>1</sup>Center for High-Technology Materials, The University of New Mexico, United States; <sup>2</sup>Sandia National Laboratories, United States.

**BP01.05**

**Experimental and Analytical Determination of Optimum Carbon Doping Level in AlGaIn/GaN HEMT on Silicon** Nayana Remesh, Nagaboopathy Mohan, Rangarajan Muralidharan, Srinivasan Raghavan and Dignijoy N. Nath; Indian Institute of Science, India.

**BP01.06**

**Characteristics of the Resonant Field-Noise Around GaN-HEMT Switching Circuits** Katsumi Furuya, Hiroshi Chonan, Toshihide Ide, Ryosaku Kaji, Noriyuki Takada and Mitsuaki Shimizu; National Institute of Advanced Industrial Science and Technology (AIST), Japan.

**BP01.07**

**AlGaIn/GaN HEMT 2DEG Impact by *In Situ* SiN<sub>x</sub> Passivating Layer Stoichiometry Grown by MOCVD** Md Anwar Siddique<sup>1</sup>, Raju Ahmed<sup>1</sup>, Jonathan Anderson<sup>1</sup> and Edwin L. Piner<sup>1,2</sup>; <sup>1</sup>Texas State University, United States; <sup>2</sup>Texas State University, United States.

**BP01.08**

**Growth and Characterization of Al<sub>x</sub>Ga<sub>1-x</sub>N/GaN/AlN Double-Hetero Structure HEMT** Ujho Choi, Kyeongjae Lee, Taemyung Kwak, Taehoon Jang, Yongjun Nam, Donghyeop Jung, Byeongchan So and Okhyun Nam; Korea Polytechnic University, Korea (the Republic of).

**BP01.09**

**Investigation of Relationship Between E-Mode GaN HEMT Dynamic Ron and Different Test Conditions** Ziyang Xiao, Prasad Venkatraman, Ali Salih and Woochul Jeon; ON Semiconductor, United States.

**BP01.10**

**Low RF Loss Buffer Layers on 3C-SiC/Si(111) Templates for AlGaIn/GaN High Electron Mobility Transistors** Eric Frayssinet<sup>1</sup>, Luan Nguyen<sup>1</sup>, Marie Leseq<sup>2</sup>, Nicolas Defrance<sup>2</sup>, Remi Comyn<sup>1</sup>, Thi Huong Ngo<sup>1</sup>, Marcin Zielinski<sup>3</sup>, Marc Portail<sup>1</sup>, Jean-Claude De Jaeger<sup>2</sup> and Yvon Cordier<sup>1</sup>; <sup>1</sup>University Côte d'Azur CNRS-CRHEA, France; <sup>2</sup>CNRS IEMN, University Lille, France; <sup>3</sup>NOVASIC, France.

**BP01.11**

**Dynamic Performance of AlGaIn MOSHFETs with High-k ALD Oxides** Mikhail Gaevski<sup>1</sup>, Shahab Mollah<sup>1</sup>, Kamal Hussain<sup>1</sup>, Richard Floyd<sup>1</sup>, Md Abdullah-Al Mamun<sup>2</sup>, MVS Chandrashekar<sup>1</sup>, Iftikhar Ahmad<sup>1</sup>, Grigory Simin<sup>1</sup>, Virginia Wheeler<sup>2</sup>, Charles R. Eddy Jr.<sup>2</sup> and Asif Khan<sup>1</sup>; <sup>1</sup>University of South Carolina, United States; <sup>2</sup>U.S. Naval Research Laboratory, United States.

**BP01.12**

**Direct Bonding of GaN and Diamond Without an Intermediate Layer at Room Temperature** Jianbo Liang<sup>1</sup>, Makoto Kasu<sup>2</sup>, Martin Kuball<sup>3</sup> and Naoteru Shigekawa<sup>1</sup>; <sup>1</sup>Osaka City University, Japan; <sup>2</sup>Saga University, Japan; <sup>3</sup>University of Bristol, United Kingdom.

**BP01.13**

**High Performance Lateral GaN Schottky Barrier Diode on Silicon Substrate with High Breakdown Voltage of 2.74 kV and High Power Figure-of-Merit of 2.53 GW/cm<sup>2</sup> with Post-Anode-Annealing Treatment** Tao Zhang, Jincheng Zhang, Hong Zhou and Yue Hao; Xidian University, China.

**BP01.14**

**Low Static and Dynamic ON-Resistance with Improved Power Figure-of-Merit in AlGaIn/GaN HEMTs on CVD Diamond** Kumud Ranjan, Arulkumaran Subramaniam and Geok Ing Ng; Nanyang Technological University, Singapore.

**BP01.15**

**High Performance Lateral GaN Schottky Barrier Diode on Silicon Substrate with Molybdenum Anode and Low Turn-on Voltage of 0.31 V** Yi Wang, Tao Zhang, Hong Zhou, Jincheng Zhang and Yue Hao; Xidian University, China.

**BP01.16**

**Normally-Off High Electron Mobility Transistors with Regrown p-GaN Gate and LPCVD SiN<sub>x</sub> Passivation** Yaorong Zhong<sup>1,2</sup>, Shuai Su<sup>1,2</sup>, Yu Zhou<sup>2</sup>, Xin Chen<sup>2</sup>, Hongwei Gao<sup>2</sup>, Qian Sun<sup>1,2</sup> and Hui Yang<sup>1,2</sup>; <sup>1</sup>University of Science and Technology of China, China; <sup>2</sup>Suzhou Institute of Nano-Tech and Nano-Bionics, China.

**BP01.17**

**Improvement of Proton Radiation Hardness Through Bi-Layer Gate Insulating System in GaN-Based MIS-HEMTs** Sung-Jae Chang<sup>1</sup>, Kyu-Jun Cho<sup>1</sup>, Hyun-Wook Jung<sup>1</sup>, Jeong-Jin Kim<sup>1</sup>, Yoo Jin Jang<sup>1</sup>, Sung-Bum Bae<sup>1</sup>, Dong-Seok Kim<sup>2</sup>, Youngho Bae<sup>3</sup>, Hyung Sup Yoon<sup>1</sup>, Ho-Kyun Ahn<sup>1</sup>, Byoung-Gue Min<sup>1</sup>, Haecheon Kim<sup>1</sup> and Jong-Won Lim<sup>1</sup>; <sup>1</sup>Electronics and Telecommunications Research Institute, Korea (the Republic of); <sup>2</sup>Korea Multi-Purpose Accelerator Complex, Korea Atomic Energy Research Institute, Korea (the Republic of); <sup>3</sup>Uiduk University, Korea (the Republic of).

**BP01.18**

**Al<sub>x</sub>Ga<sub>1-x</sub>N (x>0.4) Channel MOSFETs with High-k ALD Gate-Oxides** Shahab Mollah<sup>1</sup>, Kamal Hussain<sup>1</sup>, Richard Floyd<sup>1</sup>, Md Abdullah-Al Mamun<sup>1</sup>, Mikhail Gaevski<sup>1</sup>, MVS Chandrashekar<sup>1</sup>, Iftikhar Ahmad<sup>1</sup>, Grigory Simin<sup>1</sup>, Virginia Wheeler<sup>2</sup>, Charles R. Eddy Jr.<sup>2</sup> and Asif Khan<sup>1</sup>; <sup>1</sup>University of South Carolina, United States; <sup>2</sup>Naval Research Laboratory, United States.

**BP01.19**

**Lateral GaN Schottky Barrier Diode for Wireless High Power Transfer with High RF/DC Conversion Efficiency** Kui Dang, Hong Zhou, Jincheng Zhang, Jing Ning and Yue Hao; Xidian University, China.

**BP01.20**

**Threshold Voltage Shift in AlGaIn/GaN HEMTs with Body-Diode Based Back-Gate Control** Isra Mahaboob, Michael Yakimov, Sean A. Tozier, Kasey Hogan, Emma Rocco and Fatemeh (Shadi) Shahedipour-Sandvik; SUNY Polytechnic Institute, United States.

**BP01.21**

**Polarization Edge Termination for GaN Vertical Power Devices** Matthew R. Peart and Jonathan Wierer; Lehigh University, United States.

**BP01.22**

**The Demonstration of Nearly Ideal GaN Vertical Schottky Diodes After Gamma Irradiation** Zhaoke Bian, Shenglei Zhao, Jincheng Zhang, Tao Zhang, Jiabo Chen and Yue Hao; Xidian University, China.

**BP01.23**

**High Average Breakdown Field Between Gate and Drain in AlGaIn/GaN HEMTs with High-k Passivation Layer** Ryo Tomita, Shingo Ueda, Yuki Kawada and Kazushige Horio; Shibaura Institute of Technology, Japan.

**BP01.24**

**Electronic Band Structure of Etched-and-Regrown Interfaces in p-i-n GaN Epilayers Using Electron Holography** Shanthan Reddy Alugubelli<sup>1</sup>, Hanxiao Liu<sup>1</sup>, Houqiang Fu<sup>2</sup>, Kai Fu<sup>2</sup>, Yuji Zhao<sup>2</sup> and Fernando Ponce<sup>1</sup>; <sup>1</sup>Arizona State University, United States; <sup>2</sup>Arizona State University, United States.

**BP01.25**

**Limitations for Reliable Operation at Elevated Temperatures of AlGaIn/GaN HEMT Grown by MOCVD on Silicon Substrate** Lars Heuken<sup>1</sup>, Alessandro Ottaviani<sup>1</sup>, Dirk Fahle<sup>2</sup>, Thorsten Zweipfennig<sup>3</sup>, Gerrit Lükens<sup>3</sup>, Holger Kalisch<sup>3</sup>, Andrei Vescan<sup>3</sup>, Michael Heuken<sup>2,3</sup> and Joachim N. Burghartz<sup>1</sup>; <sup>1</sup>Institut für Mikroelektronik Stuttgart, Germany; <sup>2</sup>AIXTRON SE, Germany; <sup>3</sup>RWTH Aachen University, Germany.

**BP01.26**

**Comparison of Performance Limits of GaAs and GaN Vertical Superjunction Devices** Xiang Zhou and T. Paul Chow; Rensselaer Polytechnic Institute (RPI), United States.

**BP01.27**

**Field Dependent Off-State Degradation and Recovery of NiO, TiO<sub>2</sub> and Al<sub>2</sub>O<sub>3</sub> Based MOS-HEMTs** Jaya Jha, Mudassar Imam Yahya Meer, Swaroop Ganguly and Dipankar Saha; IIT Bombay, India.

**BP01.28**

**An Over 2300 V AlGaIn/GaN HEMT with AlGaIn Back Barrier and Hybrid Drain Contacts** Weihang Zhang, Jincheng Zhang and Yue Hao; Xidian University, China.

**BP01.29**

**β-Ga<sub>2</sub>O<sub>3</sub> Versus GaN HEMTs—A Closer Look** Sandeep Kumar, Rohith Soman, Anamika S. Pratiyush, Rangarajan Muralidharan and Digbijoy N. Nath; Indian Institute of Science (IISc), India.

**BP01.30**

**Evaluation of Subsequent Implantation Effect into Mg Implanted Region in GaN** Shinya Takashima<sup>1</sup>, Ryo Tanaka<sup>1</sup>, Katsunori Ueno<sup>1</sup>, Hideaki Matsuyama<sup>1</sup>, Yuta Fukushima<sup>1</sup>, Masaharu Edo<sup>1</sup>, Kohei Shima<sup>2</sup>, Kazunobu Kojima<sup>2</sup>, Shigefusa F. Chichibu<sup>2,3</sup> and Akira Uedono<sup>4</sup>; <sup>1</sup>Fuji Electric Co., Ltd., Japan; <sup>2</sup>Tohoku University, Japan; <sup>3</sup>Nagoya University, Japan; <sup>4</sup>University of Tsukuba, Japan.

SESSION CP01: Poster Session I: Photovoltaics, Energy Harvesting and Photo Detectors

Monday Afternoon, July 8, 2019

6:30 PM - 8:30 PM

Grand Ballroom, Second Floor

**CP01.01**

**Design and Simulation of High-Efficiency GaN-Based Betavoltaic Battery** Dong-Seok Kim<sup>1</sup>, Yong Seok Hwang<sup>1</sup>, Jaekwon Suk<sup>1</sup>, Jun-Hyeok Lee<sup>2</sup>, Jeong-Gil Kim<sup>2</sup>, Hyeon-Su Lee<sup>2</sup> and Jung-Hee Lee<sup>2</sup>; <sup>1</sup>Korea Atomic Energy Research Institute, Korea (the Republic of); <sup>2</sup>Kyungpook National University, Korea (the Republic of).

**CP01.02**

**The Effects of Hydrogen Passivation on the Performance of GaInNAs Solar Cells** Collin Brown<sup>1</sup>, Vincent R. Whiteside<sup>1</sup>, Miwa Fukuda<sup>1</sup>, Tong Mou<sup>2</sup>, Bin Wang<sup>2</sup>, Amrit Kaple<sup>3</sup>, Parameswar Hari<sup>3</sup>, Khalid Hossain<sup>4</sup>, Terry Golding<sup>4</sup>, Mathieu Leroux<sup>2</sup>, Mohamed Al Khalilou<sup>2</sup> and Ian R. Sellers<sup>1</sup>; <sup>1</sup>University of Oklahoma, United States; <sup>2</sup>University of Oklahoma, United States; <sup>3</sup>University of Tulsa, United States; <sup>4</sup>Amethyst Research Inc., United States; <sup>5</sup>CRHEA-CNRS, France.

**CP01.03**

**AlGaN-Based Deep Ultraviolet Schottky Barrier Photodetectors Grown on Si(111) by MOCVD** Meixin Feng, Fangzhou Liang, Yingnan Huang, Qian Sun, Jianxun Liu, Xiujian Sun, Xiaoning Zhan, Hongwei Gao, Yu Zhou and Hui Yang; Suzhou Institute of Nano-tech and Nano-bionics, CAS, China.

**CP01.04**

**Influence of AlN Buffer Layer on the Performance of GaN-Based UV Photodetection Devices** Govind Gupta<sup>1</sup>, Shubin Krishna<sup>1</sup>, Neha Aggarwal<sup>1</sup>, Abhiram Gundimeda<sup>2</sup>, Alka Sharma<sup>1</sup> and Sudhir Husale<sup>1</sup>; <sup>1</sup>CSIR-National Physical Laboratory, India; <sup>2</sup>University of Cambridge, United Kingdom.

**CP01.05**

**Graphene/InGaN Quantum Dots-Based Ultrahighly Sensitive Photodetectors** Anqi Hu and Xia Guo; Beijing University of Posts and Telecommunications, China.

**CP01.06**

**Improved Electrical Properties of InGaN Thin Films Grown on AlN Buffer Layer by RF Sputtering for Solar Cell Applications** Pratheesh Kumar Jakkala; Illinois College, United States.

**CP01.07**

**Growth and Fabrication of Al<sub>0.30</sub>Ga<sub>0.70</sub>N/AlN Heterostructure Based Solar-Blind UV Photodetection Device** Neha Aggarwal, Shubhendra K. Jain, Lalit Goswami, Jasveer Singh, Nita Dilawar and Govind Gupta; CSIR-National Physical Laboratory, India.

**CP01.08**

**Utilization of GaN and Its Alloy Nanostructures as Photoelectrodes for Solar Hydrogen Generation** Shivaram B. Kubakaddi; Jawaharlal Nehru Centre for Advanced Scientific Research, Bengaluru, India, India.

SESSION DP01: Poster Session: Sensors, Actuators and Acoustic Devices

Monday Afternoon, July 8, 2019

6:30 PM - 8:30 PM

Grand Ballroom, Second Floor

**DP01.01**

**Influence of Ionic Surfactant Adsorption on the Response of Reference-Electrode-Free GaN/AlGaIn/GaN pH Sensors** Jianan Wang<sup>1</sup>, Xing Zhang<sup>1</sup>, Hua Li<sup>1</sup>, Haoran Li<sup>2</sup>, Stacia Keller<sup>2</sup>, Umesh K. Mishra<sup>2</sup>, Brett Nener<sup>1</sup>, Giacinta Parish<sup>1</sup> and Rob Atkin<sup>1</sup>; <sup>1</sup>The University of Western Australia, Australia; <sup>2</sup>University of California Santa Barbara, United States.

**DP01.02**

**Ultra-High Sensitive Mercury Ion Detector Using AlGaIn/GaN HEMT** Shivanshu Mishra<sup>1</sup>, Nidhi Chaturvedi<sup>1</sup>, Richard Lossy<sup>2</sup>, Kuldip Singh<sup>1</sup>, Pharyanshu Kachhawa<sup>1</sup>, Amber Jain<sup>1</sup>, Dheeraj Kharbanda<sup>1</sup>, Kaushal Kishore<sup>3</sup>, Ashok Chauhan<sup>1</sup>, Pramod Khanna<sup>1</sup> and Joachim Wuertl<sup>2</sup>; <sup>1</sup>CSIR-Central Electronics Engineering Research Institute, India; <sup>2</sup>Ferdinand-Braun-Institut Leibniz-Institut für Höchstfrequenztechnik, Germany; <sup>3</sup>CSIR-Central Electronics Engineering Research Institute, India.

**DP01.03**

**Sensitivity of N-Polar GaN Surface Barrier to Ambient Gases Probed by Contactless Electroreflectance** Lukasz Janicki<sup>1</sup>, Jan Misiewicz<sup>1</sup>, Marcin Siekacz<sup>2</sup>, Henryk Turski<sup>2</sup>, Joanna Moneta<sup>2</sup>, Sandeep Gorantla<sup>3</sup>, Czeslaw Skierbiszewski<sup>2,4</sup> and Robert Kudrawiec<sup>1,3</sup>; <sup>1</sup>Wroclaw University of Science and Technology, Poland; <sup>2</sup>Institute of High Pressure Physics PAS, Poland; <sup>3</sup>Polich Center for Technology Development PORT, Poland; <sup>4</sup>TopGaN Sp. z o.o., Poland.

**DP01.04**

**Development of AlGaIn/GaN High Electron Mobility Transistor Based Gas Sensors for Harsh Environmental Applications** Chuyoung Cho, Hae-Yong Jeong, Hyeong-Ho Park and Kyung-Ho Park; Korea Advanced Nano Fab Center, Korea (the Republic of).

**DP01.05**

**Design Factors for Reference Electrode Free AlGaIn/GaN-Based pH Sensors** Giacinta Parish<sup>1</sup>, Farah L. Khir<sup>1,2</sup>, N. R. Krishnan<sup>1</sup>, Jianan Wang<sup>1</sup>, Jonathan Krisjanto<sup>1</sup>, Haoran Li<sup>3</sup>, Gilberto A. Umana-Membreno<sup>1</sup>, Stacia Keller<sup>2</sup>, Umesh K. Mishra<sup>3</sup>, Murray V. Baker<sup>1</sup>, Brett Nener<sup>1</sup> and Matthew Myers<sup>4,1</sup>; <sup>1</sup>University of Western Australia, Australia; <sup>2</sup>Universiti Teknologi MARA, Malaysia; <sup>3</sup>University of California, Santa Barbara, United States; <sup>4</sup>CSIRO, Australia.

SESSION EP01: Poster Session I: Processing, Fabrication and Thermal Management

Monday Afternoon, July 8, 2019

6:30 PM - 8:30 PM

Grand Ballroom, Second Floor

**EP01.01**

**Pick-and-Place of III-Nitride Devices without Dicing, Enabled by 2D h-BN Grown on Micro-Patterned SiO<sub>2</sub>/Sapphire Substrates** Taha Ayari<sup>1,2</sup>, Suresh Sundaram<sup>1,2</sup>, Chris Bishop<sup>3</sup>, Adama Mballo<sup>2</sup>, Phuong Vuong<sup>2</sup>, Yacine Halfaya<sup>2</sup>, Soufiane Karrakchou<sup>4,2</sup>, Simon Gautier<sup>3</sup>, Paul Voss<sup>4,2</sup>, Jean Paul Salvestrini<sup>2,1</sup> and Abdallah Ougazzaden<sup>4,2</sup>; <sup>1</sup>Georgia Tech Lorraine, France; <sup>2</sup>CNRS, UMI 2958, G T-CNRS, France; <sup>3</sup>Institut Lafayette, France; <sup>4</sup>Georgia Institute of Technology, France.

**EP01.02**

**Electro-Plated Micro Stud Bumps—An Efficient, Scalable Bonding Technology for Flip Chip Mounting of UV LED Dies** Jens Rass<sup>1,2</sup>, Neysha Lobo Ploch<sup>1,2</sup>, Christoph Stölmacker<sup>1</sup>, Andreas Thies<sup>1</sup>, Stefan Hochheim<sup>1</sup>, Frank Schmieder<sup>1</sup>, Anna Mogilatenko<sup>1</sup>, Jan Ruschel<sup>1</sup>, Steffen Knigge<sup>1</sup>, Olaf Krüger<sup>1</sup> and Sven Einfeld<sup>1</sup>; <sup>1</sup>Ferdinand-Braun-Institut, Leibniz-Institut für Höchstfrequenztechnik, Germany; <sup>2</sup>UVphotonics NT GmbH, Germany.

**EP01.03**

**Thermal Conductivity of AlGaIn Layers Grown by MOCVD** Dat Q. Tran<sup>1</sup>, Pitsiri Sukkaew<sup>1</sup>, Hengfang Zhang<sup>1</sup>, Jr-Tai Chen<sup>1</sup>, Motoaki Iwaya<sup>2</sup>, Isamu Akasaki<sup>3</sup>, Bo Monemar<sup>1</sup>, Vanya Darakchieva<sup>1</sup> and Plamen P. Paskov<sup>1</sup>; <sup>1</sup>Linköping University, Sweden; <sup>2</sup>Meijo University, Japan; <sup>3</sup>Nagoya University, Japan.

**EP01.04**

**Effects of Semiconductor Surface Treatments and Dielectric Anneal on the Electrical Characteristics of GaN-Based Metal-Insulator-Semiconductor Devices** Benjamin McEwen<sup>1</sup>, Isra Mahaboob<sup>1</sup>, Kasey Hogan<sup>1</sup>, Emma Rocco<sup>1</sup>, Vincent Meyers<sup>1</sup>, Sean A. Tozier<sup>1</sup>, Aivars Lelis<sup>2</sup>, Ronald Green<sup>2</sup>, Franklin Nouketcha<sup>2</sup> and Fatemeh (Shadi) Shahedipour-Sandvik<sup>1</sup>; <sup>1</sup>SUNY Polytechnic Institute, United States; <sup>2</sup>U.S. Army Research Laboratory, United States.

**EP01.05**

**Compositional Changes Occurring in GaN-on-Diamond Adhesion Layers** Jonathan Anderson<sup>1</sup> and Edwin L. Piner<sup>2</sup>; <sup>1</sup>Texas State University, United States; <sup>2</sup>Texas State University, United States.

**EP01.06**

**Deep Level Traps Introduced in GaN Layers by High-Temperature Thermal Treatment with SiN Cap Layers** Satomu Furuta<sup>1</sup>, Masahiro Horita<sup>1,2</sup>, Nariaki Tanaka<sup>3</sup>, Tohru Oka<sup>4</sup> and Jun Suda<sup>1,2</sup>; <sup>1</sup>Nagoya University, Japan; <sup>2</sup>Institute of Materials and Systems for Sustainability, Japan; <sup>3</sup>Toyoda Gosei, Japan.

**EP01.07**

**A Hybrid Dry/Photoelectrochemical Etch Approach for Complete Removal of AlN Capping Layer and Ohmic Contact Formation to p-GaN Surface** Vincent Meyers, Emma Rocco, Kasey Hogan, Sean A. Tozier, Benjamin McEwen, Isra Mahaboob and Fatemeh (Shadi) Shahedipour-Sandvik; State University of New York Polytechnic Institute, United States.

**EP01.08**

**Electrochemical Characterization on N-Type GaN for Simple Wet-Etching Utilizing S<sub>2</sub>O<sub>8</sub><sup>2-</sup> Containing Solution** Masachika Toguchi<sup>1</sup>, Kazuki Miwa<sup>1</sup>, Fumimasa Horikiri<sup>2</sup>, Noboru Fukuhara<sup>2</sup>, Yoshinobu Narita<sup>2</sup>, Takehiro Yoshida<sup>2</sup> and Taketomo Sato<sup>1</sup>; <sup>1</sup>Hokkaido University, Japan; <sup>2</sup>SCIOCS Co., Ltd., Japan.

SESSION FP01: Poster Session: Bulk Growth

Monday Afternoon, July 8, 2019

6:30 PM - 8:30 PM

Grand Ballroom, Second Floor

**FP01.01**

**Detailed Study of HVPE-GaN Doped with Silicon** Boleslaw Lucznik, Malgorzata Iwinska, Tomasz Sochacki, Mikolaj Amilusik, Michal Fijalkowski, Marcin Zajac, Elzbieta Litwin-Staszewska, Ryszard Piotrkowski, Leszek Konczewicz, Piotr Jaroszynski, Aneta Sidor, Izabella Grzegory and Michal Boćkowski; Institute of High Pressure Physics Polish Academy of Sciences (Unipress), Poland.

**FP01.02**

**The p-T Windows for Crystallization of GaN from Solution in Ga-Fe in Gas and Solid Pressure Media Systems** Bohdan Sadovyi<sup>1</sup>, P. Sadovyi<sup>1</sup>, S. Porowski<sup>1</sup>, I. Petrusha<sup>2</sup>, V. Turkevich<sup>2</sup>, A. Nikolenko<sup>3</sup>, B. Tsykaniuk<sup>3</sup>, V. Strelchuk<sup>3</sup> and Izabella Grzegory<sup>1</sup>; <sup>1</sup>Institute of High Pressure Physics Polish

Academy of Sciences, Poland; <sup>2</sup>V. Bakul Institute for Superhard Materials NASU, Ukraine; <sup>3</sup>V. Lashkariov Institute of Semiconductor Physics NASU, Ukraine.

#### FP01.03

**Near-Colorless Free-Standing Bulk GaN c-Plane Substrates with Excellent Crystal Quality Grown by the Ammonothermal Method** Daryl Key, Edward Letts and Tadao Hashimoto; SixPoint Materials Inc., United States.

#### FP01.04

**Growth Behaviors of Different GaN Crystal Planes in the Basic Ammonothermal Method** Tengkun Li<sup>1</sup>, Guoqiang Ren<sup>1,2</sup>, Xu J. Su<sup>1</sup>, Zongliang Liu<sup>1</sup> and Ke Xu<sup>1,2</sup>; <sup>1</sup>Suzhou Institute of Nano-Tech and Nano-Bionics, Chinese Academy of Sciences, China; <sup>2</sup>Suzhou Nanowin Science and Technology Co., Ltd., China.

#### FP01.05

**Comparison of Stress States and Dislocations in HVPE-AlN Films Grown on Sapphire Substrate with Different Buffer Layer** Xu J. Su<sup>1</sup>, Jun Huang<sup>1</sup> and Ke Xu<sup>1,2</sup>; <sup>1</sup>Suzhou Institute of Nano-Tech and Nano-Bionics, Chinese Academy of Sciences, China; <sup>2</sup>Suzhou Nanowin Science Technology Co., Ltd, China.

#### FP01.06

**Reduction of Dislocation Density and Curvature of GaN Substrates Grown by Hydride Vapor Phase Epitaxy** Jianfeng Wang<sup>1,2</sup>, Yu Xu<sup>1,2</sup>, Demin Cai<sup>2</sup>, Yumin Zhang<sup>1,2</sup>, Mingyue Wang<sup>1,2</sup>, Zongyao Li<sup>2</sup>, Xiaojian Hu<sup>1,2</sup> and Ke Xu<sup>1,2</sup>; <sup>1</sup>Suzhou Institute of Nano-Tech and Nano-Bionics, Chinese Academy of Sciences, China; <sup>2</sup>Suzhou Nanowin Science and Technology Co., Ltd, China.

#### FP01.07

**Characterization of V-Pits in Fe Doped GaN Grown by HVPE** Yumin Zhang<sup>1,2,3</sup>, Jianfeng Wang<sup>1,2</sup>, Demin Cai<sup>2</sup>, Yu Xu<sup>1,2</sup>, Mingyue Wang<sup>1,2</sup>, Xiaojian Hu<sup>1,2</sup> and Ke Xu<sup>1,2</sup>; <sup>1</sup>Suzhou Institute of Nano-tech and Nano-Bionics, Chinese Academy of Sciences, China; <sup>2</sup>Suzhou Nanowin Science and Technology Co., Ltd., China; <sup>3</sup>University of Science and Technology of China, China.

#### FP01.08

**Influence of Dislocation on the Thermal Decomposition of GaN** Yumin Zhang<sup>1,2,3</sup>, Jianfeng Wang<sup>1,2</sup>, Demin Cai<sup>2</sup>, Yu Xu<sup>1,2</sup>, Mingyue Wang<sup>1,2</sup>, Xiaojian Hu<sup>1,2</sup>, Zongyao Li<sup>2</sup> and Ke Xu<sup>1,2</sup>; <sup>1</sup>Suzhou Institute of Nano-tech and Nano-Bionics, Chinese Academy of Sciences, China; <sup>2</sup>Suzhou Nanowin Science and Technology Co., Ltd., China; <sup>3</sup>University of Science and Technology of China, China.

SESSION GP01: Poster Session I: Epitaxial Growth  
Monday Afternoon, July 8, 2019  
6:30 PM - 8:30 PM  
Grand Ballroom, Second Floor

#### GP01.01

**Dispersion-Free Low RF Loss GaN-on-Si Structures Grown on 200 mm Si Substrate Using MOVPE** Ming Zhao<sup>1</sup>, Shane Chang<sup>1,2,3</sup>, Robert Langer<sup>1</sup> and Nadine Collaert<sup>1</sup>; <sup>1</sup>imec, Belgium; <sup>2</sup>KU Leuven, Belgium; <sup>3</sup>National Chiao Tung University, Taiwan.

#### GP01.02

**Nitridation of GaAs Films Obtained by Close-Spaced Vapor Transport Technique** José de Jesús C. Bueno<sup>1</sup>, Godofredo García<sup>1</sup>, Alberto Luna<sup>1</sup>, Fabiola Nieto<sup>2</sup>, Tomás Díaz<sup>2</sup>, Enrique Rosendo<sup>1</sup>, Antonio Coyopol<sup>1</sup>, Román Romano<sup>1</sup>, Crisóforo Morales<sup>1</sup> and Reina Galeazzi<sup>1</sup>; <sup>1</sup>Benemérita Universidad Autónoma de Puebla, Mexico; <sup>2</sup>Benemérita Universidad Autónoma de Puebla, Mexico.

#### GP01.03

**Polarity Control in Hot-Wall MOCVD III-Nitride Epitaxy on On-Axis and Vicinal SiC (000-1) Substrates** Hengfang Zhang<sup>1</sup>, Ingemar Persson<sup>1</sup>, Per Persson<sup>1</sup>, Alyssa Mock<sup>1</sup>, Pitsiri Sukkaew<sup>1</sup>, Jr-Tai Chen<sup>2</sup> and Vanya Darakchieva<sup>1</sup>; <sup>1</sup>Linköping University, Sweden; <sup>2</sup>SweGaN AB, Sweden.

#### GP01.04

**Optimization of GaN Nanowires Reformation Process by MOCVD for Device-Quality GaN Templates** Rosalía Delgado-Carrascon<sup>1</sup>, Dat Q. Tran<sup>1</sup>, Pitsiri Sukkaew<sup>1</sup>, Alyssa Mock<sup>1</sup>, Plamen P. Paskov<sup>1</sup>, Rafal Ciechonski<sup>2</sup>, Jonas Ohlsson<sup>3,4</sup>, Yadan Zhu<sup>3</sup>, Bo Monemar<sup>1</sup>, Lars Samuelson<sup>3</sup> and Vanya Darakchieva<sup>1</sup>; <sup>1</sup>Sweden4Center for III-Nitride Technology C3NiT - Janzén, Linköping University, Sweden; <sup>2</sup>GLO-AB, Ideon Science Park, Sweden; <sup>3</sup>Department of Solid State Physics, Nanolund, LundUniversity, Sweden; <sup>4</sup>Hexagem AB, Sweden.

#### GP01.05

**In<sub>0.1</sub>Ga<sub>0.9</sub>N Alloys Grown by Plasma-Assisted Molecular Beam Epitaxy (PAMBE) with Growth Rates Up to 1.3 μm/hr** Kelsey Jorgensen and James Speck; University of California, Santa Barbara, United States.

#### GP01.06

**Combining Nano-Patterned Sapphire and High Temperature Annealing of AlN for UV LEDs** Sylvia Hagedorn<sup>1</sup>, Sebastian Walde<sup>1</sup>, Nadine Tillner<sup>2</sup>, Ralph-Stephan Unger<sup>1</sup>, Harun H. Solak<sup>3</sup>, Hans-Juergen Lugauer<sup>2</sup> and Markus Weyers<sup>1</sup>; <sup>1</sup>Ferdinand-Braun-Institut Berlin, Germany; <sup>2</sup>Osram Opto Semiconductors GmbH, Germany; <sup>3</sup>EULITHA AG, Switzerland.

#### GP01.07

**Single Crystal Multilayer Nitride, Metal, Oxide Structures on Engineered Silicon for New Generation RF Filters Application** Rytis Dargis<sup>1</sup>, Andrew Clark<sup>1</sup>, Azadeh Ansari<sup>2</sup>, Zhijian Hao<sup>2</sup>, Mingyo Park<sup>2</sup>, DeaGyu Kim<sup>2</sup>, Robert Yanka<sup>1</sup>, Richard Hammond<sup>1</sup>, Mukul Debnath<sup>1</sup> and Rodney Pelzel<sup>1</sup>; <sup>1</sup>IQE Plc, United States; <sup>2</sup>Georgia Institute of Technology, United States.

#### GP01.08

**Optimization of MOCVD Regrown n-GaN** Stefano Leone<sup>1</sup>, Peter Brueckner<sup>1</sup>, Philipp Doering<sup>2</sup>, Theodor Fuchs<sup>1</sup>, Lutz Kirste<sup>1</sup>, Stefan Mueller<sup>1</sup>, Mario Prescher<sup>1</sup>, Ruediger Quay<sup>1</sup> and Oliver Ambacher<sup>1</sup>; <sup>1</sup>Fraunhofer IAF, Germany; <sup>2</sup>Inatech, Germany.

#### GP01.09

**Broad-Band UV Emission from a Two-Dimensional Array of AlGaN Microstructures** Mitsuru Funato, Ken Kataoka and Yoichi Kawakami; Kyoto University, Japan.

#### GP01.10

**Development of Semi-Polar (11-22) GaN for Green Emitters on Si Substrates** X Yu, S H. Shen, X. M. Zhao, C Zhu, P Fletcher, Y Cai, Jie Bai and T Wang; University of Sheffield, United Kingdom.

#### GP01.11

**Plasma-Assisted Atomic Layer Epitaxy of Indium Aluminum Nitride Studied Using *In Situ* Grazing Incidence Small-Angle X-Ray Scattering** Jeffrey M. Woodward<sup>2</sup>, Samantha G. Rosenberg<sup>2</sup>, Scooter D. Johnson<sup>1</sup>, Neeraj Nepal<sup>1</sup>, Zachary R. Robinson<sup>3</sup>, Karl F. Ludwig<sup>4</sup> and Charles R. Eddy Jr.<sup>1</sup>; <sup>1</sup>U.S. Naval Research Laboratory, United States; <sup>2</sup>ASEE (residing at U.S. Naval Research Laboratory), United States; <sup>3</sup>State University of New York at Brockport, United States; <sup>4</sup>Boston University, United States.

#### GP01.12

**Enhanced Strain Relaxation in AlGaIn Layers Grown on Sputter-Based AlN Templates** Yosuke Mogami<sup>1,2</sup>, Shogo Motegi<sup>1,2</sup>, Atsushi Osawa<sup>3</sup>, Kazuto Osaki<sup>3</sup>, Yukitake Tanioka<sup>3</sup>, Atsushi Maeoka<sup>3</sup>, Yuri Itokazu<sup>1,2</sup>, Shunsuke Kuwaba<sup>1,2</sup>, Masafumi Jo<sup>1</sup>, Noritoshi Maeda<sup>1</sup>, Hiroyuki Yaguchi<sup>2</sup> and Hideki Hirayama<sup>1</sup>; <sup>1</sup>RIKEN, Japan; <sup>2</sup>Saitama University, Japan; <sup>3</sup>SCREEN Finetech Solutions Co. Ltd, Japan.

#### GP01.13

**Growth of Lattice-Relaxed InGaIn Thick Films on Patterned Sapphire Substrates by Tri-Halide Vapor Phase Epitaxy** Kentaro Ema, Rio Uei, Mitsuki Kawabe, Hisashi Murakami, Yoshinao Kumagai and Akinori Koukitu; Tokyo University of Agriculture and Technology, Japan.

#### GP01.14

**The Ammonia Predose—A Tool for Controlling the Bow in GaN-on-Si Structures** Alexander M. Hinz<sup>1</sup>, David Wallis<sup>1,2</sup> and Rachel Oliver<sup>1</sup>; <sup>1</sup>University of Cambridge, United Kingdom; <sup>2</sup>University of Cardiff, United Kingdom.

#### GP01.15

**Achieving High-Quality and Coalescence-Free AlN Template on Nano-Patterned Sapphire Substrate by Pre-Planarization Technique** Chia-Yen Huang<sup>1</sup>, Yem-Yeu Chang<sup>2</sup>, Cheng-Yao Huang<sup>3</sup>, Chia-Lung Tsai<sup>1</sup>, Hung-Wei Yen<sup>3</sup>, Yew-Chung Wu<sup>1</sup>, Yi-Keng Fu<sup>1</sup> and Yuh-Renn Wu<sup>1</sup>; <sup>1</sup>Industrial Technology Research Institute, Taiwan; <sup>2</sup>Crystalwise Technology Inc., Taiwan; <sup>3</sup>National Taiwan University, Taiwan.

#### GP01.17

**Pulsed Sputter Deposition of AlN and GaN** Florian Hörich, Christopher Kahrmann, Jürgen Bläsing, Armin Dadgar and André Strittmatter; Otto-von-Guericke University, Germany.

#### GP01.18

**Mechanisms of Intrinsic Carbon Doping During MOVPE of AlN- and GaN-Based Materials** Roman Talalaev and Anna Lobanova; STR Group, Russian Federation.

#### GP01.19

**Shubnikov de-Hass Oscillations of 2DEG in AlN/GaN Heterostructures Grown by Molecular Beam Epitaxy** Liuyun Yang, Wenjie Zhang, Jingyue Wang, Tao Wang, Ding Wang, Xiaosong Wu, Bo Shen and Xinqiang Wang; Peking University, China.

#### GP01.20

**P-Doped GaMnN(As) Epitaxial Layers with High Mn Concentration Grown by MBE** Edyta Piskorska-Hommel<sup>1,2</sup>, Jaroslaw Serafiniczuk<sup>2,3</sup>, Milosz



Grodzicki<sup>2,4</sup>, Dominika Majchrzak<sup>1,2</sup>, Jean-Guy Rousset<sup>3</sup> and Detlef Hommel<sup>2,4</sup>; <sup>1</sup>Institute of Low Temperature and Structure Research PAS W. Trzebiatowski Institute, Poland; <sup>2</sup>PORT Polish Center for Technology Development, Poland; <sup>3</sup>Faculty of Fundamental Problems of Technology, Wrocław University of Science and Technology, Poland; <sup>4</sup>Faculty of Physics and Astronomy, University of Wrocław, Poland.

#### GP01.21

##### **Growth by PAMBE and Characterization of GaN Doped with As, Towards an Efficient p-Type Doping of III-N Semiconductors for Deep UV Emitters**

Jean-Guy Rousset<sup>1</sup>, Ciechanowicz Paulina<sup>1,2</sup>, Milosz Grodzicki<sup>1,2</sup>, Edyta Piskorska-Hommel<sup>1,3</sup>, Jaroslaw Serafinczuk<sup>1,4</sup>, Ewelina Zdanowicz<sup>1,5</sup>, Robert Kudrawiec<sup>1,5</sup> and Detlef Hommel<sup>1,2</sup>; <sup>1</sup>PORT - Polish Center for Technology Development, Poland; <sup>2</sup>Faculty of Physics and Astronomy, University of Wrocław, Poland; <sup>3</sup>Institute of Low Temperature and Structure Research, Polish Academy of Sciences, Poland; <sup>4</sup>Faculty of Microsystems Electronics and Photonics, Wrocław University of Science and Technology, Poland; <sup>5</sup>Faculty of Fundamental Problems of Technology, Wrocław University of Science and Technology, Poland.

#### GP01.22

##### **Dramatic Improvement in the Surface Quality of High Temperature Annealed c-Plane (0001) Sapphire Substrates and Its Impact on the Quality of AlN Films from 1 nm to 2 μm**

Habib Ahmad, Evan A. Clinton, Christopher M. Matthews, Zachary Engel and William A. Doolittle; Georgia Institute of Technology, United States.

#### GP01.23

**PAMBE Growth of 1- or 2-ML Thick In(Ga)N/GaN Quantum Wells** Chen Li, Yurii Maidaniuk, Andrian Kuchuk, Yuriy Mazur, Mourad Benamara, Morgan Ware and Gregory Salamo; Institute for Nanoscience and Engineering, United States.

#### GP01.25

##### **Optimizing Underlayers for Efficient GaInN/GaN Quantum Well Structures—The Delicate Interplay of Hydrogen and Indium**

Philipp Horenburg<sup>1</sup>, Fedor Alexej Ketzer<sup>1</sup>, Silke Wolter<sup>1</sup>, Torsten Langer<sup>1</sup>, Philipp Henning<sup>1,2</sup>, Shawutjiang (Savutjan) Sidikejiang (Sidik)<sup>1</sup>, Heiko Bremers<sup>1,2</sup>, Uwe Rossow<sup>1</sup> and Andreas Hangleiter<sup>1,2</sup>; <sup>1</sup>Braunschweig University of Technology, Germany; <sup>2</sup>Braunschweig University of Technology, Germany.

#### GP01.26

##### **Suppressing the Compositional Nonuniformity of AlGaIn Grown on HVPE-AlN Template with Large Macro-Steps**

Xiaojuan Sun<sup>1,2</sup>, Ke Jiang<sup>1,2</sup>, Yuping Jia<sup>1,2</sup>, Zhiming Shi<sup>1,2</sup>, Shanli Zhang<sup>1,2</sup> and Dabing Li<sup>1,2</sup>; <sup>1</sup>Changchun Institute of Optics, Fine Mechanics and Physics, Chinese Academy of Sciences, China; <sup>2</sup>University of Chinese Academy of Sciences, China.

#### GP01.27

**Decreasing the Threading Dislocation Density of GaN Films by Preferentially Passivating the Etched Defect Pits** Ziguang Ma, Wei Hu and Hong Chen; Institute of Physics, Chinese Academy Sciences, China.

#### GP01.28

**Epitaxial Lateral Overgrowth of GaN on Partially Crystallized Cavity Engineered Sapphire Substrate** Jeonghwan Jang<sup>1</sup>, Jungel Ryu<sup>1</sup>, Duiyoung Yang<sup>1</sup>, Daehan Choi<sup>1</sup>, Seungmin Lee<sup>1</sup>, Daeyoung Moon<sup>1</sup>, Giwoong Kim<sup>1</sup>, Jehong Oh<sup>1</sup>, Yongjo Park<sup>1</sup> and Euijoon Yoon<sup>1,2,3</sup>; <sup>1</sup>Seoul National University, Korea (the Republic of); <sup>2</sup>Research Institute of Advanced Materials, Korea (the Republic of); <sup>3</sup>Inter-University Semiconductor Research Center, Korea (the Republic of).

#### GP01.29

**Nitrogen-Rich Condition for High Efficiency P-Type Doping of GaN by Plasma-Assisted Molecular Beam Epitaxy** Haipeng Tang and Sharif Sadaf; National Research Council Canada, Canada.

#### GP01.30

**Simple and Accurate Modelling and Prediction of AlGaIn MOVPE Growth for HEMT Structures** Matthew Charles, Joel Kanyandekwe and Matthieu Lafossas; CEA-LETI, France.

SESSION HP01: Poster Session I: Nanostructures and Nano-Devices  
Monday Afternoon, July 8, 2019  
6:30 PM - 8:30 PM  
Grand Ballroom, Second Floor

#### HP01.01

**The Influence of AlN Buffer Layer on the Growth of Self-Assembled GaN Nanocolumns on Graphene** Andreas Liudi Mulyo<sup>1,2</sup>, Mohana Krishnappa Rajpalke<sup>1</sup>, Per Erik Vullum<sup>3</sup>, Helge Weman<sup>1</sup>, Katsumi Kishino<sup>2,4</sup> and Bjorn-Ove Fimland<sup>1</sup>; <sup>1</sup>Norwegian University of Science and Technology (NTNU), Norway; <sup>2</sup>Sophia University, Japan; <sup>3</sup>SINTEF Industry, Norway; <sup>4</sup>Sophia University, Japan.

#### HP01.02

**Displacement Talbot Lithography for Nano-Engineering of III-Nitride Materials** Pierre-Marie Coulon<sup>1</sup>, Benjamin Damilano<sup>2</sup>, Blandine Alloing<sup>2</sup>, Sebastian Walde<sup>3</sup>, Johannes Enslin<sup>4</sup>, Gunnar Kusch<sup>5</sup>, Pierre Chausse<sup>1</sup>, Stephane Vézian<sup>2</sup>, Sylvia Hagedorn<sup>3</sup>, Tim Wernicke<sup>4</sup>, Jean Massies<sup>2</sup>, Jesus Zuniga-Perez<sup>2</sup>, Markus Weyers<sup>5</sup>, Michael Kneissl<sup>4,3</sup>, Carol Trager-Cowan<sup>5</sup>, Robert Martin<sup>5</sup> and Philip Shields<sup>1</sup>; <sup>1</sup>University of Bath, United Kingdom; <sup>2</sup>Université Côte d'Azur, CNRS, CRHEA, France; <sup>3</sup>Ferdinand-Braun-Institut, Germany; <sup>4</sup>Technische Universität Berlin, Institute of Solid State Physics, Germany; <sup>5</sup>University of Strathclyde, United Kingdom.

#### HP01.03

**Structural Stability of GaN Nanowires in Aqueous Electrolytes Under High Optical Excitation Intensities** Florian Pantle, Max Kraut, Julia Winnerl, Martin Hetzl, Felix Eckmann, Ian D. Sharp and Martin Stutzmann; Walter Schottky Institute, Germany.

#### HP01.04

**An Alternative Route for Low-Temperature Growth of Crystalline III-Nitride Thin Films and Nanostructures—Hollow-Cathode Plasma-Assisted Atomic Layer Deposition** Necmi Biyikli<sup>1</sup>, Adnan Mohammad<sup>1</sup>, Deepa Shukla<sup>2</sup> and Saidjafarzoda Ilhom<sup>1</sup>; <sup>1</sup>University of Connecticut, United States; <sup>2</sup>University of Connecticut, United States.

#### HP01.05

**Ferroelectric Polarization Switching Behavior of Hf<sub>0.5</sub>Zr<sub>0.5</sub>O<sub>2</sub> on Gallium Nitride HEMT Heterostructures** Chunlei Wu, Hansheng Ye, Benjamin Grisafe, Suman Datta and Patrick Fay; University of Notre Dame, United States.

#### HP01.06

**High Linearity Double-Channel Al(In)GaN/GaN FinFET with High On-Current** Jun-Hyeok Lee, Jeong-Min Ju, Kyung-Wan Kim, Jeong-Gil Kim, Dong-Hyeok Son, Seung-Hyeon Kang, Yong-Soo Lee and Jung-Hee Lee; Kyungpook National University, Korea (the Republic of).

#### HP01.07

**Boosting Rabi Splitting of Exciton-Polaritons in a GaN Microrod by Manipulating Optical Modes** Guo Yu, Junchao Li, Menglai Lei, Hua Zong and Xiaodong Hu; Peking University, China.

#### HP01.08

**Wafer-Scale MoS<sub>2</sub>/GaN Heterostructure Growth Using Metalorganic Chemical Vapor Deposition** Taemyung Kwak, Juhun Lee, Hyunwoo Jang, Byeongchan So, Ujho Choi and Okhyun Nam; Korea Polytechnic University, Korea (the Republic of).

#### HP01.09

**Selective Area Growth of GaN Nanowires on Silicon Carbide** Theresa Hoffmann<sup>1</sup>, Andrea Wieland<sup>1</sup>, Julia Winnerl<sup>1</sup>, Markus Döblinger<sup>2</sup>, Sonja Match<sup>1</sup> and Martin Stutzmann<sup>1</sup>; <sup>1</sup>Walter Schottky Institute, Germany; <sup>2</sup>Ludwig-Maximilians-Universität München, Germany.

#### HP01.10

**Analysis of GaN Vertical Nanowire Transistors with Negative Transconductance as Well as Contact Potential Near Drain** Dong-Hyeok Son, Jeong-Gil Kim, Jun-Hyeok Lee, Hyeoun-Su Lee, Yong-Soo Lee and Jung-Hee Lee; Kyungpook National University, Korea (the Republic of).

#### HP01.11

**The Study of Size Dependent Carrier Capture and Recombination Rate of InGaN Nano-Disk in a Wire Array by Ultrafast Transient Absorption Spectroscopy** Pratim K. Saha, Shonal Chouksey, Vikas Pendem, Tarni Aggarwal, Ankit Udai, Swaroop Ganguly and Dipankar Saha; Indian Institute of Technology Bombay, India.

#### HP01.12

**Strongly Linear Polarized Emission from InGaIn Quantum Wire Grown by MOCVD on c-Axis GaN Template** Hwan-Seop Yeo, Kwanjae Lee, Yong Chul Sim and Yong-Hoon Cho; Korea Advanced Institute of Science and Technology, Korea (the Republic of).

#### HP01.13

**Lattice-Matched Nano/Mesoporous AlGaIn DBRs for Vertical-Cavity GaN Nanowire Lasers on Si Substrates** Mahmoud Behzadizad<sup>1</sup>, Morteza Monavarian<sup>1</sup>, Neal Wostbrock<sup>1</sup>, Saadat Mishkat-UI-Masabih<sup>1</sup>, Alejandro Manjavacas<sup>2</sup>, Daniel Feezell<sup>1</sup> and Tito Busani<sup>1</sup>; <sup>1</sup>University of New Mexico, United States; <sup>2</sup>University of New Mexico, United States.

#### HP01.14

**Birefringence of Subsurface Porous GaN Multilayers** Alexander Hinz, Peter Griffin, Tongtong Zhu, Rachel Oliver and Boning Ding; University of Cambridge, United Kingdom.

SESSION IP01: Poster Session I: Optical and Electronic Properties  
Monday Afternoon, July 8, 2019  
6:30 PM - 8:30 PM  
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#### IP01.01

**Direct Determination of Carrier Concentration in InGaN/GaN Quantum Wells by Photomodulated Reflectivity—Evidence that Efficiency Droop Process has a Greater than 3<sup>rd</sup> Power Dependence on Carrier Concentration** Matthew Halsall<sup>1</sup>, Iain Crowe<sup>1</sup>, Rachel Oliver<sup>3</sup>, Menno Kappers<sup>3</sup> and Colin J. Humphreys<sup>2</sup>; <sup>1</sup>The University of Manchester, United Kingdom; <sup>2</sup>Queen Mary University of London, United Kingdom; <sup>3</sup>University of Cambridge, United Kingdom.

#### IP01.02

**Optical and Structural Properties of One-Directionally Lattice-Matched (11-22) Oriented AlInN/GaN Heterostructures** Shawutijiang (Savutjan) Sidikejiang (Sidik)<sup>1</sup>, Philipp Henning<sup>1,2</sup>, Philipp Horenburg<sup>1</sup>, Heiko Bremers<sup>1,2</sup>, Uwe Rossow<sup>1</sup>, Ferdinand Scholz<sup>2</sup> and Andreas Hangleiter<sup>1,2</sup>; <sup>1</sup>Braunschweig University of Technology, Germany; <sup>2</sup>Braunschweig University of Technology, Germany; <sup>3</sup>University of Ulm, Germany.

#### IP01.03

**Temperature Dependent Capacitance-Voltage Spectroscopy of Self-Assembled GaN Quantum Dot Ensembles** Carlo A. Sgroi<sup>1</sup>, Julien Brault<sup>2</sup>, Jean-Yves Duboz<sup>2</sup>, Sébastien Chenot<sup>2</sup>, Arne Ludwig<sup>1</sup> and Andreas D. Wieck<sup>1</sup>; <sup>1</sup>Ruhr-Universität Bochum, Germany; <sup>2</sup>CNRS – CRHEA, France.

#### IP01.04

**Photoluminescence and Structural Properties of GaN/AlN SLs—Quantum Well Width vs Built-in Electric Field Effects** Andrian Kuchuk<sup>1</sup>, Yuriy Mazur<sup>1</sup>, Yuri Mайданиuk<sup>1</sup>, Pijush Ghosh<sup>2</sup>, Hryhorii Stanchu<sup>1</sup>, Mourad Benamara<sup>1</sup>, Morgan Ware<sup>1</sup> and Gregory Salamo<sup>1</sup>; <sup>1</sup>Institute for Nanoscience and Engineering, United States; <sup>2</sup>Electrical Engineering Department, United States.

#### IP01.05

**Electrical Properties of GaN Schottky Barrier Diodes with 14 MeV Fast Neutron Irradiation** Yuan Ren<sup>1,3</sup>, Xing Lu<sup>1,2</sup>, Huaxing Jiang<sup>2</sup>, Bajun Zhang<sup>1</sup>, Zhitao Chen<sup>3</sup> and Kei May Lau<sup>2</sup>; <sup>1</sup>Sun Yat-sen University, China; <sup>2</sup>Hong Kong University of Science and Technology, Hong Kong; <sup>3</sup>Guangdong Institute of Semiconductor Industrial Technology, China.

#### IP01.06

**All-Optical Determination of Free-Carrier Concentration and Composition in Cubic GaN and AlGaIn** Elias Baron<sup>1</sup>, Michael Deppe<sup>2</sup>, Fabian Tacke<sup>2</sup>, Martin Feneberg<sup>1</sup>, Donat J. As<sup>2</sup> and Rüdiger Goldhahn<sup>1</sup>; <sup>1</sup>Otto-von-Guericke-Universität Magdeburg, Germany; <sup>2</sup>University of Paderborn, Germany.

#### IP01.07

**Two-Wavelength Excited Photoluminescence Study of Upconversion Photoluminescence from GaPN Alloys** Hiroyuki Yaguchi<sup>1</sup>, Wataru Takahashi<sup>1</sup>, Kengo Takamiya<sup>1</sup>, Shuhei Yagi<sup>1</sup>, Norihiko Kamata<sup>1</sup>, Yuji Hazama<sup>2</sup> and Hidefumi Akiyama<sup>2</sup>; <sup>1</sup>Saitama University, Japan; <sup>2</sup>The University of Tokyo, Japan.

#### IP01.08

**Influence of the Strain Relaxation on the Optical Property of AlGaIn Quantum Wells** Yuri Itokazu<sup>1,2</sup>, Yosuke Mogami<sup>1,2</sup>, Shunsuke Kuwaba<sup>1,2</sup>, Shogo Motegi<sup>1,2</sup>, Atsushi Osawa<sup>1</sup>, Kazuto Osaki<sup>1</sup>, Yukitake Tanioka<sup>3</sup>, Masafumi Jo<sup>1</sup>, Norihiko Kamata<sup>2</sup> and Hideki Hirayama<sup>1</sup>; <sup>1</sup>RIKEN, Japan; <sup>2</sup>Saitama University, Japan; <sup>3</sup>SCREEN Finetech Solutions Co. Ltd, Japan.

#### IP01.09

**Electron Beam Induced Current Study of Defects in InGaIn LEDs and Laser Diode Structures** Lucja Marona<sup>1,2</sup>, Dario Schiavon<sup>1,2</sup>, Szymon Grzanka<sup>1,2</sup> and Piotr Perlin<sup>1,2</sup>; <sup>1</sup>Institute of High Pressure Physics, Poland; <sup>2</sup>TopGaN, Poland.

#### IP01.10

**Deep Level Luminescence of HVPE Grown GaN by Below-Bandgap Photo-Excitation** Daisuke Uehara<sup>1</sup>, Moe Kikuchi<sup>1</sup>, Bei Ma<sup>1</sup>, Ken Morita<sup>1</sup>, Hideto Miyake<sup>2</sup> and Yoshihiro Ishitani<sup>1</sup>; <sup>1</sup>Chiba University, Japan; <sup>2</sup>Mie University, Japan.

#### IP01.11

**Characterization of Potential Fluctuations and Optical Constants in Al<sub>x</sub>In<sub>1-x</sub>N Alloys Grown on C-Plane GaN Substrate** Daichi Imai<sup>1</sup>, Tomoaki Yamaji<sup>1</sup>, Makoto Miyoshi<sup>2</sup>, Tetsuya Takeuchi<sup>1</sup> and Takao Miyajima<sup>2</sup>; <sup>1</sup>Meijo University, Japan; <sup>2</sup>Nagoya Institute of Technology, Japan.

#### IP01.12

**Direct Observation of the Carrier Behavior by Kelvin Probe Force Microscopy** Yuping Jia<sup>1</sup>, Xiaojuan Sun<sup>1</sup>, Cuihong Kai<sup>1</sup>, Zhiming Shi<sup>1</sup> and Dabing Li<sup>1,2</sup>; <sup>1</sup>Changchun Institute of Optics, Fine Mechanics and Physics,

Chinese Academy of Sciences, China; <sup>2</sup>University of Chinese Academy of Sciences, China.

#### IP01.13

**Interfacial Polarization of Thin Alq<sub>3</sub>, Gaq<sub>3</sub> and Erq<sub>3</sub> Films on GaN(0001)** Antoni Ciszewski, Milosz Grodzicki, Jakub Sito and Piotr Mazur; University of Wrocław, Poland.

#### IP01.14

**Impact of Substrate Misorientation on Nanoscale Optical Properties of InGaN/GaN Quantum Wells** Thomas Weatherley, Wei Liu, Camille Haller, Jean-François Carlin, Raphaël Butté and Nicolas Grandjean; EPFL, Switzerland.

#### IP01.15

**Double Differential Femto-Second Transient Absorption Spectroscopy for Real-Time Probing of Near-Surface Carrier and Photon Dynamics in Semiconductors** Shonal Chouksey and Dipankar Saha; Indian Institute of Technology Bombay, India.

#### IP01.16

**Effect of High Temperature Annealing on the Structural and Optical Effects of AlN Grown by Molecular Beam Epitaxy** Eric T. Reid, David A. Laleyan, Ping Wang and Zetian Mi; University of Michigan–Ann Arbor, United States.

#### IP01.17

**Surface Electronic Properties of Si-Doped AlGaIn and the Thermionic Emission Characteristics with Adsorption of Alkali Metal Atoms** Shigeo Kimura<sup>1</sup>, Hisashi Yoshida<sup>1</sup>, Shota Uchida<sup>2</sup> and Akihisa Ogino<sup>2</sup>; <sup>1</sup>Toshiba, Japan; <sup>2</sup>Shizuoka University, Japan.

#### IP01.18

**First-Principles Calculation of Band Gaps of Al<sub>x</sub>In<sub>1-x</sub>N Alloys and Short Period Al<sub>1-x</sub>In<sub>x</sub>N/Al<sub>1-x</sub>In<sub>x</sub>N Superlattices** Takahiro Kawamura<sup>1</sup>, Yuma Fujita<sup>1</sup>, Yuya Hamaji<sup>1</sup>, Toru Akiyama<sup>1</sup>, Yoshihiro Kangawa<sup>2</sup>, Izabela Gorczyca<sup>3</sup>, Tadeusz Suski<sup>3</sup>, Malgorzata Wierzbowska<sup>3</sup> and Stanislaw Krukowski<sup>3</sup>; <sup>1</sup>Mie University, Japan; <sup>2</sup>Kyushu University, Japan; <sup>3</sup>Institute of High Pressure Physics, Poland.

#### IP01.19

**Optical Properties of Rare Earth Nitrides** Muhammad Azeem<sup>1,2</sup>; <sup>1</sup>University of Sharjah, United Arab Emirates; <sup>2</sup>Victoria University of Wellington, New Zealand.

#### IP01.20

**Effects of 3 MeV Proton Radiation on Ultrawide Bandgap Aluminum Nitride Schottky Barrier Diodes** Jossue Montes, Houqiang Fu, Tsung-Han Yang, Hong Chen, Xuanqi Huang, Kai Fu, Izak Baranowski and Yuji Zhao; Arizona State University, United States.

#### IP01.21

**Electrical Characterization of Vertically Conducting GaN-on-Si Heterojunctions** Christopher M. Matthews, Evan A. Clinton and William A. Doolittle; Georgia Institute of Technology, United States.

SESSION JP01: Poster Session I: Defect Characterization and Engineering  
Monday Afternoon, July 8, 2019  
6:30 PM - 8:30 PM  
Grand Ballroom, Second Floor

#### JP01.01

**Issues in the Extraction by X-Ray Diffraction of Threading Dislocations Density in GaN Films Grown on Silicon Substrate** Victor R. Yon, Patrice Gergaud, Emmanuel Nolot and Matthew Charles; CEA, France.

#### JP01.02

**Behavior of Dislocations Propagating from GaN Substrate to Epitaxial Layer** Sho Inotsume<sup>1,2</sup>, Nobuhiko Kokubo<sup>1,2,3</sup>, Hisashi Yamada<sup>2</sup>, Shoichi Onda<sup>1</sup>, Jun Kojima<sup>1</sup>, Junji Ohara<sup>1,4</sup>, Shunta Harada<sup>1</sup>, Miho Tagawa<sup>1</sup> and Toru Ujihara<sup>1,2</sup>; <sup>1</sup>Nagoya Graduate Schools, Japan; <sup>2</sup>AIST GaN-OIL, Japan; <sup>3</sup>Current affiliation: Hitachi, Ltd, Japan; <sup>4</sup>Current affiliation: DENSO Corporation, Japan.

#### JP01.04

**DLTS Investigation of Transient Capacitance and Trap States on p-GaN Gate HEMT Structures** Song Yang<sup>1</sup>, Sen Huang<sup>2</sup>, Jin Wei<sup>1</sup>, Yuru Wang<sup>1</sup>, Zheyang Zheng<sup>1</sup>, Jiabei He<sup>1</sup> and Kevin J. Chen<sup>1</sup>; <sup>1</sup>The Hong Kong University of Science and Technology, Hong Kong; <sup>2</sup>Institute of Microelectronics, Chinese Academy of Sciences, China.

**JP01.05**

**Annealing Behavior of Deep Levels in Carbon Implanted n-GaN** Giovanni Alfieri and Vinoth K. Sundaramoorthy; ABB, Switzerland.

**JP01.06**

**Multilateral Investigation of Electrical and Microstructural Properties of Threading Dislocations in Na-Flux-Grown GaN Crystals** Takeaki Hamachi<sup>1</sup>, Tetsuya Tohei<sup>1</sup>, Masayuki Imanishi<sup>2</sup>, Yusuke Mori<sup>2</sup> and Akira Sakai<sup>1</sup>; <sup>1</sup>Osaka University, Japan; <sup>2</sup>Osaka University, Japan.

**JP01.07**

**GaN Surface Sputter Damage Investigated Using Deep-Level Transient Spectroscopy** Xiaoyan Tang<sup>1</sup>, Simon Hammersley<sup>1</sup>, Vladimir Markevich<sup>1</sup>, Iain Crowe<sup>1</sup>, Ian Hawkins<sup>1</sup>, Trevor Martin<sup>2</sup>, Tony Peaker<sup>1</sup> and Matthew Halsall<sup>1</sup>; <sup>1</sup>University of Manchester, United Kingdom; <sup>2</sup>IQE, United Kingdom.

**JP01.08**

**Surface States in AlGaIn/GaN High Electron Mobility Transistors—Qualitative Profiles from Channel Photocurrent Spectroscopy** Yury Turkulets and Ilan Shalish; Ben Gurion University in the Negev, Israel.

**JP01.09**

**Defects Characterization of Mg Implanted Homoepitaxial GaN on High Quality GaN Substrates** Yekan Wang<sup>1</sup>, Kenny Huynh<sup>1</sup>, Tingyu Bai<sup>1</sup>, Mathew H. Breckenridge<sup>2</sup>, James Tweedie<sup>3</sup>, Michal Boćkowski<sup>4</sup>, Yuzi Liu<sup>5</sup>, Ramón Collazo<sup>2</sup>, Zlatko Sitar<sup>2</sup> and Mark Goorsky<sup>1</sup>; <sup>1</sup>University of California Los Angeles, United States; <sup>2</sup>North Carolina State University, United States; <sup>3</sup>Adroit Materials, Inc, United States; <sup>4</sup>Institute of High Pressure Physics, Poland; <sup>5</sup>Argonne National Laboratory, United States.

**JP01.10**

**The Impact Of Point Defects Present in He Implanted N-Type and P-Type GaN Layers on Thermal Decomposition of InGaIn/GaN QWs in Blue and Green LED and Laser Diodes Emitters** Mikolaj Grabowski<sup>1</sup>, Ewa Grzanka<sup>1,2</sup>, Szymon Grzanka<sup>1,2</sup>, Artur Lachowski<sup>1,6</sup>, Julita Smalc-Koziorowska<sup>1,2</sup>, Robert Czernecki<sup>1,2</sup>, Roman Hrytsak<sup>1,3</sup>, Grzegorz Gawlik<sup>4</sup>, Andrzej Turowski<sup>4,5</sup> and Mike Leszczynski<sup>1,2</sup>; <sup>1</sup>Institute of High Pressure Physics Polish Academy of Sciences, Poland; <sup>2</sup>Top-GaN Ltd, Poland; <sup>3</sup>University of Rzeszow, Poland; <sup>4</sup>Institute of Electronic Materials Technology, Poland; <sup>5</sup>Institute of Electron Technology, Poland; <sup>6</sup>Warsaw University of Technology, Poland.

**JP01.11**

**Microstructural and Compositional Analysis of N-Polar GaN:Mg Hillcock Structures** Emma Rocco<sup>1</sup>, Isra Mahaboob<sup>1</sup>, Kasey Hogan<sup>1</sup>, Sean A. Tozier<sup>1</sup>, Vincent Meyers<sup>1</sup>, Benjamin McEwen<sup>1</sup>, Olivia Licata<sup>2</sup>, Baishakhi Mazumder<sup>2</sup>, Jamie Hart<sup>3</sup>, Mitra Taheri<sup>3</sup>, Michael Reshchikov<sup>4</sup> and Fatemeh (Shadi) Shahedipour-Sandvik<sup>1</sup>; <sup>1</sup>SUNY Polytechnic Institute, Colleges of Nanoscale Science and Engineering, United States; <sup>2</sup>University at Buffalo, United States; <sup>3</sup>Drexel University, United States; <sup>4</sup>Virginia Commonwealth University, United States.

**JP01.12**

**Electronic Properties of GaN Nanopipe Threading Dislocation with M-Plane Surface** Takashi Nakano<sup>1</sup>, Kenta Chokawa<sup>1</sup>, Masaaki Araidai<sup>2,1</sup>, Kenji Shiraiishi<sup>2,1</sup>, Atsushi Oshiyama<sup>2</sup>, Shigeoyoshi Usami<sup>1</sup>, Akira Kusaba<sup>3</sup>, Yoshihiro Kangawa<sup>4,2</sup>, Atsushi Tanaka<sup>2</sup>, Yoshio Honda<sup>2,1</sup> and Hiroshi Amano<sup>2,1</sup>; <sup>1</sup>Graduate School of Engineering, Nagoya University, Japan; <sup>2</sup>Institute of Materials and Systems for Sustainability, Nagoya University, Japan; <sup>3</sup>Graduate School of Engineering, Kyushu University, Japan; <sup>4</sup>Research Institute for Applied Mechanics Kyushu University, Japan.

**JP01.13**

**Transient Hall Effect Characterization of Non-Exponential Photocarrier Decay in AlGaIn/GaN Heterostructures** David R. Daughton, BoKuai Lai and Jeffrey Lindemuth; Lake Shore Cryotronics, United States.

**JP01.14**

**Characteristics of Proton Irradiated AlGaIn/GaN HEMTs Structures** Jaime Freitas; U.S. Naval Research Laboratory, United States.

SESSION KP01: Poster Session: Structural Analysis  
Monday Afternoon, July 8, 2019  
6:30 PM - 8:30 PM  
Grand Ballroom, Second Floor

**KP01.01**

**Correlation Between Surface Nanostructure and Luminescence in Mg-Doped GaN Layers Grown on Miscut GaN Substrates** Po-Yi Su<sup>1</sup>, Hanxiao Liu<sup>1</sup>, Shuo Wang<sup>1</sup>, Hongpo Hu<sup>2</sup>, Binzhong Dong<sup>2</sup>, Zhihao Wu<sup>2</sup>, Jiangbo Wang<sup>2</sup>, Rong Liu<sup>2</sup> and Fernando Ponce<sup>1</sup>; <sup>1</sup>Arizona State University, United States; <sup>2</sup>HC SemiTek Corporation, China.

**KP01.02**

**Analysis of Highly Si-Doped GaN Using Various Lattice Vibration Modes Observed by Infrared and Raman Spectroscopy** Bei Ma; Chiba University, Japan.

**KP01.03**

**Observation of Lattice-Plane Bending Angle Modulation of Mg-Doped GaN Homo-Epitaxy by X-Ray Diffraction Topography** Jaemyung Kim<sup>1</sup>, Okkyun Seo<sup>1</sup>, Chulho Song<sup>2</sup>, Satoshi Hiroi<sup>1</sup>, Yanna Chen<sup>3</sup>, Yoshihiro Irokawa<sup>4</sup>, Toshihide Nabatame<sup>4</sup>, Yasuo Koide<sup>4</sup> and Osami Sakata<sup>1</sup>; <sup>1</sup>National Institute for Materials Science, Japan; <sup>2</sup>NISSAN ARC, LTD., Japan; <sup>3</sup>Northwestern University, United States; <sup>4</sup>National Institute for Materials Science, Japan.

**KP01.04**

**Structural Analyses of GaInN Films Grown at Different Temperatures on (0001)GaN/a-Al<sub>2</sub>O<sub>3</sub> Templates by RF-MBE** Soichiro Ohno<sup>1</sup>, Tomohiro Yamaguchi<sup>1</sup>, Tsutomu Araki<sup>2</sup>, Tooru Honda<sup>1</sup>, Takeyoshi Onuma<sup>1</sup>, Hideki Hashimoto<sup>1</sup>, Yusuke Nakajima<sup>1</sup>, Hiroki Hirukawa<sup>1</sup> and Ryoosuke Yoshida<sup>1</sup>; <sup>1</sup>Kogakuin University, Japan; <sup>2</sup>Ritsumeikan university, Japan.

**KP01.05**

**Mechanical Stress Mapping of GaN and AlInGaP Films by Raman Scattering Spectroscopy for Characterization of LEDs** David M. Miller, Darren Dunphy, Xiaoru Guo, Gregory Stone and Sungwook Huh; Lumileds, United States.

SESSION MP01: Poster Session I: New Materials and Device Concepts

Monday Afternoon, July 8, 2019

6:30 PM - 8:30 PM

Grand Ballroom, Second Floor

**MP01.01**

**Efficient Hybrid Organic/Inorganic P-N White Light-Emitting Diodes with 4,4'-cyclohexane-1,1-diyldis[N,N-bis(4-methylphenyl)aniline] as Hole Transport Layer** Danbei Wang<sup>1</sup>, Bin Liu<sup>1</sup>, Hongmei Zhang<sup>2</sup>, Hong Zhao<sup>1</sup>, Tao Tao<sup>1</sup>, Zili Xie<sup>1</sup>, Rong Zhang<sup>1,3</sup> and Youdou Zheng<sup>1</sup>; <sup>1</sup>Nanjing University, China; <sup>2</sup>Institute of Advanced Materials (IAM), Nanjing University of Posts and Telecommunications, China; <sup>3</sup>Xiamen University, China.

**MP01.02**

**Boron Rich B(Al)N Alloys Grown by MOVPE** Adama Mballo<sup>1</sup>, Phuong Vuong<sup>1</sup>, Tinh Tran<sup>2</sup>, Suresh Sundaram<sup>1,3,4</sup>, Yacine Halfaya<sup>1</sup>, Feras AlQatari<sup>2</sup>, Xiao Tang<sup>2</sup>, Xiaohang Li<sup>2</sup>, Paul Voss<sup>1,4</sup> and Abdallah Ougazzaden<sup>1,4</sup>; <sup>1</sup>CNRS, UMI 2958, G T - CNRS, France; <sup>2</sup>King Abdullah University of Science and Technology, Saudi Arabia; <sup>3</sup>GT Lorraine, France; <sup>4</sup>Georgia Institute of Technology, France.

**MP01.03**

**Structural and Electronic Properties of the V-V Compounds Isoelectronic to GaN and Isostructural to Gray Arsenic** Zhao Yang, Dan Han and Shiyu Chen; East China Normal University, China.

**MP01.04**

**Proposal of N-Polar (Al)GaIn/AlN High Electron Mobility Transistor and its Heteroepitaxy** Tadatashi Ito<sup>1</sup>, Narihito Okada<sup>1</sup>, Ryota Sakamoto<sup>1</sup>, Tatsuya Isono<sup>1</sup>, Yongzhao Yao<sup>2</sup>, Yukari Ishikawa<sup>2</sup> and Kazuyuki Tadatomo<sup>1</sup>; <sup>1</sup>Yamaguchi University, Japan; <sup>2</sup>Japan Fine Ceramics Center (JFCC), Japan.

**MP01.05**

**Growth of AlN Barriers in Al/AlN/Al SIS Josephson Junctions by Low Temperature Atomic Layer Epitaxy** Charles R. Eddy Jr.<sup>1</sup>, Daniel J. Pennachio<sup>2</sup>, Joon S. Lee<sup>2</sup>, Anthony McFadden<sup>2</sup>, Samantha G. Rosenberg<sup>3,1</sup>, Yu H. Chang<sup>2</sup> and Chris J. Palmström<sup>2</sup>; <sup>1</sup>Naval Research Laboratory, United States; <sup>2</sup>University of California Santa Barbara, United States; <sup>3</sup>American Society for Engineering Education, United States.

**MP01.06**

**GaN/AlInO Waveguide for Visible Light Communications** Rebecca M. Lentz, Matthew R. Peart and Jonathan J. Wierer; Lehigh University, United States.

**MP01.07**

**Insights into Nucleation and Growth of Thermodynamically Controlled CVD Growth of Hexagonal Boron Nitride (h-BN)** Ankit Rao and Srinivasan Raghavan; Indian Institute of Science, India.

# TUESDAY PRESENTATIONS

\* Invited Paper

SESSION A03: Efficiency in Light Emitters  
Session Chairs: Yasufumi Fujiwara and Yoichi Kawakami  
Tuesday Morning, July 9, 2019  
Evergreen Ballroom E-F, Lobby Level

8:30 AM \*A03.01

**Exploring the Fundamentals of Efficiency in III-N LEDs** James Speck;  
University of California, United States.

9:00 AM A03.02

**Demonstration of Tunneling and Sub-Bandgap Recombination in InGaN LEDs at Extremely Low Current Levels** Nicola Renso, Matteo Buffolo, Carlo De Santi, Gaudenzio Meneghesso, Enrico Zanoni and Matteo Meneghini; University of Padova, Italy.

9:15 AM A03.03

**Auger Recombination in AlGaIn/AlN Quantum Wells** Felix Nippert<sup>1</sup>, Mohammad Tollabi Mazraehno<sup>1,2</sup>, Matthew J. Davies<sup>2</sup>, Marc P. Hoffmann<sup>2</sup>, Hans-Juergen Lugauer<sup>2</sup>, Thomas Kure<sup>1</sup>, Michael Kneissl<sup>1</sup>, Axel Hoffmann<sup>1</sup> and Markus R. Wagner<sup>1</sup>; <sup>1</sup>Technische Universität Berlin, Germany; <sup>2</sup>OSRAM Opto Semiconductors GmbH, Germany.

9:30 AM A03.04

**On the Origin of Thermal and Efficiency Droop in III-Nitride Light-Emitting Diodes—A Temperature-Dependent Carrier Dynamics Method** Arman Rashidi, Morteza Monavarian, Andrew A. Aragon and Daniel Feezell; Center for High-Technology Materials, The University of New Mexico, United States.

9:45 AM A03.05

**Modeling of Thermal Droop in InGaN Layers and UV-A LEDs—Contribution of SRH Recombination and Thermionic Escape** Carlo De Santi, Matteo Meneghini, Desiree Monti, Gaudenzio Meneghesso and Enrico Zanoni; University of Padova, Italy.

10:00 AM A03.06

**Modeling of Lateral Carrier Diffusion by Considering InGaN Composition Fluctuation in Green InGaN LEDs and the Influences of QW Numbers** Ren-Shiun Liou<sup>1</sup>, Guillaume Lheureux<sup>2</sup>, Bastien Bonef<sup>2</sup>, Cheyenne Lynsky<sup>2</sup>, Ryan White<sup>2</sup>, Abdullah Alhassan<sup>2</sup>, James Speck<sup>2</sup>, Claude Weisbuch<sup>2,4</sup> and Yuh-Renn Wu<sup>1,3</sup>; <sup>1</sup>National Taiwan University, Taiwan; <sup>2</sup>University of California, Santa Barbara, United States; <sup>3</sup>Industrial Technology Research Institute, Taiwan; <sup>4</sup>CNRS-Ecole Polytechnique, France.

10:15 AM BREAK

SESSION A04: Light Emitter Systems  
Session Chairs: Philippe Boucaud, T. Paul Chow and Piotr Perlin  
Tuesday Morning, July 9, 2019  
Evergreen Ballroom E-F, Lobby Level

10:45 AM \*A04.01

**Gallium Nitride Micro-LED Drive Circuits for Visible Light Communications** Johannes Herrnsdorf<sup>1</sup>, Jonathan McKendry<sup>1</sup>, Alexander Griffiths<sup>1</sup>, Michael Strain<sup>1</sup>, Robert Henderson<sup>2</sup> and Martin Dawson<sup>1</sup>; <sup>1</sup>University of Strathclyde, United Kingdom; <sup>2</sup>University of Edinburgh, United Kingdom.

11:15 AM A04.02

**Heterogeneously Integrated InGaN Laser—A Grand Challenge from Perspective of Silicon Photonics** Toshihiro Kamei<sup>1,2</sup>, Takeshi Kamikawa<sup>1</sup>, Masahiro Araki<sup>1</sup>, Steven P. DenBaars<sup>1</sup>, Shuji Nakamura<sup>1</sup> and John E. Bowers<sup>1</sup>; <sup>1</sup>University of California, Santa Barbara, United States; <sup>2</sup>National Institute of Advanced Industrial Science and Technology, Japan.

11:30 AM A04.03

**A III-Nitride on Silicon Nanophotonic Platform—Electrical Injection and Microlaser Photonic Circuits** Farsane Tabataba-Vakili<sup>1,2</sup>, Stéphanie Rennesson<sup>3</sup>, Benjamin Damilano<sup>3</sup>, Laetitia Doyennette<sup>4</sup>, Christelle Brimont<sup>4</sup>, Thierry Guillot<sup>4</sup>, Eric Frayssinet<sup>3</sup>, Julien Brault<sup>3</sup>, Jean-Yves Duboz<sup>3</sup>, Iannis Roland<sup>1</sup>, Moustafa El Kurdi<sup>1</sup>, Xavier Checoury<sup>1</sup>, Sébastien Sauvage<sup>1</sup>, Fabrice Semond<sup>3</sup>, Bruno Gayral<sup>3</sup> and Philippe Boucaud<sup>3</sup>; <sup>1</sup>C2N, CNRS, University Paris-Sud, Université Paris-Saclay, France; <sup>2</sup>CEA, INAC-PHELIQS,

University Grenoble Alpes, France; <sup>3</sup>Université Côte d'Azur, CRHEA-CNRS, France; <sup>4</sup>L2C, Université de Montpellier, France.

11:45 AM A04.04

**MOVPE of Cascaded LEDs Using GaN:Mg/GaN:Ge Tunnel Junctions** Silvio Neugebauer, Jürgen Blasing, Armin Dajdar and André Strittmatter; Otto-von-Guericke University Magdeburg, Germany.

12:00 PM A04.05

**High-Power InGaN Superluminescent Diode with 400-MHz Modulation Bandwidth Exciting Perovskite Nanocrystals for Solid-State Lighting and Visible Light Communication** Abdullah A. Alatawi<sup>1,2</sup>, Jorge A. Holguin-Lerma<sup>1</sup>, Chun H. Kang<sup>1</sup>, Chao Shen<sup>1</sup>, Ibrahim Dursun<sup>4</sup>, Lutfan Sinatra<sup>3</sup>, Abdulrahman M. Albadri<sup>2</sup>, Ahmed Y. Alyamani<sup>2</sup>, Osman M. Bakr<sup>4</sup>, Tien Khee Ng<sup>1</sup> and Boon S. Ooi<sup>1</sup>; <sup>1</sup>King Abdullah University of Science and Technology (KAUST), Saudi Arabia; <sup>2</sup>King Abdulaziz City for Science and Technology (KACST), Saudi Arabia; <sup>3</sup>Quantum Solutions LLC, Saudi Arabia; <sup>4</sup>King Abdullah University of Science and Technology (KAUST), Saudi Arabia.

12:15 PM A04.06

**Room-Temperature Continuous-Wave Electrically Injected GaN-on-Si Microdisk Lasers** Meixin Feng, Jin Wang, Jianxun Liu, Qian Sun, Hongwei Gao, Yu Zhou, Jianping Liu, Shuming Zhang, Deyao Li, Liqun Zhang and Hui Yang; Suzhou Institute of Nano-Tech and Nano-Bionics, Chinese Academy of Sciences, China.

SESSION B03: High Frequency HEMTs  
Session Chairs: Debdeep Jena and Farid Medjdoub  
Tuesday Morning, July 9, 2019  
Cedar Ballroom, Second Floor

8:30 AM \*B03.01

**W Band and Beyond GaN Devices** Yan Tang<sup>1</sup>, D. Micovic<sup>2</sup>, D. Regan<sup>1</sup>, J. Wong<sup>1</sup>, A. Schmitz<sup>1</sup>, S. Kim<sup>1</sup> and A. Corrión<sup>1</sup>; <sup>1</sup>HRL Laboratories, LLC, United States; <sup>2</sup>Raytheon, United States.

9:00 AM B03.02

**Evaluation of Bias-Dependent Electron Velocity in mm-Wave N-Polar GaN Deep Recess HEMTs Extracted from Small-Signal Equivalent Circuit Parameters** Brian Romanczyk<sup>1</sup>, Matthew Guidry<sup>1</sup>, Xun Zheng<sup>1</sup>, Haoran Li<sup>1</sup>, Elaheh Ahmadi<sup>2</sup>, Stacia Keller<sup>1</sup> and Umesh K. Mishra<sup>1</sup>; <sup>1</sup>University of California, Santa Barbara, United States; <sup>2</sup>University of Michigan, United States.

9:15 AM B03.03

**Deeply-Scalded GaN-on-Si HEMTs with  $f_T$  up to 300 GHz** Zhihong Liu<sup>1</sup>, Weichuan Xing<sup>2</sup>, Hanlin Xie<sup>1</sup>, Kumud Ranjan<sup>2</sup>, Kenneth E. Lee<sup>1</sup> and Geok Ing Ng<sup>2</sup>; <sup>1</sup>Singapore-MIT Alliance for Research and Technology, Singapore; <sup>2</sup>Nanyang Technological University, Singapore.

9:30 AM B03.04

**High Linearity Graded AlGaIn Channel Field Effect Transistors with Epitaxial Passivation** Shahadat H. Sohel<sup>1</sup>, Andy Xie<sup>2</sup>, Edward Beam<sup>2</sup>, Hao Xue<sup>1</sup>, Towhidur Razzak<sup>1</sup>, Sanyam Bajaj<sup>1</sup>, Yu Cao<sup>2</sup>, Wu Lu<sup>1</sup> and Siddharth Rajan<sup>1</sup>; <sup>1</sup>The Ohio State University, United States; <sup>2</sup>Qorvo, Inc., United States.

9:45 AM \*B03.05

**Next Generation RF Switches Using the Super Lattice Castellated Field Effect Transistor (SLCFET)** Robert S. Howell; Northrop Grumman Corporation, United States.

10:15 AM BREAK

SESSION B04: Vertical Devices  
Session Chairs: Rongming Chu and Hu Liang  
Tuesday Morning, July 9, 2019  
Cedar Ballroom, Second Floor

10:45 AM B04.01

**Vertical GaN Fin Transistor for High Power RF Applications** Nadim Chowdhury<sup>1</sup>, Qingyun Xie<sup>1</sup>, Ujwal Radhakrishna<sup>1</sup>, Joshua A. Perozek<sup>1</sup>, Xingyu Zou<sup>1</sup>, Thomas Jokinen<sup>2</sup>, Garrett J. Schlenvogt<sup>2</sup>, Dimitri A. Antoniadis<sup>1</sup> and Tomas Paliacios<sup>1</sup>; <sup>1</sup>Massachusetts Institute of Technology, United States; <sup>2</sup>Silvaco, Inc., United States.

11:00 AM B04.02

**Vertical GaN-on-Si Power Devices** Elison Matioli; Ecole Polytechnique Federale de Lausanne, Switzerland.

#### 11:15 AM B04.03

**Leakage and Breakdown Mechanisms of 1.2 kV GaN Vertical Power FinFETs** Ming Xiao<sup>1</sup>, Xiang Gao<sup>2</sup>, Tomas Palacios<sup>3</sup> and Yuhao Zhang<sup>1</sup>; <sup>1</sup>Virginia Tech, United States; <sup>2</sup>IQE RF LLC, United States; <sup>3</sup>Massachusetts Institute of Technology, United States.

#### 11:30 AM B04.04

**Threshold Voltage Variations in Semi-Vertical GaN-on-Si FETs—A Comprehensive Study** Kalparupa Mukherjee<sup>1</sup>, Matteo Borga<sup>1</sup>, Maria S. Ruzzarin<sup>1</sup>, Steve Stoffels<sup>2</sup>, Karen Geens<sup>2</sup>, Hu Liang<sup>2</sup>, Stefaan Decoutere<sup>2</sup>, Gaudenzio Meneghesso<sup>1</sup>, Enrico Zanoni<sup>1</sup> and Matteo Meneghini<sup>1</sup>; <sup>1</sup>University of Padua, Italy; <sup>2</sup>imec, Belgium.

#### 11:45 AM B04.05

**Fabrication and Characterization of First GaN-on-Si Based Vertical MOSFETs** Debaleen Biswas, Naoki Torii, Keiji Yamamoto and Takashi Egawa; Nagoya Institute of Technology, Japan.

#### 12:00 PM B04.06

**E-Mode AlGaIn/GaN Vertical Trench MIS-HEMTs with a High (~1 A/mm) Drain Current Fabricated Using AlGaIn Regrowth Technique** Akio Yamamoto, Keito Kanatani, Naofumi Yoneda and Masaaki Kuzuhara; University of Fukui, Japan.

#### 12:15 PM B04.07

**Estimation of Impact Ionization Coefficient in GaN and Its Temperature Dependence by Photomultiplication Measurements Utilizing Franz-Keldysh Effect** Takuya Maeda<sup>1</sup>, Tetsuo Narita<sup>2</sup>, Hiroyuki Ueda<sup>2</sup>, Masakazu Kanechika<sup>2</sup>, Tsutomu Uesugi<sup>2</sup>, Tetsu Kachi<sup>3</sup>, Tsunenobu Kimoto<sup>1</sup>, Masahiro Horita<sup>1,3</sup> and Jun Suda<sup>1,3</sup>; <sup>1</sup>Kyoto University, Japan; <sup>2</sup>Toyota Central R&D Labs., Inc., Japan; <sup>3</sup>Nagoya University, Japan.

#### SESSION G03: BN Epitaxy

Session Chairs: Guillaume Cassabois and Xiaohang Li  
Tuesday Morning, July 9, 2019  
Evergreen Ballroom A-C, Lobby Level

#### 8:30 AM G03.01

**Growth of BGaN Films Using BBr<sub>3</sub> Gas as B Source in MBE** Richard C. Cramer, Bastien Bonef, John English and James Speck; University of California, Santa Barbara, United States.

#### 8:45 AM G03.02

**Optimization of Vapor Phase Epitaxy for Thick Boron Nitride Films** Anthony Rice, Andrew Allerman, Mary Crawford, Michael Smith, Gregory Pickrell and Paul Sharps; Sandia National Laboratories, United States.

#### 9:00 AM G03.03

**Ion-Irradiation Effects on Crystal Quality of Epitaxial c-BN (001) Films** Kazuyuki Hiram, Yoshitaka Taniyasu, Hideki Yamamoto and Kazuhide Kumakura; NTT Basic Research Laboratories, Japan.

#### 9:15 AM G03.04

**MOVPE Grown Hexagonal Boron Nitride for SERS Application** Dipankar Chugh, Jennifer Wong-Leung, Li Li, Mykhaylo Lysevych, Chennupati Jagadish and Hoe Tan; Australian National University, Australia.

#### 9:30 AM G03.05

**Molecular Beam Epitaxy and Characterization of Hexagonal Boron Nitride Quantum Dots** Ping Wang<sup>1</sup>, David A. Laleyan<sup>1</sup>, Eric T. Reid<sup>1</sup>, Jiseok Gim<sup>2</sup>, Qiannan Wen<sup>1</sup>, Zhe Liu<sup>1</sup>, Zhaohui Zhong<sup>1</sup>, Mackillo Kira<sup>1</sup>, Robert Hovden<sup>2</sup> and Zetian Mi<sup>1</sup>; <sup>1</sup>University of Michigan, United States; <sup>2</sup>University of Michigan, United States.

#### 9:45 AM G03.06

**Phase Control of CVD-Grown BN Layer on Al<sub>2</sub>O<sub>3</sub> Substrate** Hisashi Yamada<sup>1</sup>, Sho Inotsume<sup>1,2</sup>, Naoto Kumagai<sup>1</sup>, Toshikazu Yamada<sup>1</sup> and Mitsuoaki Shimizu<sup>1,2</sup>; <sup>1</sup>National Institute of Advanced Industrial Science and Technology (AIST), Japan; <sup>2</sup>Nagoya-University, Japan.

#### 10:00 AM LATE NEWS

#### 10:15 AM BREAK

SESSION G04: Epitaxy for UV Applications  
Session Chairs: Motoaki Iwaya and Michael Kneissl  
Tuesday Morning, July 9, 2019  
Evergreen Ballroom A-C, Lobby Level

#### 10:45 AM \*G04.01

**Growth of Ultrathin GaN Quantum Wells Towards Deep Ultraviolet Light Sources** Xinqiang Wang<sup>1</sup>, Y.X. Wang<sup>1</sup>, S Ivanov<sup>2</sup>, Tao Wang<sup>1</sup>, Bowen Sheng<sup>1</sup>, Shipping Guo<sup>3</sup>, Hideto Miyake<sup>4</sup>, Frank Bertram<sup>5</sup>, Xin Rong<sup>1</sup>, V Kozlovsky<sup>6</sup>, Juergen Christen<sup>5</sup> and Bo Shen<sup>1</sup>; <sup>1</sup>Peking University, China; <sup>2</sup>Ioffe Institute, Russian Federation; <sup>3</sup>Advanced Micro-Fabrication Equipment Inc, China; <sup>4</sup>Mie University, Japan; <sup>5</sup>Otto-von-Guericke-University Magdeburg, Germany; <sup>6</sup>Lebedev Physical Institute, Russian Federation.

#### 11:15 AM G04.02

**Highly Efficient UV Emission from Ultrathin GaN/AlN Quantum Wells Grown by Metalorganic Vapor Phase Epitaxy** Mitsuru Funato, Hirotsugu Kobayashi and Yoichi Kawakami; Kyoto University, Japan.

#### 11:30 AM G04.03

**High Quality AlN Growth by Ammonia-Free High Temperature MOVPE** Xuqiang Shen, K Kojima and H Okumura; National Institute of Advanced Industrial Science and Technology (AIST), Japan.

#### 11:45 AM G04.04

**High-Temperature Molecular Beam Epitaxy and Characterization of High Quality Al(GaN) on Sapphire** David A. Laleyan<sup>1</sup>, Eric T. Reid<sup>1</sup>, Xianhe Liu<sup>1</sup>, Ayush Pandey<sup>1</sup>, Mohammad Soltani<sup>2</sup>, Gianluigi Botton<sup>3</sup> and Zetian Mi<sup>1</sup>; <sup>1</sup>University of Michigan, United States; <sup>2</sup>Raytheon BBN Technologies, United States; <sup>3</sup>McMaster University, Canada.

#### 12:00 PM G04.05

**Crack and Strain Free 16 μm Thick AlN on Sapphire Templates** Iftikhar Ahmad<sup>1</sup>, Kamal Hussain<sup>1</sup>, Md Abdullah-Al Mamun<sup>1</sup>, Mikhail Gaevski<sup>1</sup>, MVS Chandrashekar<sup>1</sup>, Kenny Huynh<sup>2</sup>, Michael E. Liao<sup>2</sup>, Tingyu Bai<sup>2</sup>, Mark Gorskyy<sup>2</sup>, Grigory Simin<sup>1</sup> and Asif Khan<sup>1</sup>; <sup>1</sup>University of South Carolina, United States; <sup>2</sup>University of California, Los Angeles, United States.

#### 12:15 PM G04.06

**Epitaxial Lateral Overgrowth of AlN with Partially Non-Dislocation-Region on Vicinal AlN Template** Narihito Okada<sup>1</sup>, Fijun Kim<sup>1</sup>, Takahiro Saito<sup>1</sup>, Sachie Fujikawa<sup>2</sup>, Noritoshi Maeda<sup>3</sup>, Hideki Hirayama<sup>3</sup> and Kazuyuki Tadatomo<sup>1</sup>; <sup>1</sup>Yamaguchi University, Japan; <sup>2</sup>Tokyo Denki University, Japan; <sup>3</sup>Riken, Japan.

#### SESSION H02: Nanostructures and Nano-Devices I

Session Chairs: Zhaoxia Bi and Andreas Waag  
Tuesday Morning, July 9, 2019  
Regency Ballroom E-G, Second Floor

#### 8:30 AM \*H02.01

**Challenges in Accurate Assessment of Nanorod Structures** Robert Martin; University of Strathclyde, United Kingdom.

#### 9:00 AM H02.02

**AlGaIn Microfins for Efficient UV Emitters: Growth and Optical Characterization** Christoph Margenfeld<sup>1,2</sup>, Hendrik Spende<sup>1,2</sup>, Maximilian Zapf<sup>3</sup>, Hans-Juergen Lugauer<sup>4</sup>, Carsten Ronning<sup>3</sup>, Hergo-Heinrich Wehmann<sup>1,2</sup> and Andreas Waag<sup>1,2</sup>; <sup>1</sup>Technische Universität Braunschweig, Germany; <sup>2</sup>Epitaxy Competence Center ec2, Germany; <sup>3</sup>Friedrich Schiller University Jena, Germany; <sup>4</sup>Osram Opto Semiconductors GmbH, Germany.

#### 9:15 AM H02.03

**Problematics of P-Type AlN Nanowires—Mg/In Codoping and Activation Issues** Alexandra M. Siladic<sup>1,3</sup>, Gwénoél Jacopin<sup>2</sup>, Ana Cros<sup>4</sup>, Núria Garro<sup>4</sup>, Eric Robin<sup>5,3</sup>, Damien Calliste<sup>6</sup>, Pascal Pochet<sup>6</sup>, Fabrice Donatini<sup>2</sup>, Julien Pernot<sup>2</sup> and Bruno Daudin<sup>1</sup>; <sup>1</sup>CEA, INAC-PHELIQS “Nanophysics and Semiconductors” Group, France; <sup>2</sup>Institut Néel, Université Grenoble Alpes, CNRS, Grenoble INP, France; <sup>3</sup>Université Grenoble Alpes, France; <sup>4</sup>Institute of Materials Science (ICMUV), Universidad de Valencia, Spain; <sup>5</sup>CEA, INAC-MEM, LEMMA, France; <sup>6</sup>CEA, INAC-MEM, L-SIM, France.

#### 9:30 AM H02.04

**High Performance of AlGaIn/GaN FinMISHFETs by Using m-Plane Sidewall Channel** Quan Dai, Dong-Hyeok Son, Young-Jun Yoon, Ryun-Hwi Kim, Jeong-Gil Kim, Jun-Hyeok Lee, Hyeon-Su Lee, Kyung-Wan Kim, Yong-Soo Lee and Jung-Hee Lee; Kyungpook National University, Korea (the Republic of).

**9:45 AM H02.05**

**Fabrication of GaN-on-GaN Vertical Nanowire Schottky Barrier Diodes by Top-Down Approach** Yaqiang Liao<sup>1</sup>, Jia Wang<sup>1</sup>, Yuto Ando<sup>1</sup>, Xu Yang<sup>1</sup>, Jun Hirotsu<sup>1</sup>, Maki Kushimoto<sup>1</sup>, Manato Deki<sup>1</sup>, Atsushi Tanaka<sup>1</sup>, Shugo Nitta<sup>1</sup>, Yoshio Honda<sup>1</sup>, Kevin J. Chen<sup>2,1</sup> and Hiroshi Amano<sup>1</sup>; <sup>1</sup>Nagoya University, Japan; <sup>2</sup>Hong Kong University of Science and Technology, China.

**10:00 AM H02.06**

**Surface Passivation Effect by Saturated Ozone Water Treatment on InGaN/GaN Nanostructures Fabricated by Hydrogen Environment Anisotropic Thermal Etching (HEATE)** Yusuke Namae<sup>1</sup>, Daichi Ito<sup>1</sup>, Akihiro Matsuoka<sup>1</sup>, Yuki Ooe<sup>1</sup>, Yuta Moriya<sup>1</sup> and Akihiko Kikuchi<sup>1,2</sup>; <sup>1</sup>Sophia University, Japan; <sup>2</sup>Sophia Nanotechnology Research Center, Japan.

SESSION M01: Ultrawide Gap Materials and Properties  
Session Chairs: Sergej Karpov and André Strittmatter  
Tuesday Morning, July 9, 2019  
Regency Ballroom E-G, Second Floor

**10:45 AM \*M01.01**

**Dopants and Defects in Ultrawide-Band-Gap Nitrides** Chris G. Van de Walle; University of California, Santa Barbara, United States.

**11:15 AM \*M01.02**

**Hexagonal Boron Nitride: Physics and Applications in the Deep Ultraviolet** Guillaume Cassabois; Montpellier University, France.

**11:45 AM M01.03**

**High Quality h-BN Thin Films and Their Application as Flexible Buffer Layer for Conventional III-Nitrides Epitaxy** Fang Liu<sup>1</sup>, Xin Rong<sup>1</sup>, Tao Wang<sup>1</sup>, Ye Yu<sup>3</sup>, Bowen Sheng<sup>1,2</sup>, Jiaqi Wei<sup>1</sup>, Yuantao Zhang<sup>3</sup>, Frank Bertram<sup>2</sup>, Fujun Xu<sup>1</sup>, Xuelin Yang<sup>1</sup>, Juergen Christen<sup>2</sup>, Bo Shen<sup>1</sup> and Xinqiang Wang<sup>1</sup>; <sup>1</sup>Peking University, China; <sup>2</sup>Otto-von-Guericke-University Magdeburg, Germany; <sup>3</sup>Jilin University, China.

**12:00 PM M01.04**

**Control of Lateral Quality of 2D h-BN Grows Selective Area Growth of III-N Device Structures** Suresh Sundaram<sup>1,2,3</sup>, Taha Ayari<sup>2,3</sup>, Soufiane Karrakchou<sup>1,2</sup>, Adama Mballo<sup>2</sup>, Phuong Vuong<sup>2</sup>, Yacine Halfaya<sup>2</sup>, Paul Voss<sup>1,2</sup>, Jean Paul Salvestrin<sup>1,2,3</sup> and Abdallah Ougazzaden<sup>1,2</sup>; <sup>1</sup>Georgia Institute of Technology, France; <sup>2</sup>CNRS, UMI 2958, GT - CNRS, France; <sup>3</sup>GT Lorraine, France.

**12:15 PM M01.05**

**Metal Organic Chemical Vapor Deposition of Hexagonal Boron Nitride on Transition Metal Surfaces** Michael Snure, Gene Siegel, Timothy Prusnick and Stefan C. Badescu; Air Force Research Laboratory, United States.

## SESSION I02: Excitons in AlGaIn

Session Chairs: Axel Hoffmann and Saulius Marcinkevicius  
Tuesday Morning, July 9, 2019  
Regency Ballroom A-C, Second Floor

**8:30 AM \*I02.01**

**Control Over Dipolar Exciton Fluids in GaN/(AlGa)N Nanostructures** Maria Vladimirova<sup>1</sup>, François Chiaruttini<sup>1</sup>, Thierry Guillet<sup>1</sup>, Christelle Brimont<sup>1</sup>, Benoit Jouault<sup>1</sup>, Pierre Lefebvre<sup>1</sup>, Sébastien Chenot<sup>2</sup>, Yvon Cordier<sup>2</sup> and Benjamin Damilano<sup>2</sup>; <sup>1</sup>CNRS-University of Montpellier, France; <sup>2</sup>University Cote d'Azur/CNRS, France.

**9:00 AM I02.02**

**Excitonic Effects on Radiative Recombination in AlGaIn Quantum Wells for Deep UV Emitters** Greg Rupper, Chelsea R. Haughn, Michael Wraback and Gregory Garrett; U.S. Army Research Laboratory, United States.

**9:15 AM I02.03**

**Role of Exciton Recombination Processes on Internal Quantum Efficiency in AlGaIn-Based UV-B Multiple Quantum Wells** Hideaki Murotani<sup>1,2</sup>, Hiroyuki Miyoshi<sup>2</sup>, Ryohei Takeda<sup>2</sup>, M. A. Khan<sup>3</sup>, Noritoshi Maeda<sup>3</sup>, Masafumi Jo<sup>3</sup>, Hideki Hirayama<sup>3</sup> and Yoichi Yamada<sup>2</sup>; <sup>1</sup>National Institute of Technology, Tokuyama College, Japan; <sup>2</sup>Yamaguchi University, Japan; <sup>3</sup>RIKEN Cluster for Pioneering Research, Japan.

**9:30 AM I02.04**

**Kinetic Monte Carlo Simulations of Carrier Dynamics in AlGaIn/AlGaIn Quantum Wells** Oleg Kravcov, Juras Mickevicius and Gintautas Tamulaitis; Vilnius University, Lithuania.

**9:45 AM I02.05**

**Comparative Study of AlGaIn Multiple Quantum Wells on Annealed-Sputtered-AlN and MOVPE-Grown-AlN on Sapphire Substrates** Kanako Shojiki<sup>1</sup>, Ryota Ishii<sup>2</sup>, Kenjiro Uesugi<sup>3</sup>, Mitsuru Funato<sup>2</sup>, Yoichi Kawakami<sup>2</sup> and Hideto Miyake<sup>4,1</sup>; <sup>1</sup>Mie University, Japan; <sup>2</sup>Kyoto University, Japan; <sup>3</sup>Mie University, Japan; <sup>4</sup>Mie University, Japan.

**10:00 AM I02.06**

**Optically Pumped Stimulated Emission from AlGaIn-Based UV-C Multiple Quantum Wells with High Internal Quantum Efficiency of 16 % at 750 K** Hideaki Murotani<sup>1,2</sup>, Keisuke Hisanaga<sup>2</sup>, Ryohei Tanabe<sup>2</sup>, Akira Hamada<sup>2</sup>, Noritoshi Maeda<sup>3</sup>, Masafumi Jo<sup>3</sup>, Hideki Hirayama<sup>3</sup> and Yoichi Yamada<sup>2</sup>; <sup>1</sup>National Institute of Technology, Tokuyama College, Japan; <sup>2</sup>Yamaguchi University, Japan; <sup>3</sup>RIKEN Cluster for Pioneering Research, Japan.

**10:15 AM BREAK**

SESSION I03: 2D Gas Properties  
Session Chairs: Elke Meissner and Grace Xing  
Tuesday Morning, July 9, 2019  
Regency Ballroom A-C, Second Floor

**10:45 AM I03.01**

**2D Electron-Hole Gas Bilayers in Undoped AlN/GaN/AlN Heterostructures** Reet Chaudhuri, Jeffrey Miller, Samuel J. Bader, Grace Xing and Debdeep Jena; Cornell University, United States.

**11:00 AM I03.02**

**Role of Background Impurities on the Formation of a 2DEG in GaN/AlGaIn Heterostructures** Stefan Schmult<sup>1</sup>, Steffen Wirth<sup>2</sup>, Victor Solovyev<sup>3</sup>, Rico Hentschel<sup>4</sup>, Andre Wachowiak<sup>4</sup>, Andreas Großer<sup>4</sup>, Igor V. Kukushkin<sup>3</sup> and Thomas Mikolajick<sup>1,4</sup>; <sup>1</sup>TU Dresden, Germany; <sup>2</sup>Max-Planck-Institute for Chemical Physics of Solids, Germany; <sup>3</sup>Institute of Solid State Physics RAS, Russian Federation; <sup>4</sup>NaMLab gGmbH, Germany.

**11:15 AM I03.03**

**Spectroscopic Toolbox for Nitride HEMT Characterization** Yury Turketuls and Ilan Shalish; Ben Gurion University, Israel.

**11:30 AM I03.04**

**Operando Analysis of Local Piezoelectric Lattice Distortion in AlGaIn/GaN HEMT Devices Using Synchrotron Radiation Nanobeam X-Ray Diffraction** Akira Ueda<sup>1</sup>, Haruna Shiomi<sup>1</sup>, Tetsuya Tohei<sup>1</sup>, Yuji Ando<sup>2</sup>, Tamotsu Hashizume<sup>2</sup>, Yasuhiko Imai<sup>3</sup>, Kazushi Sumitani<sup>3</sup>, Shigeru Kimura<sup>3</sup> and Akira Sakai<sup>1</sup>; <sup>1</sup>Osaka University, Japan; <sup>2</sup>Hokkaido University, Japan; <sup>3</sup>JASRI, Japan.

**11:45 AM I03.05**

**Effects of Surface Treatments on the Surface State Density of AlGaIn/GaN Heterostructures** Eric Blanton<sup>1</sup>, Timothy Prusnick<sup>1,2</sup>, Gene Siegel<sup>1,2</sup>, Gordon J. Grzybowski<sup>1,2</sup>, Bruce Claffin<sup>1</sup>, Nicholas R. Glavin<sup>3</sup> and Michael Snure<sup>1</sup>; <sup>1</sup>Air Force Research Laboratory, United States; <sup>2</sup>KBRWyle, United States; <sup>3</sup>Air Force Research Laboratory, United States.

**12:00 PM \*I03.06**

**Electrical Force Microscopies for the Study of Nitride Semiconductors—Results and Challenges** Ana Cros<sup>1</sup>, Núria Garro<sup>1</sup>, Albert Minj<sup>2</sup>, A. Madalina Siladie<sup>3</sup> and Bruno Daudin<sup>2</sup>; <sup>1</sup>University of Valencia, Spain, Spain; <sup>2</sup>CNRS UMR 6252, France; <sup>3</sup>University Grenoble-Alpes, CEA-INAC, PHELIQS, France.

## SESSION A05: Vertical Cavity Emitters

Session Chairs: Hideki Hirayama and Takao Miyajima  
Tuesday Afternoon, July 9, 2019  
Evergreen Ballroom E-F, Lobby Level

**2:00 PM \*A05.01**

**Progress in Ultraviolet Vertical-Cavity Surface-Emitting Lasers** Russell Dupuis, Theeradetch Detchprohm, Chuan-Wei Tsou, Young Jae Park, Hoon Jeong, Jialin Wang, Karan Mehta, Ping Chen, P. D. Yoder and Shyh-Chiang Shen; Georgia Institute of Technology, United States.

**2:30 PM A05.02**

**AlGaIn Multiple Quantum Well (MQW) Design for Low Threshold Mid Ultraviolet Laser** Qiang Guo<sup>1</sup>, Ronny Kirste<sup>2</sup>, Seiji Mita<sup>2</sup>, Pramod Reddy<sup>2</sup>, Shun Washiyama<sup>1</sup>, Yan Guan<sup>1</sup>, Felix Nippert<sup>2</sup>, Will Mecouch<sup>2</sup>, Ramón Collazo<sup>1,2</sup> and Zlatko Sitar<sup>1,2</sup>; <sup>1</sup>North Carolina State University, United States; <sup>2</sup>Adroit Materials, United States; <sup>3</sup>Technische Universität Berlin, Germany.

**2:45 PM A05.03**

**Design of Tunnel-Injected Sub-300 nm AlGaIn-Based Lasers** Syed Mohammad Najib Hasan<sup>1</sup>, Zane Jamal-Eddine<sup>1</sup>, Darshana Wickramaratne<sup>2</sup>, Banaful Paul<sup>1</sup>, Siddharth Rajan<sup>1</sup> and Shamsul Arafin<sup>1</sup>; <sup>1</sup>The Ohio State University, United States; <sup>2</sup>U.S. Naval Research Laboratory, United States.

**3:00 PM A05.04**

**Optimization of Al Composition Gradient P-Type AlGaIn Cladding Layer in UV-B Laser Structure** Yuya Ogino<sup>1</sup>, Kosuke Sato<sup>1,2</sup>, Shinji Yasue<sup>1</sup>, Motoaki Iwaya<sup>1</sup>, Satoshi Kamiyama<sup>1</sup>, Tetsuya Takeuchi<sup>1</sup> and Isamu Akasaki<sup>1,3</sup>; <sup>1</sup>Meiji University, Japan; <sup>2</sup>Asahi-Kasei Cooperation, Japan; <sup>3</sup>Akasaki Research Center, Nagoya University, Japan.

**3:15 PM A05.05**

**Vertical Microcavity Based on an AlGaIn Membrane with Two Dielectric Distributed Bragg Reflectors Emitting at 330 nm** Filip Hjort<sup>1</sup>, Johannes Enslin<sup>2</sup>, Michael A. Bergmann<sup>1</sup>, Munise Cobet<sup>2</sup>, Johan Gustavsson<sup>1</sup>, Tim Wernicke<sup>2</sup>, Michael Kneissl<sup>2</sup> and Åsa Haglund<sup>1</sup>; <sup>1</sup>Chalmers University of Technology, Sweden; <sup>2</sup>Technische Universität Berlin, Germany.

**3:30 PM A05.06**

**High Power Blue Surface Emitting Superluminescent LEDs** Rory Cahill<sup>1,2</sup>, Pleun Maaskant<sup>2</sup>, Mahbub Akhter<sup>2</sup> and Brian Corbett<sup>1,2</sup>; <sup>1</sup>University College Cork, Ireland; <sup>2</sup>Tyndall National Institute, Ireland.

**3:45 PM BREAK**

SESSION A06: Tunnel Junction Emitters  
Session Chairs: Emmanouil Kioupakis and Tetsuya Takeuchi  
Tuesday Afternoon, July 9, 2019  
Evergreen Ballroom E-F, Lobby Level

**4:15 PM A06.01**

**Tunnel Junctions for Nitride Laser Diodes** Czeslaw Skierbiszewski, Marcin Siekacz, Grzegorz Muziol, Henryk Turski, Krzesimir Nowakowski-Szkudlarek, Mateusz Hajdel, Mikolaj Zak, Anna Feduniewicz-Zmuda, Pawel Wolny and Marta Sawicka; Institute of High Pressure Physics, Polish Academy of Sciences, Poland.

**4:30 PM A06.02**

**Nano-Cathodoluminescence Investigations of Cascaded InGaIn/GaN LED Using GaN:Mg/GaN:Ge Tunnel Junctions** Juergen Christen, Gordon Schmidt, Peter Veit, Frank Bertram, Silvio Neugebauer, Jürgen Bläsing, Armin Dadgar and André Strittmatter; Otto-von-Guericke-University Magdeburg, Germany.

**4:45 PM A06.03**

**Hybrid MOCVD/MBE Tunnel Junctions for III-Nitride UVC LEDs and Low Voltage Penalty Blue LEDs** Jianfeng Wang<sup>1</sup>, Erin Young<sup>1</sup>, Burhan SaifAddin<sup>1</sup>, Christian J. Zollner<sup>1</sup>, Abdullah Almogbel<sup>1</sup>, Micha Fireman<sup>1</sup>, Michael Iza<sup>1</sup>, Shuji Nakamura<sup>1,2</sup>, Steven P. DenBaars<sup>1,2</sup> and James Speck<sup>1</sup>; <sup>1</sup>University of California, Santa Barbara, United States; <sup>2</sup>University of California, Santa Barbara, United States.

**5:00 PM A06.04**

**GaN:Mg/GaN:Ge Tunnel Junctions for Better Light Emitters** Christoph Berger, Silvio Neugebauer, Cleopace Senza, Jürgen Bläsing, Armin Dadgar and André Strittmatter; Otto-von-Guericke-University Magdeburg, Germany.

**5:15 PM A06.05**

**Ge-Doped GaN and (Al,Ga)N Tunnel Junctions on Top of Blue and UV Emitting Structures** Victor Fan Arcara<sup>1,2</sup>, Benjamin Damilano<sup>2</sup>, Guy Feuillet<sup>1</sup>, Stéphane Vézian<sup>2</sup>, Sébastien Chenot<sup>2</sup> and Jean-Yves Duboz<sup>2</sup>; <sup>1</sup>CEA, France; <sup>2</sup>CNRS - CRHEA, France.

**5:30 PM A06.06**

**High Wall Plug Efficiency III-Nitride LEDs with Tunnel Junction Contacts Grown Entirely by MOCVD** Abdullah I. Alhassan<sup>1,2</sup>, Abdulrahman M. Albadi<sup>1</sup>, Hamad Albraithen<sup>1</sup>, James Speck<sup>2</sup>, Steven P. DenBaars<sup>2</sup>, Shuji Nakamura<sup>2</sup> and Ahmed Y. Alyamani<sup>1</sup>; <sup>1</sup>King Abdulaziz City for Science and Technology, Saudi Arabia; <sup>2</sup>University of California, Santa Barbara, United States.

**5:45 PM A06.07**

**Size Dependence of Recombination Processes in Tunnel Junction  $\mu$ LEDs** Krzysztof Gibasiewicz<sup>1</sup>, Grzegorz Muziol<sup>1</sup>, Marcin Siekacz<sup>1</sup>, Jacek Kacperski<sup>2</sup>, Szymon Grzanka<sup>1,2</sup>, Lucja Marona<sup>1,2</sup>, Czeslaw Skierbiszewski<sup>1</sup>, Piotr Perlin<sup>1,2</sup> and Tadeusz Suski<sup>1</sup>; <sup>1</sup>Institute of High Pressure Physics, Poland; <sup>2</sup>TopGaN, Poland.

## SESSION B05: Transistor Performance and Circuits

Session Chairs: Robert Howell and Tomas Palacios

Tuesday Afternoon, July 9, 2019

Cedar Ballroom, Second Floor

**2:00 PM \*B05.01**

**Degradation of GaN-Based Lateral and Vertical Devices—Challenges and Perspectives** Matteo Meneghini, Carlo De Santi, Alessandro Barbato, Matteo Borga, Eleonora Canato, Francesca Chiochetta, Elena Fabris, Zhan Gao, Fabrizio Masin, Kalparupa Mukherjee, Arianna Nardo, Fabiana Rampazzo, Maria S. Ruzzarin, Mehdi Rzin, Alaleh Tajalli, Marco Barbato, Gaudenzio Meneghesso and Enrico Zanoni; University of Padova, Italy.

**2:30 PM B05.02**

**Suppression of Green Luminescence by Co-Implantation of Mg/F Ions into GaN at High Temperature** Masahiro Takahashi<sup>1</sup>, Atsushi Tanaka<sup>2,3</sup>, Shigeyoshi Usami<sup>1</sup>, Yuto Ando<sup>1</sup>, Hirotaka Watanabe<sup>2</sup>, Manato Deki<sup>2</sup>, Maki Kushimoto<sup>1</sup>, Shugo Nitta<sup>2</sup>, Yoshio Honda<sup>2</sup> and Hiroshi Amano<sup>2,4,5</sup>; <sup>1</sup>Nagoya University, Japan; <sup>2</sup>Nagoya University IMASS, Japan; <sup>3</sup>NIMS, Japan; <sup>4</sup>Nagoya University ARC, Japan; <sup>5</sup>Nagoya University VBL, Japan.

**2:45 PM B05.03**

**QuanFINE—High RF Performance AlGaIn/AlN/GaN HEMTs with a Thin Buffer Layer** Ding Yuan Chen<sup>1,2</sup>, Johan Bergsten<sup>2</sup>, Anna Malmros<sup>2</sup>, Mattias Thorsell<sup>2</sup>, Hans Hjelmgren<sup>2</sup>, Jr-Tai Chen<sup>1</sup>, Olof Kordina<sup>1</sup> and Niklas Rorsman<sup>2</sup>; <sup>1</sup>SweGaN AB, Sweden; <sup>2</sup>Chalmers University of Technology, Sweden.

**3:00 PM B05.04**

**Remarkable Lateral Breakdown Voltage in Thin Channel AlGaIn/GaN High Electron Mobility Transistors on Thick AlN/Sapphire Templates** Idriss Abid<sup>1</sup>, Riad Kabouche<sup>1</sup>, Malek Zegaoui<sup>1</sup>, Catherine Bougerol<sup>2</sup>, Remi Comyn<sup>3</sup>, Yvon Cordier<sup>3</sup> and Farid Medjdoub<sup>1</sup>; <sup>1</sup>IEMN, France; <sup>2</sup>Université Grenoble Alpes, France; <sup>3</sup>CHREA, France.

**3:15 PM B05.05**

**Monolithic GaN Power Circuits for Highly-Efficient, Fast-Switching Converter Applications with Higher Functionality** Patrick Waltereit, Richard Reiner, Stefan Moench, Stefan Mueller, Heiko Czap, Michael Dammann, Lutz Kirste and Ruediger Quay; Fraunhofer Institute for Applied Solid State Physics IAF, Germany.

**3:30 PM B05.06**

**p-GaN Gate HEMTs, RTL Logic and Gate Driver Monolithically Integrated on 200 mm QST<sup>®</sup> Substrates for GaN ICs** Xiangdong Li<sup>1,2</sup>, Karen Geens<sup>2</sup>, Weiming Guo<sup>2</sup>, Ming Zhao<sup>2</sup>, Shuzhen You<sup>2</sup>, Niels Posthuma<sup>2</sup>, Steve Stoffels<sup>2</sup>, Hu Liang<sup>2</sup>, Vladimir Odnoblyudov<sup>3</sup>, Cem Basceri<sup>3</sup>, Ozgur Aktas<sup>3</sup>, Guido Groeseneken<sup>1,2</sup> and Stefaan Decoutere<sup>2</sup>; <sup>1</sup>KU Leuven, Belgium; <sup>2</sup>imec, Belgium; <sup>3</sup>Qromis, Inc., United States.

**3:45 PM BREAK**

## SESSION B06: Electronic Device Frontiers

Session Chairs: Andrei Vescan and Patrick Waltereit

Tuesday Afternoon, July 9, 2019

Cedar Ballroom, Second Floor

**4:15 PM \*B06.01**

**The New Nitrides—Epitaxial Integration of 2D, Ferromagnetic and Superconducting Nitrides with GaN and AlN for Novel Device Applications** Debdeep Jena<sup>1,2</sup>; <sup>1</sup>Cornell University, United States; <sup>2</sup>Cornell University, United States.

**4:45 PM B06.02**

**Room Temperature NDR in Digital Alloy AlGaIn Barrier RTDs** Ding Wang<sup>1,2,3</sup>, Zhaoying Chen<sup>1</sup>, Tao Wang<sup>1</sup>, Shanshan Sheng<sup>1</sup>, Juan Su<sup>3</sup>, Wei Tan<sup>3</sup>, Shiping Guo<sup>4</sup>, Jian Zhang<sup>3</sup>, Bo Shen<sup>1</sup> and Xinqiang Wang<sup>1</sup>; <sup>1</sup>Peking University, China; <sup>2</sup>Tsinghua University, China; <sup>3</sup>China Academy of Engineering Physics, China; <sup>4</sup>Advanced Micro-Fabrication Equipment Inc, China.

**5:00 PM B06.03**

**Control of Resonant Tunneling Voltage in III-Nitride Double-Barrier Heterostructures by  $\delta$ -Doping Engineering** Jimmy Encomendero, Vladimir Protasenko, Debdeep Jena and Grace Xing; Cornell University, United States.

**5:15 PM B06.04**

**First Demonstration of AlGaIn-Based HEMTs with AlN/GaN Superlattice Channels** Ming Xiao<sup>1,2</sup>, Yuhao Zhang<sup>1</sup>, Weihang Zhang<sup>2</sup>, Hengsheng Shan<sup>3,2</sup>, Kui Dang<sup>2</sup>, Jincheng Zhang<sup>2</sup> and Yue Hao<sup>2</sup>; <sup>1</sup>Virginia Polytechnic Institute and State University, United States; <sup>2</sup>Xidian University, China; <sup>3</sup>Shaanxi University of Science and Technology, China.

**5:30 PM B06.05**

**Multi-Channel Tri-Gate Architecture for Future GaN Power Devices** Luca Nela, Jun Ma and Elisa Matioli; EPFL, Switzerland.

**5:45 PM B06.06**

**Novel GaN Based ScAlN Barrier Transistors with Greater Than 2A/mm Current Density** James Gillespie<sup>1</sup>, Andrew J. Green<sup>1</sup>, Robert Fitch<sup>1</sup>, Dennis Walker<sup>1</sup>, Antonio Crespo<sup>1</sup>, Yu Cao<sup>2</sup>, Cathy Lee<sup>2</sup>, Edward Beam<sup>2</sup>, Andy Xie<sup>2</sup>, Jose Jimenez<sup>2</sup>, Vipin Kumar<sup>2</sup>, Miles Lindquist<sup>3</sup>, Daniel Brooks<sup>1</sup>, Gregg Jessen<sup>1</sup> and Kelson Chabak<sup>1</sup>; <sup>1</sup>Air Force Research Laboratory, United States; <sup>2</sup>Qorvo, United States; <sup>3</sup>KBRWyle, United States.

## SESSION G05: P-Type and N-Polar Epitaxy

Session Chairs: Hiroshi Fujioka and Kazunobu Kojima

Tuesday Afternoon, July 9, 2019

Evergreen Ballroom A-C, Lobby Level

**2:00 PM \*G05.01**

**Growth of P-Type GaN Layers with Low Mg Concentrations by Using MOVPE and the Application to Vertical Power Devices** Tetsuo Narita<sup>1</sup>, Kazuyoshi Tomita<sup>1</sup>, Yutaka Tokuda<sup>2</sup>, Tatsuya Kogiso<sup>2</sup>, Takuya Maeda<sup>3</sup>, Masahiro Horita<sup>3,4</sup>, Masakazu Kanechika<sup>1</sup>, Hiroyuki Ueda<sup>1</sup>, Tetsu Kachi<sup>4</sup> and Jun Suda<sup>3,4</sup>; <sup>1</sup>Toyota Central R&D Labs. Inc., Japan; <sup>2</sup>Aichi Institute of Technology, Japan; <sup>3</sup>Kyoto University, Japan; <sup>4</sup>Nagoya University, Japan.

**2:30 PM G05.02**

**The Role of Hyper Mg Doping from  $1.5 \times 10^{20}$  to  $7.8 \times 10^{20}$  cm<sup>-3</sup> on the Performance of GaN Homo Junction Tunnel Diodes Exhibiting Negative Differential Resistance** Ehsan Vadiiee, Evan A. Clinton and William A. Doolittle; Georgia Institute of Technology, United States.

**2:45 PM G05.03**

**Minimizing Mg Re-Passivation in All MOCVD Tunnel Junction Based LEDs** Victor Fan Arcara<sup>1,2</sup>, Benjamin Damilano<sup>2</sup>, Guy Feuillet<sup>1</sup>, Aimeric Courville<sup>2</sup>, Sébastien Chenot<sup>2</sup> and Jean-Yves Duboz<sup>2</sup>; <sup>1</sup>CEA - LETI, France; <sup>2</sup>CNRS - CRHEA, France.

**3:00 PM G05.04**

**Electrical Characterization of N-Polar GaN PN Diodes Grown by MOCVD** Dolar Khachariya<sup>1</sup>, Dennis E. Szymanski<sup>2</sup>, Pramod Reddy<sup>3</sup>, Erhard Kohn<sup>2</sup>, Zlatko Sitar<sup>2,3</sup>, Ramón Collazo<sup>2</sup> and Spyridon Pavlidis<sup>1</sup>; <sup>1</sup>North Carolina State University, United States; <sup>2</sup>North Carolina State University, United States; <sup>3</sup>Adroit Materials, United States.

**3:15 PM G05.05**

**Properties of Nitrogen-Polar p-Type AlGaIn/GaN Superlattices Grown by MOCVD** Athith Krishna, Aditya Raj, Nirupam Hatui, Stacia Keller and Umesh K. Mishra; University of California, Santa Barbara, United States.

**3:30 PM G05.06**

**Growth of High Quality (000-1) GaN on Bulk GaN by Plasma-Assisted Molecular Beam Epitaxy Using the AlN Initiation Layer** Christian Wurm, Elaheh Ahmadi, Feng Wu, Stacia Keller, James Speck and Umesh K. Mishra; University of California, Santa Barbara, United States.

**3:45 PM BREAK**

## SESSION G06: Van-der-Waals Epitaxy

Session Chairs: Elaheh Ahmadi and Yasushi Nanishi

Tuesday Afternoon, July 9, 2019

Evergreen Ballroom A-C, Lobby Level

**4:15 PM \*G06.01**

**Opportunity and Challenges in 2D Material-Based Layer Transfer (2DLT) of III-N System** Jeehwan Kim and Wei Kong; Massachusetts Institute of Technology, United States.

**4:45 PM G06.02**

**Plasma-Assisted Molecular Beam Epitaxy of GaN on Graphene—The Effect of Kinetics** Marion Gruart<sup>1,2</sup>, Nathaniel Feldberg<sup>1,2</sup>, Bruno Gayral<sup>1,2</sup>, Catherine Bougerol<sup>2,3</sup>, Stéphanie Pouget<sup>1,2</sup>, Edith Bellet-Amalric<sup>1,2</sup>, Núria Garro<sup>4</sup>, Ana Cros<sup>4</sup>, Hanako Okuno<sup>5,2</sup> and Bruno Daudin<sup>1,2</sup>; <sup>1</sup>CEA-Grenoble, France; <sup>2</sup>Université Grenoble Alpes, France; <sup>3</sup>CNRS-Institut Néel, France; <sup>4</sup>Institute of Materials Science (ICMUV), Universidad de Valencia, Spain; <sup>5</sup>CEA-INAC, MEM, CEA-Grenoble, France.

**5:00 PM G06.03**

**Van der Waals Epitaxy of Flexible AlGaIn Deep UV LEDs on Monolayer Graphene** Ping Wang, Ayush Pandey, David A. Laleyan, Walter J. Shin, Eric T. Reid, Dehui Zhang, Zhe Liu, Zhaohui Zhong and Zetian Mi; University of Michigan, United States.

**5:15 PM G06.04**

**Investigation of GaN with Low Threading Dislocation Density Grown on Graphene/Sputtered AlN Composite Substrate** Yachao Zhang, Ge Liu, Kai Su, Jincheng Zhang and Yue Hao; Xidian University, China.

**5:30 PM G06.05**

**A New Approach for Multifunctional Two-Dimension Structure Formation** Akihiro Hashimoto; University of Fukui, Japan.

**5:45 PM G06.06**

**Systematic Approach to Developing Empirical Interatomic Potentials for Two-Dimensional III-Nitrides** Yuya Hasegawa, Toru Akiyama, Abdul Pradipto, Kohji Nakamura and Tomonori Ito; Mie University, Japan.

## SESSION H03: Nanostructures and Nano-Devices II

Session Chairs: Yasuhiko Arakawa and Bruno Daudin

Tuesday Afternoon, July 9, 2019

Regency Ballroom E-G, Second Floor

**2:00 PM \*H03.01**

**Nitride Nanowires for Mechanically Flexible Devices** Maria Tchernycheva<sup>1</sup>, Nan Guan<sup>1</sup>, Martina Morassi<sup>1</sup>, Lorenzo Mancini<sup>1</sup>, Nuno Amador<sup>1</sup>, Camille Barbier<sup>1</sup>, Akanksha Kapoor<sup>2</sup>, Joël Eymery<sup>2</sup>, Christophe Durand<sup>2</sup>, Vladimir Dubrovskii<sup>3</sup>, Andrey Babichev<sup>3</sup>, Ali Madouri<sup>1</sup>, Noelle Gogneau<sup>1</sup>, Francois H. Julien<sup>1</sup>, Ludovic Largeau<sup>1</sup> and Jean-Christophe Harmand<sup>1</sup>; <sup>1</sup>C2N-CNRS, University Paris Sud, University Paris Saclay, France; <sup>2</sup>University Grenoble Alpes, CEA, INAC, France; <sup>3</sup>ITMO University, Russian Federation.

**2:30 PM H03.02**

**Determination of Crystallographic Polarity in Two-Terminal GaN Nanowire Devices by Lateral Piezoresponse Force Microscopy** Matt Brubaker, Alexana Roshko, Paul Blanchard, Samuel Berweger, Charles Little, Todd Harvey and Kris Bertness; National Institute of Standards and Technology, United States.

**2:45 PM H03.03**

**GaN Thin Film and Nanowire Based Flexible Energy Harvesting Nanodevices and Pressure Sensor** Adil Waseem, Muhammad A. Johar, Mostafa Afifi Hassan, Indrajit V. Bagal, Jin Ho Kang and Sang-Wan Ryu; Chonnam National University, Korea (the Democratic People's Republic of).

**3:00 PM H03.04**

**Tuning the Photonic Bandgap in GaN Nanopillar Arrays on Stretchable PDMS Films** Kwai Hei Li, Yuk Fai Cheung and Hoi Wai Choi; The University of Hong Kong, Hong Kong.

**3:15 PM H03.05**

**Selective Area Sublimation of GaN for the Fabrication of Nano-Porous Structures and Arrays of Nanolasers** Benjamin Damilano<sup>1</sup>, Stéphane Vézian<sup>1</sup>, Pierre-Marie Coulon<sup>2</sup>, Thi Huong Ngo<sup>1</sup>, Pierre Valvin<sup>3</sup>, Julien Brault<sup>1</sup>, Virginie Brandli<sup>1</sup>, Marc Portail<sup>1</sup>, Philip Shields<sup>2</sup>, Jean Massies<sup>1</sup> and Bernard Gil<sup>2</sup>; <sup>1</sup>CRHEA-CNRS, France; <sup>2</sup>University of Bath, United Kingdom; <sup>3</sup>L2C-CNRS, France.

**3:30 PM H03.06**

**Strain-Relaxation Studies of Thick (>100nm) and Wide (>500nm) InGaN Stripe Arrays** Chirag Gupta, Yusuke Tsukada, Shubhra Pasayat, Wenjian Liu, Stacia Keller, Shuji Nakamura and Umesh K. Mishra; University of California, Santa Barbara, United States.

**3:45 PM BREAK**

## SESSION L01: Piezoelectricity and Theory for Electronic Devices

Session Chairs: Chris Van de Walle and Doug Yoder

Tuesday Afternoon, July 9, 2019

Regency Ballroom E-G, Second Floor

**4:15 PM \*L01.01**

**Nonlinear Piezoelectricity in III-N Heterostructures—The Role of the Growth Plane** Saroj K. Patra<sup>1,3</sup> and Stefan Schulz<sup>1,2</sup>; <sup>1</sup>Tyndall National Institute, Ireland; <sup>2</sup>University College Cork, Ireland; <sup>3</sup>University College Cork, Ireland.



**4:45 PM L01.02**

**The Mobility of a GaN-on-AlN Two-Dimensional Hole Gas** Samuel J. Bader, Reet Chaudhuri, Grace Xing and Debdeep Jena; Cornell University, United States.

**5:00 PM L01.03**

**Automated Simulation-Assisted Design and Layout of 600V, Lateral GaN Power HFEs** Collin Hitchcock<sup>1</sup>, Shuyao Chen<sup>1,2</sup> and T. Paul Chow<sup>1</sup>; <sup>1</sup>Rensselaer Polytechnic Institute, United States; <sup>2</sup>Cornell University, United States.

**5:15 PM L01.04**

**Phenomena Limiting the Off-State Breakdown Voltage in AlGaIn/GaN HEMTs for Power Converters** Nicolò Zagni<sup>1</sup>, Francesco Maria Puglisi<sup>1</sup>, Paolo Pavan<sup>1</sup>, Alessandro Chini<sup>1</sup> and Giovanni Verzellesi<sup>2,3</sup>; <sup>1</sup>Università degli Studi di Modena e Reggio Emilia, Italy; <sup>2</sup>Università degli Studi di Modena e Reggio Emilia, Italy; <sup>3</sup>Università degli Studi di Modena e Reggio Emilia, Italy.

**5:30 PM L01.05**

**Currents in Nitride Tunnel Junctions** Jean-Yves Duboz, Victor Fan Arcara and Borge Vinter; CNRS, France.

**5:45 PM LATE NEWS**

## SESSION I04: InGaN Properties

Session Chairs: Adrian Avramescu and Lorenzo Rigutti

Tuesday Afternoon, July 9, 2019

Regency Ballroom A-C, Second Floor

**2:00 PM I04.01**

**High Temperature Switching of Exciton Character in Double InGaIn/GaN Quantum Wells** Tadeusz Suski<sup>1</sup>, Grzegorz Staszczak<sup>1</sup>, Grzegorz Muziol<sup>1</sup>, Czeslaw Skierbiszewski<sup>1,2</sup> and Piotr Perlin<sup>1,2</sup>; <sup>1</sup>Institute of High Pressures Physics, UNIPRESS, Poland; <sup>2</sup>TopGaN, Poland.

**2:15 PM I04.02**

**Carrier Dynamics of Nonpolar and Polar InGaIn/GaN MQWs at High Temperatures** Xuanqi Huang<sup>1</sup>, Dongying Li<sup>1</sup>, Houqiang Fu<sup>1</sup>, Kai Fu<sup>1</sup>, Tsung-Han Yang<sup>1</sup>, Chen Yang<sup>1</sup>, Jingan Zhou<sup>1</sup>, Jossue Montes<sup>1</sup>, Steven P. DenBaars<sup>2</sup>, Shuji Nakamura<sup>2</sup>, Cun-Zheng Ning<sup>1</sup> and Yuji Zhao<sup>1</sup>; <sup>1</sup>Arizona State University, United States; <sup>2</sup>University of California, Santa Barbara, United States.

**2:30 PM I04.03**

**Impact of Point Defects on Auger Recombination in InGaIn/GaN Quantum Well in the Droop Regime** Wei Liu<sup>1</sup>, Camille Haller<sup>1</sup>, Gordon Callsen<sup>1</sup>, Thomas Weatherley<sup>1</sup>, Jean-François Carlin<sup>1</sup>, Raphaël Butté<sup>1</sup>, Gwénoél Jacopin<sup>2</sup> and Nicolas Grandjean<sup>1</sup>; <sup>1</sup>EPFL, Switzerland; <sup>2</sup>Institut Néel, Université Grenoble Alpes, CNRS, Grenoble INP, France.

**2:45 PM I04.04**

**Strain Relaxation and Stokes Shift of In<sub>x</sub>Ga<sub>1-x</sub>N Epilayers over the Full Composition Range** Alec M. Fischer<sup>1,2</sup>, Joshua J. Williams<sup>3</sup> and Fernando Ponce<sup>1</sup>; <sup>1</sup>Arizona State University, United States; <sup>2</sup>STACE Solar, Canada; <sup>3</sup>Arizona State University, United States.

**3:00 PM I04.05**

**Probing Alloy Formation Using Different Excitonic Species—The Particular Case of InGaIn** Gordon Callsen, Raphaël Butté and Nicolas Grandjean; École Polytechnique Fédérale de Lausanne (EPFL), Switzerland.

**3:15 PM I04.06**

**Luminescence and Defect Imaging in Semi-Polar InGaIn/GaN ‘Bow-Tie’ Structures on Patterned Si Substrates** Jochen Bruckbauer<sup>1</sup>, Carol Trager-Cowan<sup>1</sup>, Ben Hourahine<sup>1</sup>, Aimo Winkelmann<sup>1,2</sup>, X Yu<sup>3</sup>, Anja Ipsen<sup>4</sup>, Michael Wallace<sup>1</sup>, Paul Edwards<sup>1</sup>, G. Naresh Kumar<sup>1</sup>, Matthias Hocker<sup>4</sup>, Sebastian Bauer<sup>1</sup>, Raphael Müller<sup>4</sup>, Jie Bai<sup>3</sup>, Klaus Thonke<sup>4</sup>, T Wang<sup>3</sup> and Robert Martin<sup>1</sup>; <sup>1</sup>University of Strathclyde, United Kingdom; <sup>2</sup>Laser Zentrum Hannover e.V., Germany; <sup>3</sup>University of Sheffield, United Kingdom; <sup>4</sup>Ulm University, Germany.

**3:30 PM I04.07**

**Reduced Non-Radiative Recombination in Semi-Polar Green-Emitting III-N Quantum Wells with Strain-Reducing AlInN Buffer Layers** Philipp Henning<sup>1,2</sup>, Daniel Schmid<sup>1,2</sup>, Philipp Horenburg<sup>1,2</sup>, Heiko Bremers<sup>1,2</sup>, Uwe Rossow<sup>1,2</sup>, Florian Tendille<sup>3</sup>, Philippe Vennéguès<sup>3</sup>, Philippe de Mierry<sup>3</sup>, Jesus Zuniga-Perez<sup>3</sup> and Andreas Hangleiter<sup>1,2</sup>; <sup>1</sup>TU Braunschweig, Germany; <sup>2</sup>TU Braunschweig, Germany; <sup>3</sup>CNRS, France.

**3:45 PM BREAK**

SESSION F02: Bulk Growth of AlN and GaN  
Session Chairs: Yutaka Mikawa and Marcin Zajac  
Tuesday Afternoon, July 9, 2019  
Regency Ballroom A-C, Second Floor

**4:15 PM \*F02.01**

**AlN Single Crystal Substrate Growth for UV Applications** Rafael Dalmau, Jeffrey Britt and Raoul Schlessler; HexaTech, Inc., United States.

**4:45 PM F02.02**

**60mm Bulk AlN Single Crystalline Wafers with Excellent Deep UV Transparency Grown by PVT Method for DUV-LED Applications** Qikun Wang, Dan Lei, Guangdong He, Jianchao Gong, Jiali Huang and Jason Wu; Ultratrend Technologies Inc, China.

**5:00 PM \*F02.03**

**Recent Advances of GaN Growth by Na-Flux Method** Yusuke Mori, Masayuki Imanishi and Masashi Yoshimura; Osaka University, Japan.

**5:30 PM F02.04**

**Modeling of Bulk GaN Crystal Growth from Na-Ga Solution** Alexey Kondratyev, Andrei Vorob'ev, Vladimir Kalaev and Roman Talalaev; STR Group Inc., Russian Federation.

**5:45 PM F02.05**

**3-Inch Homogeneous GaN Single Crystal Grown by Na Flux Method** Zongliang Liu<sup>1</sup>, Ke Xu<sup>1,2</sup> and Jianfeng Wang<sup>1,2</sup>; <sup>1</sup>Suzhou Institute of Nano-Tech and Nano-Bionics, CAS, China; <sup>2</sup>Suzhou Nanowin Science and Technology Co., Ltd., China.

**POSTER SESSIONS**

SESSION AP02: Poster Session II: Light Emitting Devices  
Tuesday Afternoon, July 9, 2019  
6:30 PM - 8:30 PM  
Grand Ballroom, Second Floor

**AP02.01**

**Performance Improvement of InGaIn/GaN Blue LEDs with Distributed Contact Flip Chip Design** Muhammet Genç<sup>1,2</sup>, Volodymyr Sheremet<sup>3</sup>, Mustafa Elçi<sup>3</sup>, A.E. Kasapoğlu<sup>4</sup>, Ismail Altuntas<sup>5</sup>, Gamze Egin<sup>2</sup>, Selcen Islamoglu<sup>3</sup>, Emre Gur<sup>4</sup>, Nizam Muzafferoglu<sup>2</sup>, Sezai Elagoz<sup>2</sup>, Oguz Gulseren<sup>6</sup> and Atilla Aydinli<sup>7</sup>; <sup>1</sup>Sabancı University, Turkey; <sup>2</sup>Ermaksan Optoelectronic R&D Center, Turkey; <sup>3</sup>Advanced Research Laboratories, Turkey; <sup>4</sup>Atatürk University, Turkey; <sup>5</sup>Cumhuriyet University, Turkey; <sup>6</sup>Bilkent University, Turkey; <sup>7</sup>Uludağ University, Turkey.

**AP02.02**

**Fabrication of an Array of Sapphire Nano-Membranes for Micro-LED Display** Jehong Oh<sup>1</sup>, Seungmin Lee<sup>1</sup>, Jongmyeong Kim<sup>1</sup>, Jungel Ryu<sup>1</sup> and Euijoon Yoon<sup>1,2,3</sup>; <sup>1</sup>Seoul National University, Korea (the Republic of); <sup>2</sup>Seoul National University, Korea (the Republic of); <sup>3</sup>Seoul National University, Korea (the Republic of).

**AP02.03**

**Resistance Reduction of n-AlGaIn Layer with AlN Mole Fraction 62% for n-Type Conductive Layer in Deep Ultraviolet Light Emitting Emitters** Kengo Nagata<sup>1,2</sup>, Hiroaki Makino<sup>1,2</sup>, Keita Kataoka<sup>3</sup>, Tetsuo Narita<sup>3</sup> and Yoshiki Saito<sup>1,2</sup>; <sup>1</sup>Toyoda Gosei, Japan; <sup>2</sup>TS Opto, Japan; <sup>3</sup>Toyota Central R&D Labs, Japan.

**AP02.04**

**Multi-Color InGaIn Nanocrystal Micro LEDs Grown by Molecular Beam Epitaxy** Xianhe Liu, Kishwar Mashooq, Ayush Pandey, Walter J. Shin and Zetian Mi; University of Michigan, United States.

**AP02.05**

**Optimizing AlGaIn-Based UVB LEDs Using Experimental Device Data in the Nextnano Software** Maria Cecilia d. Figueira<sup>1</sup>, Alex Trellakis<sup>1</sup>, Stefan Birner<sup>1</sup>, M. A. Khan<sup>2,3</sup> and Hideki Hirayama<sup>2,3</sup>; <sup>1</sup>nextnano GmbH, Germany; <sup>2</sup>RIKEN, Japan; <sup>3</sup>RIKEN Center for Advanced Photonics (RAP), Japan.

**AP02.06**

**Enhanced Efficiency of InGaIn/GaN MQWs LED with Ga-Doped ZnO Transparent Conducting Layer** Sang-Jo Kim<sup>1</sup>, Kwang Jae Lee<sup>1</sup>, Semi Oh<sup>1</sup>, Jang Hwan Han<sup>1</sup>, Dong Seon Lee<sup>2</sup> and Seong-Ju Park<sup>1</sup>; <sup>1</sup>Gwangju Institute Science and Technology, Korea (the Republic of); <sup>2</sup>Gwangju Institute Science and Engineering, Korea (the Republic of).

**AP02.07**

**Improved the AlGaN-Based Ultraviolet LEDs Performance with Super-Lattice Structure Last Barrier on Sputtered AlN/Sapphire Substrate** Jun Zhang, Qian Chen, Bo Tan, Hanling Long, Yi Zhang, Jiangnan Dai and Changqing Chen; Huazhong University of Science and Technology, China.

**AP02.08**

**High Quality InGaN/GaN Nanopillar Fabricated by Neutral Beam Etching for Directional Micro-LED** Kexiong Zhang; National Institute of Advanced Industrial Science and Technology (AIST), Japan.

**AP02.09**

**Half Nanometer Wavelength Uniformity Achievement by Introducing Low Temperature Sensitive InGaN Deposition Process** Bumjoon Kim, Soo Min Lee, Eric Tucker, Drew Hanser and Ajit Paranjpe; Veeco, United States.

**AP02.10**

**Wavefunction Overlap Calculations in Thin and Thick InGaN/GaN Polar and Nonpolar Single Quantum Wells** Morteza Monavarian and Daniel Feezell; Center for High-Technology Materials, The University of New Mexico, United States.

**AP02.11**

**Arrays of TiO<sub>2</sub> Sphere for the Improvement of Light Extraction Efficiency in III-Nitride Light-Emitting Diodes** Dohyun Kim, Dongsu Shin, Jiyeon Yu and Jinsub Park; Hanyang, Korea (the Republic of).

**AP02.12**

**Room Temperature Luminescence of Passivated InGaN Quantum Dots Formed by Quantum-Sized-Controlled Photoelectrochemical Etching** Xiongliang Wei, Syed Ahmed Al Mueeed, Matthew R. Peart, Sun Wei, Renbo Song, Nelson Tansu and Jonathan Wierer; Lehigh University, United States.

**AP02.13**

**Improvement in Heat Dissipation Characteristics of InGaN/GaN Quantum-Well LEDs using Multiple-Layer Hexagonal Boron Nitride** Ilguy Choi<sup>1</sup>, Kwanjae Lee<sup>2</sup>, Soo Min Kim<sup>3</sup>, Cheul-Ro Lee<sup>1</sup> and Jin Soo Kim<sup>1</sup>; <sup>1</sup>Chonbuk National University, Korea (the Republic of); <sup>2</sup>Korea Advanced Institute of Science and Technology, Korea (the Republic of); <sup>3</sup>Korea Institute of Science and Technology, Korea (the Republic of).

**AP02.14**

**Design and Growth of Strain Relieved Laser Diode Emitting at 450 nm** Avinash S. Paliwal<sup>1,2</sup>, Kuldip Singh<sup>1</sup> and Manish Mathew<sup>1,2</sup>; <sup>1</sup>CSIR-Central Electronics Engineering Research Institute, Pilani, India, India; <sup>2</sup>Academy of Scientific and Innovative Research (AcSIR), CSIR-CEERI Campus, India.

**AP02.15**

**Enhanced Emission Efficiency of GaInN-Based Green Light-Emitting Diodes with Aluminium Thin-Film Deposition** Ryoya Mano<sup>1</sup>, Dong-Pyo Han<sup>1</sup>, Kengo Yamamoto<sup>1</sup>, Seiji Ishimoto<sup>1</sup>, Satoshi Kamiyama<sup>1</sup>, Tetsuya Takeuchi<sup>1</sup>, Motoaki Iwaya<sup>1</sup> and Isamu Akasaki<sup>1,2</sup>; <sup>1</sup>Meijo University, Japan; <sup>2</sup>Nagoya University, Japan.

**AP02.16**

**Investigation of Emission Efficiency in GaInN-Based Green Light-Emitting Diodes with Various Structures of Underlying Layer** Dong-Pyo Han<sup>1</sup>, Kengo Yamamoto<sup>1</sup>, Seiji Ishimoto<sup>1</sup>, Ryoya Mano<sup>1</sup>, Motoaki Iwaya<sup>1</sup>, Tetsuya Takeuchi<sup>1</sup>, Satoshi Kamiyama<sup>1</sup> and Isamu Akasaki<sup>1,2</sup>; <sup>1</sup>Meijo University, Japan; <sup>2</sup>Nagoya University, Japan.

**AP02.17**

**Light Extraction Improvement of Transfer Printable GaN LEDs on Si with Backside Roughening** Zhi Li, Zcinab Shaban, Yan Lei, Mahub Akhter, James O'Callaghan and Brian Corbett; Tyndall National Institute, University College Cork, Ireland.

**AP02.18**

**Study on Thermal Management for Chip-Scale Package GaN Light-Emitting Diodes** Byongjin Ma; Korea Electronics Technology Institute, Korea (the Republic of).

**AP02.19**

**Electro-Optical Numerical Modeling for the Optimization of InGaN Based Vertical Cavity Surface Emitting Laser Diodes** Zih-Hong Young<sup>1</sup> and Yuh-Renn Wu<sup>1,2</sup>; <sup>1</sup>National Taiwan University, Taiwan; <sup>2</sup>Industrial Technology Research Institute, Taiwan.

**AP02.20**

**Flexible GaN Light Emitting Diode Using Micron-Scale Pyramidal Arrays** Zhenhuan Tian<sup>1,2</sup>, Qiang Li<sup>1,2</sup>, Xilin Su<sup>1,2</sup>, Ye Zhang<sup>1,2</sup>, Maofeng Guo<sup>1,2</sup>, Minyan Zhang<sup>1,2</sup>, Wen Ding<sup>1,2</sup>, Yufeng Li<sup>1,2</sup>, Feng Yun<sup>1,2</sup> and S. W. Ricky Lee<sup>3,4</sup>; <sup>1</sup>Key Laboratory for Physical Electronics and Devices of the Ministry of Education and Shaanxi Provincial Key Laboratory of Photonics & Information Technology, Xi'an Jiaotong University, China; <sup>2</sup>Solid-State

Lighting Engineering Research Center, Xi'an Jiaotong University, China; <sup>3</sup>Department of Mechanical and Aerospace Engineering, Hong Kong University of Science and Technology, Hong Kong; <sup>4</sup>HKUST LED-FPD Technology R&D Center at Foshan, China.

**AP02.21**

**Improvement of Quantum Efficiency by Employing Hole Injection-Promoted and Active-Layer-Friendly AlInGaN Insertion Layer in InGaN/GaN Light-Emitting Diodes** Naixin Liu and Tongbo Wei; Institute of Semiconductor, CAS, China.

**AP02.22**

**Thermal Analysis for UV-Micro-LED on GaN-Substrate Under kA/cm<sup>2</sup> Current Injection Level by Forward Voltage Method and Infrared Imaging** Chengcheng Li and Zhizhong Chen; Peking University, China.

**AP02.23**

**Four Monochromatic LEDs Mixing with Two White LEDs for Circadian Rhythm and Vision Simultaneously** Jingxin Nie and Zhizhong Chen; Peking University, China.

**AP02.24**

**Fabrication of LED Pixels of 16 × 16 Array Structure Using Si Micro-Cup Substrate** Kota Sato<sup>1</sup>, Yoshihumi Kamei<sup>1</sup>, Ryosuke Nawa<sup>1</sup>, Shinya Aikawa<sup>2</sup>, Yasuhisa Usida<sup>3</sup>, Takeyoshi Onuma<sup>1</sup>, Tomohiro Yamaguchi<sup>1</sup> and Toru Honda<sup>1</sup>; <sup>1</sup>Kogakuin University, Japan; <sup>2</sup>Kogakuin University, Japan; <sup>3</sup>Nagoya University, Japan.

**AP02.25**

**Coupling Resonance for CdSe/ZnS Quantum Dots on Blue LED Embedded by Ag Nanoparticles** Yifan Chen and Zhizhong Chen; State Key Laboratory for Artificial Microstructure and Mesoscopic Physics, School of Physics, Peking University, China.

**AP02.26**

**Study on ITO Electrode on GaN Shell in Multi-Quantum-Shell LED** Atsushi Suzuki<sup>1</sup>, Hideki Murakami<sup>1</sup>, Kyohei Nokimura<sup>1</sup>, Minoru Takebayashi<sup>1</sup>, Nanami Goto<sup>1</sup>, Mizuki Terazawa<sup>1</sup>, Weifang Lu<sup>1</sup>, Naoki Sone<sup>1,2</sup>, Kazuyoshi Iida<sup>1,3</sup>, Masaki Ohya<sup>1,3</sup>, Satoshi Kamiyama<sup>1</sup>, Tetsuya Takeuchi<sup>1</sup>, Motoaki Iwaya<sup>1</sup> and Isamu Akasaki<sup>1,4</sup>; <sup>1</sup>Meijo University, Japan; <sup>2</sup>Koito Manufacturing CO.,LTD, Japan; <sup>3</sup>Toyota Gosei Co.,Ltd, Japan; <sup>4</sup>Akasaki Research Center, Nagoya University, Japan.

**AP02.27**

**Depth Dependent Strain Analysis in AlGaN Deep Ultra-Violet Light Emitting Diodes Using Surface-Plasmon Enhanced Raman Spectroscopy** Gunwoo Jung<sup>1</sup>, Kyuheon Kim<sup>1</sup>, Chanmi Choi<sup>1</sup>, Ukgeun Gang<sup>1</sup>, Tachwan Park<sup>1</sup>, Boram Jeon<sup>1</sup>, Youngbo Moon<sup>2</sup> and Junghoon Song<sup>1</sup>; <sup>1</sup>Kongju National University, Korea (the Republic of); <sup>2</sup>UJL, Korea (the Republic of).

**AP02.28**

**Towards High Quality, Low Damage RIE Etched Laser Mirror Facets for Integrated on Wafer InGaN Laser Diodes** Krzysztof Gibasiewicz<sup>1</sup>, Jacek Kacperski<sup>2</sup>, Szymon Grzanka<sup>1,2</sup>, Lucja Marona<sup>1,2</sup>, Piotr Perlin<sup>1,2</sup> and Tadeusz Suski<sup>1</sup>; <sup>1</sup>Institute of High Pressure Physics, Poland; <sup>2</sup>TopGaN, Poland.

**AP02.29**

**Lasng Action on Whispering Gallery Mode of GaN Hexagonal Microdisks Fabricated on Sapphire Substrates** Geng He; Key Lab of Advanced Optical Manufacturing Technologies of Jiangsu Province and Key Lab of Modern Optical Technologies of Education Ministry of China, Soochow University, China.

**AP02.30**

**The Effects of Structural Parameters on Optical Gain in InGaN Based Quantum Wires Laser Diodes** Asghar Asgari Tokaldani<sup>1,2</sup>; <sup>1</sup>University of Tabriz, Iran (the Islamic Republic of); <sup>2</sup>University of Western Australia, Australia.

**AP02.31**

**Improving Efficiency of Boron Nitride Deep Ultra-Violet ac-Driven Electroluminescence Devices** Weiqiang Yuan<sup>1</sup>, Thushan Wickramasinghe<sup>2</sup> and Wojciech M. Jadwisieniczak<sup>1</sup>; <sup>1</sup>Ohio University, United States; <sup>2</sup>Ohio University, United States.

**AP02.32**

**Preparation of Carbon Dots by Microwave Synthesis for White LED Devices** Zhang Shengnan and Yun Feng; Xi'an Jiaotong University, China.

**AP02.33**

**Improved Emission Performance of N-Polar GaN-Based Blue-Violet Light-Emitting Diodes with a Polarization-Induced Tunneling Junction** Gaoqiang Deng, Yuantao Zhang, Long Yan, Xu Han, Ye Yu, Yang Wang and Guotong Du; Jilin University, China.

**AP02.34**

**Dislocation Related Nonradiative Recombination in InGaN Laser Diodes** Agata Bojarska<sup>1</sup>, Dario Schiavon<sup>2</sup>, Szymon Grzanka<sup>1</sup>, Lucja Marona<sup>1,2</sup>, Grzegorz Staszczak<sup>1</sup>, Julita Smalc-Koziorowska<sup>1</sup>, Jan Weyher<sup>1</sup> and Piotr Perlin<sup>1,2</sup>; <sup>1</sup>Institute of High Pressure Physics PAS, Poland; <sup>2</sup>TopGaN Limited, Poland.

SESSION BP02: Poster Session II: Electronic Devices  
Tuesday Afternoon, July 9, 2019  
6:30 PM - 8:30 PM  
Grand Ballroom, Second Floor

**BP02.01**

**Stable C-V Characteristics of Al<sub>2</sub>O<sub>3</sub>/m-Plane GaN Structures at High Temperatures** Shota Kaneki and Tamotsu Hashizume; RCIQE of Hokkaido University, Japan.

**BP02.02**

**Investigation of the Early Pinch-Off Effect of AlGaIn/GaN Schottky-Gate Fin-HEMTs and Its Threshold Voltage Modulation** Li-Cheng Chang<sup>1</sup>, Jih-Hao Lin<sup>2</sup>, Cheng-Jia Dai<sup>1</sup>, Ming Yang<sup>1</sup>, Yi-Hong Jiang<sup>1</sup>, Yuh-Renn Wu<sup>2</sup> and Chao-Hsin Wu<sup>1,2</sup>; <sup>1</sup>National Taiwan University, Taiwan; <sup>2</sup>National Taiwan University, Taiwan.

**BP02.03**

**Design of GaN Based Multi-Channel FinFETs with a Full 3D Simulation** Chun-Lin Yu<sup>1</sup>, Jih-Hao Lin<sup>1</sup> and Yuh-Renn Wu<sup>1,2</sup>; <sup>1</sup>National Taiwan University, Taiwan; <sup>2</sup>Industrial Technology Research Institute, Taiwan.

**BP02.04**

**Gate-Length Dependence of Gate Lag, Drain Lag and Current Collapse in Field-Plate AlGaIn/GaN HEMTs** Tomochika Chiba, Yasunori Saito, Ryouhei Tsurumaki and Kazushige Horio; Shibaura Institute of Technology, Japan.

**BP02.05**

**Normally-Off AlGaIn/GaN HEMT on 200 mm Silicon with ON-Current 500 mA/mm and V<sub>th</sub> > 5V** Sandeep Kumar<sup>1</sup>, Sandeep Vura<sup>1</sup>, Vanjari S. Charan<sup>1</sup>, Surani B. Dolmanan<sup>2</sup>, Sudhiranjan Tripathy<sup>2</sup>, Rangarajan Muralidharan<sup>1</sup> and Digbijoy N. Nath<sup>1</sup>; <sup>1</sup>Indian Institute of Science (IISc), India; <sup>2</sup>Institute of Materials Research and Engineering (IMRE), Agency for Science, Technology, and Research, Singapore.

**BP02.06**

**Effects of Recessed-Gate Structure on AlGaIn/GaN MIS-HEMTs Using PEALD AlO<sub>x</sub>N<sub>y</sub> Thin Film** Hyun-Seop Kim<sup>1</sup>, Myoung-Jin Kang<sup>2</sup>, Ilhwan Hwang<sup>2</sup>, Su-Keun Eom<sup>2</sup>, Kwang-Seok Seo<sup>2</sup> and Ho-Young Cha<sup>1</sup>; <sup>1</sup>Hongik University, Korea (the Republic of); <sup>2</sup>Seoul National University, Korea (the Republic of).

**BP02.07**

**Optimization of Crucial Device Parameters for GaN Vertical Trench MOSFETs** Shuang Liu, Shenglei Zhao, Jincheng Zhang and Yue Hao; Xidian University, China.

**BP02.08**

**Vertical GaN-on-GaN Schottky Barrier Diode with Fluorite-Ion-Implanted Edge Termination** Zirui Liu, Jianfeng Wang, Hong Gu, Ke Xu and Yumin Zhang; Suzhou Institute of Nano-tech and Nano-bionics, Chinese Academy of Sciences, China.

**BP02.09**

**Reliability Investigation on Recessed AlGaIn/GaN SBDs** Ge Liu, Shenglei Zhao, Jiabo Chen, Jincheng Zhang and Yue Hao; Xidian University, China.

**BP02.10**

**Electrical Properties of GaAs/GaN Junctions by Bonding GaN Layers Grown on Free Standing Substrates** Shoji Yamajo, Jianbo Liang and Naoteru Shigekawa; Osaka City University, Japan.

**BP02.11**

**Characterization of Heavy-Ion Irradiation Effects on AlInN/GaN on Si High-Electron-Mobility Transistors (HEMTs)** Seshagiri Rao Challa<sup>1</sup>, Nahuel A. Vega<sup>2,3,4</sup>, Christian Kristukat<sup>2,3</sup>, Nahuel Müller<sup>2</sup>, Mario Debray<sup>2,3</sup>, Gordon Schmidt<sup>1</sup>, Juergen Christen<sup>1</sup>, Florian Hörich<sup>1</sup>, Hartmut Witte<sup>1</sup>, Armin Dadgar<sup>1</sup> and André Strittmatter<sup>1</sup>; <sup>1</sup>Institute für experimentelle Physik/OVGU Magdeburg, Germany; <sup>2</sup>Gerencia de Investigación y Aplicaciones, Argentina; <sup>3</sup>Escuela de Ciencia y Tecnología, Universidad Nacional de San Martín (UNSAM), Argentina; <sup>4</sup>Consejo Nacional de Investigaciones Científicas y Tecnológicas (CONICET), Argentina.

**BP02.12**

**Investigation on Threshold Voltage of GaN Vertical MOSFETs** Xiufeng Song, Jincheng Zhang, Shenglei Zhao and Yue Hao; Xidian University, China.

**BP02.13**

**Possible Use of Wide Bandgap Semiconductor in Enhancement Mode Using P-Type Gate Dielectric** Mudassar Imam Yahya Meer, Yogendra K. Yadav, Akanksha Rawat, Jaya Jha, Swaroop Ganguly and Dipankar Saha; Indian Institute of Technology, India.

**BP02.14**

**AlGaIn/GaN Diode with MIS-Gated Hybrid Anode and Edge Termination** Ilhwan Hwang<sup>2</sup>, Raseoung Ki<sup>1</sup>, Ho-Young Cha<sup>3</sup> and Kwang-Seok Seo<sup>1</sup>; <sup>2</sup>Seoul National University, Korea (the Republic of); <sup>3</sup>Hongik University, Korea (the Republic of).

**BP02.15**

**Breakdown Voltage Analysis for the New RESURF AlGaIn Channel HEMTs** Zhongyang Li, Shenglei Zhao, Jincheng Zhang and Yue Hao; Xidian University, China.

**BP02.16**

**Reduction of Radiated Emission from Resonance Coil in GaN Wireless Power Transmission Circuit by Using Nd-Fe-N Core** Toshihide Ide<sup>1,2</sup>, Nobuyoshi Imaoka<sup>3</sup>, Mikio Oomori<sup>2</sup>, Kimihiro Ozaki<sup>3</sup>, Mitsuaki Shimizu<sup>1</sup> and Noriyuki Takada<sup>2</sup>; <sup>1</sup>Advanced Industrial Science and Technology (AIST), Japan; <sup>2</sup>Advanced Industrial Science and Technology (AIST), Japan; <sup>3</sup>Advanced Industrial Science and Technology (AIST), Japan.

**BP02.17**

**Delta-Doping Effect in Normally-off GaN-cap/AlGaIn/GaN HEMT on Electrical Properties** Ryohei Yamaguchi, Jumpei Sumino, Momoe Shojima and Akio Wakejima; Nagoya Institute of Technology, Japan.

**BP02.18**

**Effect of Spatial Position of Traps Located at the Oxide/AlGaIn Interface on the Device Characteristics** Sreenadh Surapaneni, Jaya Jha, Swaroop Ganguly and Dipankar Saha; IIT Bombay, India.

**BP02.19**

**Ultra-Low Turn-on Voltage GaN Vertical Schottky Diodes with Tungsten Anode Contact** Zhaoke Bian, Tao Zhang, Jiabo Chen, Jincheng Zhang and Shenglei Zhao; Xidian University, China.

**BP02.20**

**GaN Bipolar Junction Transistor for Monolithic Integration** Wai Yuen Fu and Hoi Wai Choi; The University of Hong Kong, Hong Kong.

**BP02.21**

**Trap States in Normally-Off Gate-Recessed AlGaIn/GaN/AlGaIn Double-Heterojunction High-Electron-Mobility Transistors** Dan Zhu, Jincheng Zhang and Shenglei Zhao; Xidian University, China.

**BP02.22**

**High-Quality Cat-CVD SiN Passivation Layer for Low Current Collapsed AlGaIn/GaN HEMT-on-Si** Myoung-Jin Kang<sup>1</sup>, Hyun-Seop Kim<sup>2</sup>, Su-Keun Eom<sup>1</sup>, Ho-Young Cha<sup>2</sup> and Kwang-Seok Seo<sup>1</sup>; <sup>1</sup>Seoul National University, Korea (the Republic of); <sup>2</sup>Hongik University, Korea (the Republic of).

**BP02.23**

**Improvement of Pulse Characteristics of GaN Schottky Barrier Diode Using Diamond Substrate Which has Thermally Better Property than Si Substrate** Ra-Seong Ki<sup>1</sup>, Ho-Young Cha<sup>2</sup> and Kwang-Seok Seo<sup>1</sup>; <sup>1</sup>Seoul National University, Korea (the Republic of); <sup>2</sup>Hongik University, Korea (the Republic of).

**BP02.24**

**Effect of Field Plate on Breakdown Characteristics of p-AlGaIn Gate AlGaIn/GaN HEMTs** Junwei Liu, Jincheng Zhang, Shenglei Zhao and Yue Hao; Xidian University, China.

**BP02.25**

**Effect of AlN Insert Layer on Al<sub>x</sub>Ga<sub>1-x</sub>N/AlN/GaN HEMT Structure** Uiho Choi, Kyeongjae Lee, Yongjun Nam, Taehoon Jang, Donghyeop Jung and Okhyun Nam; Korea Polytechnic University, Korea (the Republic of).

**BP02.26**

**Ka Band AlGaIn/GaN HEMT with U-Trench Gate** Ke Wei; Institute of Microelectronics Chinese Academy of Science, China.

**BP02.27**

**Performance of AlGaIn/GaN MISHEMT with Fin-Structured Second Gate in Wide Access Region** Ryun-Hwi Kim, Hyeon-Su Lee, Seung-Hyeon Kang and Jung-Hee Lee; Kyungpook National University, Korea (the Republic of).

**BP02.28**

**Comprehensive Study and Optimization of Ti/Au/Al/Ni/Au Ohmic Contact on III-N Heterostructure** Yogendra K. Yadav, Bhanu Upadhyay, Mudassar Imam Yahya Meer, Tarni Aggarwal, Swaroop Ganguly and Dipankar Saha; Indian Institute of Technology Bombay, India, India.

**BP02.29**

**GaN Based Gate Drive Circuit for Phase-Shifter Application** Weijun Luo; Institute of Microelectronics, Chinese Academy of Sciences, China.

**BP02.30**

**Threshold Voltage Dependence of Normally-Off p-GaN/AlGaN/GaN on Schottky Barrier Height** Jozef Osvald; IEE SAS Bratislava, Slovakia, Slovakia.

**BP02.31**

**A Novel Measurement Technique to Investigate OFF-State Performance of AlGaN/GaN HEMT on Silicon** Nayana Remesh, Sandeep Kumar, Rangarajan Muralidharan, Srinivasan Raghavan and Digbijoy N. Nath; Indian Institute of Science, India.

**BP02.32**

**High Breakdown Voltage Vertical GaN p-n Junction Diodes with Excellent Breakdown Capabilities by Application of a Two-Step Mesa Structure** Hiroshi Ohta<sup>1</sup>, Naomi Asai<sup>1</sup>, Fumimasa Horikiri<sup>2</sup>, Yoshinobu Narita<sup>2</sup>, Takehiro Yoshida<sup>2</sup>, Tomoaki Nishimaura<sup>1</sup> and Tomoyoshi Mishima<sup>1</sup>; <sup>1</sup>Hosei University, Japan; <sup>2</sup>SCIOCS Co. Ltd., Japan.

SESSION CP02: Poster Session II: Photovoltaics, Energy Harvesting and Photo Detectors

Tuesday Afternoon, July 9, 2019

6:30 PM - 8:30 PM

Grand Ballroom, Second Floor

**CP02.01**

**Van der Waals Epitaxy of AlN Nanorods on Graphene for High-Performance Ultraviolet Detectors** Xianjie Xiong; Key Lab of Advanced Optical Manufacturing Technologies of Jiangsu Province and Key Lab of Modern Optical Technologies of Education Ministry of China, Soochow University, China.

**CP02.02**

**Ultrafast Indium Nitride Based VIS-NIR Photo-Detector** Shibin Krishna<sup>1,2</sup>, Alka Sharma<sup>1</sup>, Neha Aggarwal<sup>1</sup>, Sudhir Husale<sup>1</sup> and Govind Gupta<sup>1</sup>; <sup>1</sup>CSIR-National Physical Laboratory, India; <sup>2</sup>King Abdullah University of Science and Technology, Saudi Arabia.

**CP02.03**

**Reconsideration of the Gallium Nitride—Dual Functionality as an Electron Transporter and Transparent Conductor for Recyclable Solar Cell Substrate Applications** Kwang Jae Lee<sup>1</sup>, Namchul Cho<sup>2</sup> and Jong H. Kim<sup>1</sup>; <sup>1</sup>Ajou University, Korea (the Republic of); <sup>2</sup>Soonchunhyang University, Korea (the Republic of).

**CP02.04**

**Growth and Fabrication of Backside Illuminated Metal-Semiconductor-Metal Deep Ultraviolet Photodetectors on High Quality AlN** Joocheol Jeong, John Son and Joo Jin; Genicom Co., Ltd., Korea (the Republic of).

**CP02.05**

**Solar Conversion of CO<sub>2</sub> with Light and Water Using InGaN Photoelectrode Grown by MBE** Hyojung Bae<sup>1</sup>, Koike Kayo<sup>2</sup>, Katsushi Fujii<sup>2</sup>, Soon Hyung Kang<sup>1</sup>, Sang-Wan Ryu<sup>1</sup> and Jun-Seok Ha<sup>1</sup>; <sup>1</sup>Chonnam National University, Korea (the Republic of); <sup>2</sup>RIKEN, Japan.

**CP02.06**

**Surface Engineered Polar and Non-Polar GaN Nanostructure Based Ultraviolet Photosensors** Monu Mishra<sup>1</sup> and Govind Gupta<sup>1,2</sup>; <sup>1</sup>CSIR-National Physical Laboratory, India; <sup>2</sup>Academy of Scientific & Innovative Research, India.

**CP02.07**

**Effects of the P-Doping in the Charge Layer on Quantum Efficiency in p-i-n GaN-Based Avalanche Photodiodes** Seong Ran Jeon; Korea Photonics Technology Institute, Korea (the Republic of).

**CP02.08**

**Non-Hybrid Single Layer Visible-Light Responsive Titanium Oxynitride Thin Films for Light Harvesting Applications** Nikhil Reddy Mucha, Dhanaanjay Kumar and Surabhi Shaji; North Carolina A&T State University, United States.

SESSION EP02: Poster Session II: Processing, Fabrication and Thermal Management

Tuesday Afternoon, July 9, 2019

6:30 PM - 8:30 PM

Grand Ballroom, Second Floor

**EP02.01**

**ALE of GaN (0001) for Removal of Etch-Induced Damage** Kevin A. Hatch<sup>1</sup>, Daniel Messina<sup>1</sup>, Houqiang Fu<sup>2</sup>, Kai Fu<sup>2</sup>, Xingye Wang<sup>1</sup>, Mei Hao<sup>1</sup>, Yuji Zhao<sup>2</sup> and Robert J. Nemanich<sup>1</sup>; <sup>1</sup>Arizona State University, United States; <sup>2</sup>Arizona State University, United States.

**EP02.02**

**Size Effects of the AlN on the Thermal Transport Across Metal/Semiconductor Interface** Yee Rui Koh<sup>1</sup>, John T. Gaskins<sup>1</sup>, Jeffrey L. Braun<sup>1</sup>, Habib Ahmad<sup>2</sup>, John Tomko<sup>1</sup>, William A. Doolittle<sup>2</sup> and Patrick Hopkins<sup>1</sup>; <sup>1</sup>University of Virginia, United States; <sup>2</sup>Georgia Institute of Technology, United States.

**EP02.03**

**Low Temperature Aluminum Nitride Deposition Enabled by Hydrazine** Daniel Alvarez<sup>1</sup>, Jeffrey Spiegelman<sup>1</sup> and Keisuke Andachi<sup>2</sup>; <sup>1</sup>RASIRC, United States; <sup>2</sup>Taiyo Nippon Sanso Corporation, Japan.

**EP02.04**

**Detection of Deep Level States Generated in GaN by Mg-Ion Implantation Using Conductance Method for MOS Diodes** Masamichi Akazawa and Ryo Kamoshida; Hokkaido University, Japan.

**EP02.05**

**Improved Thermal Performance of Homoepitaxial GaN-FETs Directly Bonded on a Graphite Composite Heat Spreader** Lei Li, Aozora Fukui and Akio Wakejima; Nagoya Institute of Technology, Japan.

**EP02.06**

**Optimization of a Cl Based ICP/RIE Plasma Etching of Semi-Insulating GaN** Matthew A. Gaddy<sup>1</sup>, Vladimir Kuryatkov<sup>1</sup>, Keller Andrews<sup>2</sup>, Nicholas Wilson<sup>1</sup>, Andreas Neuber<sup>1</sup>, Richard Ness<sup>3</sup> and Sergey Nikishin<sup>1</sup>; <sup>1</sup>Texas Tech University, United States; <sup>2</sup>Texas Tech University, United States; <sup>3</sup>Ness Engineering, United States.

**EP02.07**

**Photoelectrochemical Etching of Aluminum Nitride for Fast and Low Damage Surface Roughening** Yong Ha Choi<sup>1,2</sup>, Kwang Hyeon Baik<sup>3</sup>, Rakjun Choi<sup>4</sup>, Jeongtak Oh<sup>4</sup> and Jihyun Kim<sup>1,2</sup>; <sup>1</sup>Korea University, Korea (the Republic of); <sup>2</sup>Korea University, Korea (the Republic of); <sup>3</sup>Hongik University, Korea (the Republic of); <sup>4</sup>LG Innotek, Korea (the Republic of).

**EP02.08**

**Mg Recoil-Implantation by Nitrogen Bombardment to GaN** Toshikazu Yamada, Hisashi Yamada, Hiroshi Chonan, Noriyuki Taoka, Tokio Takahashi and Mitsuaki Shimizu; National Institute of Advanced Industrial Science and Technology, Japan.

SESSION GP02: Poster Session II: Epitaxial Growth

Tuesday Afternoon, July 9, 2019

6:30 PM - 8:30 PM

Grand Ballroom, Second Floor

**GP02.01**

**The Influence of AlN Nucleation Layer on Radio Frequency (RF) Transmission Loss of GaN-on-Si Structure** Shane Chang<sup>4,2,3</sup>, Ming Zhao<sup>1</sup>, Valentina Spampinato<sup>1</sup>, Alexis Franquet<sup>1</sup>, Do Hein<sup>3</sup>, Li Chang<sup>3</sup> and Akira Uedono<sup>5</sup>; <sup>1</sup>IMEC, Belgium; <sup>2</sup>Katholieke Universiteit Leuven, Belgium; <sup>3</sup>National Chiao Tung University, Taiwan; <sup>4</sup>imec, Belgium; <sup>5</sup>University of Tsukuba, Japan.

**GP02.02**

**Growth of N-Polar AlN on Sapphire with Off-Cut Angle and AlN Bulk Substrate** Narihito Okada<sup>1</sup>, Tatsuya Isono<sup>1</sup>, Tadatoshi Ito<sup>1</sup>, Ryota Sakamoto<sup>1</sup>, Yongzhao Yao<sup>2</sup>, Yukari Ishikawa<sup>2</sup> and Kazuyuki Tadatomo<sup>1</sup>; <sup>1</sup>Yamaguchi University, Japan; <sup>2</sup>Japan Fine Ceramics Center (JFCC), Japan.

**GP02.03**

**Two-Dimensional Rhombohedral BN Grown on AlN Template—The Effect of V/III Ratio on the Interface Quality** Chun-Pin Huang<sup>1</sup>, Jen-Inn Chyi<sup>2</sup> and Kun-Yu Lai<sup>1</sup>; <sup>1</sup>National Central University, Taiwan; <sup>2</sup>National Central University, Taiwan.

**GP02.05**

**AlGaN Nanowires Grown on SiO<sub>2</sub>/Si (100) Using Graphene as a Buffer Layer** Zhiqiang Liu<sup>1</sup>, Xiaoyan Yi<sup>1</sup>, Meng Liang<sup>1</sup>, Yunyu Wang<sup>1</sup>, Junxi Wang<sup>1</sup>, Jinmin Li<sup>1</sup> and Helge Weman<sup>2</sup>; <sup>1</sup>Institute of Semiconductors, China; <sup>2</sup>CrayoNano AS, Norway.

## GP02.06

**2DEG Enhancement in AlN/GaN/AlN Heterostructure for DH-HEMT by Epilayer Stress Engineering** Shashank Patwal<sup>1</sup>, Manvi Agrawal<sup>1,2</sup>, Nethaji Dharmarasu<sup>2</sup>, K Radhakrishnan<sup>1,2</sup> and Seah T. Alex<sup>2</sup>; <sup>1</sup>Nanyang Technological University, Singapore; <sup>2</sup>Nanyang Technological University, Singapore.

## GP02.07

**Characterisation and Elimination of Sliplines on 200 mm Diameter 1 mm Thick GaN on Silicon Wafers** Matthew Charles<sup>1</sup>, Joel Kanyandekwe<sup>1</sup>, Matthieu Lafossas<sup>1</sup>, Mrad Mrad<sup>1</sup>, Nicolas Devancier<sup>1</sup>, Mohamad Abdel Sater<sup>1</sup>, Carlos Beitia<sup>1</sup>, Isabelle Bergoend<sup>2</sup>, Mayeul Durand de Gevigney<sup>2</sup> and Dario Alliata<sup>2</sup>; <sup>1</sup>CEA-LETI, France; <sup>2</sup>Unity Semiconductor, France.

## GP02.08

**Direct Growth of AlGaIn/GaN Structure on AlN Template for Measurement of Effective Mass in InGaN Layer** Masatomo Sumiya<sup>1</sup>, Dickson Kindole<sup>2</sup>, Shuhei Yashiro<sup>1,3</sup>, Toru Honda<sup>3</sup> and Yasutaka Imanaka<sup>2</sup>; <sup>1</sup>National Institute for Materials Science, Japan; <sup>2</sup>National Institute for Materials Science, Japan; <sup>3</sup>Kougakuin, Japan.

## GP02.09

**Investigation of the Growth, Structural, and Optical Properties of Compositionally Graded InGa<sub>1-x</sub>N V-Graded Layers** Pijush K. Ghosh<sup>1</sup>, Andrian Kuchuk<sup>2</sup>, Mirsaeid Sarollahi<sup>1</sup>, Yurii Maidaniuk<sup>2</sup>, Manal Aldawsari<sup>3</sup>, Yuriy Mazur<sup>2</sup>, Gregory Salamo<sup>2</sup> and Morgan Ware<sup>1</sup>; <sup>1</sup>University of Arkansas, United States; <sup>2</sup>University of Arkansas, Fayetteville, United States; <sup>3</sup>University of Arkansas, Fayetteville, United States.

## GP02.10

**Growth Parameters Influence on InGaN/GaN Heterostructures Quality** Oleg Rabinovich, Alexander Savchuk, Marina Orlova, Sergey Marenkin, Sergey Didenko, Alexey Ril and Svetlana Podgornaya; NUST MISIS, Russian Federation.

## GP02.11

**Metal-Modulated Molecular Beam Epitaxy of Cubic-AlN on MgO Substrate for QCSE-Free Optoelectronic Devices** Jian-Wei Liang, Jung-Wook Min, Dalaver Anjum, Kuang-Hui Li, Malleswararao Tangi, Tien Khee Ng and Boon S. Ooi; KAUST, Saudi Arabia.

## GP02.12

**Resonant and Non-Resonant Raman Spectroscopy of In-Rich InGaN Alloys Grown by Plasma-Assisted MOCVD** Daniel Seidltz<sup>1</sup>, Emanuele Poliani<sup>1</sup>, Maximilian Ries<sup>1,2,3</sup>, Markus R. Wagner<sup>1</sup> and Axel Hoffmann<sup>1</sup>; <sup>1</sup>Technische Universität, Germany; <sup>2</sup>School for Analytical Sciences Adlershof (SALSA), Germany; <sup>3</sup>Leibniz-Institut für Analytische Wissenschaften - ISAS - e.V., Germany.

## GP02.13

**Repair of Multifunctional Two-Dimension Structures by Regrowth of AlN Atomic Layer in MEE Mode** Yuta Kamada, Tomoya Takeuchi and Akihiro Hashimoto; University of Fukui, Japan.

## GP02.14

**Self-Induced InGaN Nanowires with a Controlled InN Mole Fraction by HVPE** Mohammed Zeghouane<sup>1</sup>, Geoffrey Avit<sup>1</sup>, Yamina Andre<sup>1,2</sup>, Jihen Jridi<sup>1</sup>, Catherine Bougerol<sup>3</sup>, Evelyne Gil<sup>1,2</sup>, Pierre Ferret<sup>4</sup>, Dominique Castelluci<sup>1</sup>, Yoann Robin<sup>3</sup>, Vladimir Dubrovskii<sup>2</sup>, Hiroshi Amano<sup>5</sup> and Agnes Trassoudaine<sup>1</sup>; <sup>1</sup>Université Clermont Auvergne, CNRS, SIGMA Clermont, Institut Pascal, France; <sup>2</sup>ITMO University, Kronverkskiy prospekt, Russian Federation; <sup>3</sup>CNRS, Institut Néel, France; <sup>4</sup>University Grenoble Alpes, CEA, LETI, Département Optique et Photonique, France; <sup>5</sup>IMaSS, Nagoya University, Japan.

## GP02.16

**Remote Homoepitaxy of GaN on Graphene Using RF-MBE** Ukyo Ooe, Shinichiro Mour, Yasushi Nanishi and Tsutomu Araki; Ritsumeikan University, Japan.

## GP02.17

**Growth of III-Nitride Materials on Amorphous Substrates Using a Transferred Graphene Buffer Layer** Meng Liang, Zhiqiang Liu, Yunyu Wang and Xiaoyan Yi; Institute of Semiconductors, Chinese Academy of Sciences, China.

## GP02.18

**Influence of Hydrogen in the Carrier Gas on InGaN Layers and Quantum Wells** Robert Czernecki<sup>1,2</sup>, Ewa Grzanka<sup>1,2</sup>, Julita Smalc-Koziorowska<sup>1,2</sup>, Pawel Kempisty<sup>1</sup>, Szymon Grzanka<sup>1,2</sup> and Mike Leszczynski<sup>1,2</sup>; <sup>1</sup>Institute of High Pressure Physics of the Polish Academy of Sciences, Poland; <sup>2</sup>TopGaN Ltd., Poland.

## GP02.19

**Surface Science Studies of GaN Substrates Subjected to Plasma-Assisted Atomic Layer Processes** Samantha G. Rosenberg<sup>1</sup>, Daniel J. Pennachio<sup>1</sup>, Elliot C. Young<sup>2</sup>, Yu H. Chang<sup>2</sup>, Hadass S. Inbar<sup>2</sup>, Jeffrey M. Woodward<sup>1</sup>, Zachary R.

Robinson<sup>3</sup>, Jodi Grzeskowiak<sup>4</sup>, Carl A. Ventrice, Jr.<sup>5</sup>, Chris J. Palmström<sup>2</sup> and Charles R. Eddy Jr.<sup>1</sup>; <sup>1</sup>U.S. Naval Research Laboratory, United States; <sup>2</sup>University California, Santa Barbara, United States; <sup>3</sup>SUNY Brockport, United States; <sup>4</sup>University at Albany-SUNY, United States; <sup>5</sup>SUNY Polytechnic Institute, United States.

## GP02.20

**Van der Waals Epitaxy of GaN Films on Two-Dimensional h-BN/Sapphire Substrates by Metal-Organic Chemical Vapor Deposition** Ye Yu<sup>1</sup>, Yuantao Zhang<sup>1</sup>, Gaoqiang Deng<sup>1</sup>, Fang Liu<sup>2</sup>, Yang Wang<sup>1</sup>, Lidong Zhang<sup>1</sup>, Xu Han<sup>1</sup> and Xinqiang Wang<sup>2</sup>; <sup>1</sup>Jilin University, China; <sup>2</sup>Peking University, China.

## GP02.21

**RF-MBE InN Growth on High-Quality AlN Template** Yusuke Takabayashi<sup>1</sup>, Hidenori Tachibana<sup>1</sup>, Faizulsalihin Bin Abas<sup>1</sup>, Shinichiro Mour<sup>1</sup>, Tsutomu Araki<sup>1</sup>, Hideto Miyake<sup>2</sup> and Kanako Shojiki<sup>2</sup>; <sup>1</sup>Ritsumeikan University, Japan; <sup>2</sup>Mie University, Japan.

## GP02.22

**Characteristics of GaN/h-BN Grown by MOCVD with Various Surface Treatments** Min Han, Beo Deul Ryu, Kang Bok Ko and Chang-Hee Hong; Chonbuk National University, Korea (the Republic of).

## GP02.23

**Ga-Assisted Molecular Beam Epitaxial Growth of GaAsSbN Heterostructure in Axial and Core-Shell Configured Nanowires on (111) Si** Rabin Pokharel<sup>1</sup>, Prithviraj Deshmukh<sup>1</sup>, C. Lewis Reynolds<sup>2</sup> and Shanthi Iyer<sup>1,3</sup>; <sup>1</sup>North Carolina A&T State University, United States; <sup>2</sup>North Carolina State University, United States; <sup>3</sup>North Carolina A&T State University, United States.

## GP02.24

**In-Plane Anisotropy Characteristics of (0001) Oriented AlN Epilayer Grown on (11-20) Sapphire by HVPE** Jingjing Chen<sup>1</sup>, Xu J. Su<sup>1</sup>, Jun Huang<sup>1</sup>, Mu T. Niu<sup>1</sup> and Ke Xu<sup>1,2</sup>; <sup>1</sup>Suzhou Institute of Nano-Tech and Nano-Bionics, China; <sup>2</sup>Suzhou Nanowin Science and Technology, China.

## GP02.25

**Effect of Crystallinity of SLS Buffer Layer on Warpage of GaN on Si Substrate** Yasushi Iyechika, Masayuki Tsukui, Kiyotaka Miyano and Hideshi Takahashi; NuFlare Technology, Inc., Japan.

## GP02.26

**Effect of Al Injection in InGaN Multi Quantum Well LEDs** Manish Mathew<sup>1,2</sup>, Avinash S. Paliwal<sup>1,2</sup>, Priyavart Parjapat<sup>1</sup>, Bhoopendra Kushwaha<sup>1</sup>, Kuldeep Singh<sup>1</sup> and Ashok Chauhan<sup>1</sup>; <sup>1</sup>CEERI, Pilani, India; <sup>2</sup>Academy of Scientific and Innovative Research (AcSIR), CSIR-Central Electronics Engineering Research Institute Campus, India.

## GP02.27

**Investigation of AlN Thick Films Grown on Sputtered AlN Templates by Hydride Vapor Phase Epitaxial Growth** Jun Huang, Mu T. Niu, Mao S. Sun, Xu J. Su and Ke Xu; Suzhou Institute of Nano-Tech and Nano-Bionics, China.

## GP02.28

**Strain Relaxation in Al-rich Al<sub>x</sub>Ga<sub>1-x</sub>N Films Grown by RF Plasma-Assisted Molecular Beam Epitaxy** Naozumi Tachibana, Takeyoshi Onuma, Toru Honda and Tomohiro Yamaguchi; Kogakuin University, Japan.

## GP02.29

**In-Plane Misfits' Localization in GaN via Graphene-ELOG Technology** Yu Xu<sup>1,3</sup>, Xu J. Su<sup>1</sup>, Bing Cao<sup>2</sup>, Zongyao Li<sup>3</sup>, Demin Cai<sup>3</sup>, Yi Liu<sup>2</sup>, Yumin Zhang<sup>1,3</sup>, Jianfeng Wang<sup>1,3</sup>, Chinhua Wang<sup>2</sup> and Ke Xu<sup>1,3</sup>; <sup>1</sup>Suzhou Institute of Nano-Tech and Nano-Bionics, Chinese Academy of Sciences, China; <sup>2</sup>Soochow University, China; <sup>3</sup>Suzhou Nanowin Science and Technology Co., Ltd., China.

## GP02.30

**Substrate-Decomposition-Free van der Waals Epitaxy of GaN on Graphene** Jeong Hwan Park, Junyeob Lee, Mundo Park, Jesung Lee, Hoemin Kwak and Dong Seon Lee; Gwangju Institute of Science and Technology(GIST), Korea (the Republic of).

## GP02.31

**The Influence of AlN Seeding Layer Growth Temperature on Nucleation of Self-Assembled GaN Nano-Columns** Yaozheng Wu<sup>1</sup>, Bin Liu<sup>1</sup>, Ke Wang<sup>1</sup>, Zhenhua Li<sup>1</sup>, Tao Tao<sup>1</sup>, Zili Xie<sup>1</sup>, Dunjun Chen<sup>1</sup>, Hai Lu<sup>1</sup>, Rong Zhang<sup>1,2</sup> and Youdou Zheng<sup>1</sup>; <sup>1</sup>Nanjing University, China; <sup>2</sup>Xiamen University, China.

## GP02.32

**Effects of GaN film Growth Rate on Surface Morphology and Material Quality** Zhang Hepeng, Xue Junshuai, Yongru Fu, Weiting Qiang, Yanqing Jia, Jincheng Zhang and Yue Hao; Xidian University, China.

## GP02.33

**GaN Growth on Ceramics by Low Temperature RP-MOCVD** Robert Dubreuil and Jonny Tot; Lakehead University, Canada.

#### GP02.34

**Acquirement and Significance Analysis of No Gallium and No Aluminum Environment of MOCVD Reactor** Chaopu Yang<sup>2</sup>, Wenqing Fang<sup>1</sup>, Jiancheng TANG<sup>2</sup> and Fan Yang<sup>1</sup>; <sup>1</sup>Nanchang University, China; <sup>2</sup>Nanchang University, China.

SESSION HP02: Poster Session II: Nanostructures and Nano-Devices  
Tuesday Afternoon, July 9, 2019  
6:30 PM - 8:30 PM  
Grand Ballroom, Second Floor

#### HP02.01

**Structural, Photo- and Cathodo-Luminescence Studies of GaN/Al(Ga) N Core-Shell Nanowires** Andrian Kuchuk<sup>1</sup>, Aleksandra Wierzbicka<sup>2</sup>, Anna Reszka<sup>2</sup>, Marta Sobanska<sup>2</sup>, Yuriy Mazur<sup>1</sup>, Yuriy Maidaniuk<sup>1</sup>, Mourad Benamara<sup>1</sup>, Qigeng Yan<sup>1</sup>, Hryhorii Stanchu<sup>1</sup>, Zbigniew R. Zytikiewicz<sup>2</sup> and Gregory Salamo<sup>2</sup>; <sup>1</sup>University of Arkansas, United States; <sup>2</sup>Polish Academy of Sciences, Poland.

#### HP02.02

**InN Pillars on GaN(0001)—Correlation of Structural, Optical and Electrical Properties** Peter Lytvyn<sup>1,2</sup>, Andrian Kuchuk<sup>1</sup>, Yuriy Mazur<sup>1</sup>, S.P. Minor<sup>1</sup>, Yuriy Maidaniuk<sup>1</sup>, Mourad Benamara<sup>1</sup>, Morgan Ware<sup>1</sup> and Gregory Salamo<sup>1</sup>; <sup>1</sup>Institute for Nanoscience and Engineering, United States; <sup>2</sup>V. Lashkaryov Institute of Semiconductor Physics, Ukraine.

#### HP02.03

**Probing the Dynamics of Single Photon Emission in InGaN QDs** Xiaoxiao Sun<sup>1</sup>, Ping Wang<sup>1</sup>, Zhaoying Chen<sup>1</sup>, Kang Gao<sup>2</sup>, Weikun Ge<sup>1</sup>, Yasuhiko Arakawa<sup>2</sup>, Bo Shen<sup>1</sup>, Xinqiang Wang<sup>1</sup> and Mark J. Holmes<sup>2</sup>; <sup>1</sup>Peking University, China; <sup>2</sup>Institute for Nano Quantum Information Electronics, Japan.

#### HP02.04

**Optical Properties of Closed-Packed Array of GaN Inverted Nanopyramids** Pavlos Bozinakis<sup>1</sup>, Pierre-Marie Coulon<sup>2</sup>, Michael Wallace<sup>1</sup>, Jochen Bruckbauer<sup>1</sup>, Paul Edwards<sup>1</sup>, Lennart Ramakers<sup>3</sup>, Philip Shields<sup>2</sup> and Robert Martin<sup>1</sup>; <sup>1</sup>University of Strathclyde, United Kingdom; <sup>2</sup>University of Bath, United Kingdom; <sup>3</sup>University of Strathclyde, United Kingdom.

#### HP02.05

**Tip-Enhanced Raman Spectroscopy of Buried In<sub>0.11</sub>Ga<sub>0.89</sub>N Single Quantum Wells** Maximilian Ries<sup>1,2,3</sup>, Emanuele Poliani<sup>1</sup>, Daniel Seidlitz<sup>1</sup>, Markus R. Wagner<sup>1</sup>, Axel Hoffmann<sup>1</sup> and Norbert Esser<sup>1,2,3</sup>; <sup>1</sup>Technische Universität, Germany; <sup>2</sup>School for Analytical Sciences Adlershof, Germany; <sup>3</sup>Leibniz-Institut für Analytische Wissenschaften - ISAS - e.V., Germany.

#### HP02.06

**Flexible Photosensors with InGaN-GaN Core-Shell Nanowires and Dots-Inside-a-Nanowire Horizontally Inserted in Graphene** Jihoon Song<sup>1</sup>, Sangmoon Han<sup>1</sup>, Igyu Choi<sup>1</sup>, Cheul-Ro Lee<sup>1</sup>, Mee-Yi Ryu<sup>2</sup> and Jin Soo Kim<sup>1</sup>; <sup>1</sup>Chonbuk National University, Korea (the Republic of); <sup>2</sup>Kangwon National University, Korea (the Republic of).

#### HP02.07

**Crystallographic Chemical Wet Etching of AlGaIn Nanostructures** Barbara A. Kazanowska<sup>1</sup>, Keshab Sapkota<sup>2</sup>, Andrew Allerman<sup>2</sup>, Kevin Jones<sup>1</sup> and George T. Wang<sup>2</sup>; <sup>1</sup>University of Florida, United States; <sup>2</sup>Sandia National Laboratories, United States.

#### HP02.08

**Epitaxial Growth and Characterization of AlGaIn Nanowire Heterostructures** Yong-Ho Ra, Dae-Woo Jeon, SunWoog Kim, YoungJin Lee, Jin-Ho Kim, Jonghee Hwang and Tae Young Lim; Korea Institute of Ceramic Engineering & Technology, Korea (the Republic of).

#### HP02.09

**Mechanisms of GaN Quantum Dot Formation During Nitridation of Ga Droplets** Hongling Lu<sup>1</sup>, Caleb Reese<sup>1</sup>, Sunyeol Jeon<sup>1</sup>, Yaming Fan<sup>2</sup>, Yuqun Zhuo<sup>2</sup>, Qi Liang<sup>1</sup> and Rachel Goldman<sup>1</sup>; <sup>1</sup>University of Michigan, United States; <sup>2</sup>Tsinghua University, China.

#### HP02.10

**Enhanced Blue Emission From InGaN/GaN Multiple Quantum Well Nanorods by Surface Plasmon in Silver Nanowires** Chuyoung Cho and Kyung-Ho Park; Korea Advanced Nano Fab Center, Korea (the Republic of).

#### HP02.11

**Potential Mapping in GaN Nanowire P-N Junction via Off-Axis Electron Holography** Anitha Jose<sup>1</sup>, Sharif Sadaf<sup>2</sup>, Haipeng Tang<sup>2</sup> and Karen Kavanagh<sup>1</sup>; <sup>1</sup>Simon Fraser University, Canada; <sup>2</sup>Advanced Electronics and Photonics, National Research Council Canada, Canada.

#### HP02.12

**Epitaxially Grown InGaN/GaN Nanowires on Graphene Glass** Dingding Ren<sup>1</sup>, Zhaolong Chen<sup>2</sup>, Julie S. Nilsen<sup>3</sup>, Lyubomir Ahtapodov<sup>1</sup>, Boris Borisov<sup>4</sup>, Anjan Mukherjee<sup>1</sup>, Yang Li<sup>1</sup>, Zhiqiang Liu<sup>1,5</sup>, Antonius T. van Helvoort<sup>3</sup>, Bjørn-Ove Fimland<sup>1</sup>, Zhongfan Liu<sup>2</sup> and Helge Weman<sup>1</sup>; <sup>1</sup>Norwegian University of Science and Technology, Norway; <sup>2</sup>Peking University, China; <sup>3</sup>Norwegian University of Science and Technology, Norway; <sup>4</sup>SVT Associates, United States; <sup>5</sup>Chinese Academic of Sciences, China.

#### HP02.13

**Luminescent Properties of Zigzag-Graded InGaN Quantum Wells** Mirsaeid Sarollahi<sup>1</sup>, Pijush Ghosh<sup>1</sup>, Manal Aldawsari<sup>2</sup>, Yuriy Maidaniuk<sup>2</sup>, Andrian Kuchuk<sup>3</sup>, Yuriy Mazur<sup>3</sup>, Gregory Salamo<sup>3,2,4</sup> and Morgan Ware<sup>1,2,3</sup>; <sup>1</sup>University of Arkansas, United States; <sup>2</sup>University of Arkansas, United States; <sup>3</sup>University of Arkansas, United States; <sup>4</sup>University of Arkansas, United States.

#### HP02.14

**Optical Properties of Thick Compositionally Graded InGaN Films** Manal A. Aldawsari<sup>1</sup>, Pijush Ghosh<sup>2</sup>, Mirsaeid Sarollahi<sup>2</sup>, Andrian Kuchuk<sup>3</sup> and Morgan Ware<sup>1,2,3</sup>; <sup>1</sup>University of Arkansas, United States; <sup>2</sup>University of Arkansas, United States; <sup>3</sup>Institute for Nanoscience and Engineering, United States.

#### HP02.15

**Linear Response of Bound Electrons to a Quasi-Static Oscillating Field in GaN Nanowire Structures** Chi Cuong Huynh, Roger Evrard and Ngoc Duy Nguyen; University of Liège, Belgium.

#### HP02.16

**Vertical Mesopore Arrays in nGaN by Anodic Etching and ICP Surface Etching** Xilin Su, Yufeng Li, Minyan Zhang, Peng Hu and Feng Yun; Xi'an Jiaotong University, China.

SESSION IP02: Poster Session II: Optical and Electronic Properties  
Tuesday Afternoon, July 9, 2019  
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#### IP02.01

**Impact of Surface Morphology on Leakage in III-Nitrides Based Optoelectronic and Power Electronic Devices on Si (111)** Shashwat Rathkanthiwar, Anisha Kalra, Nayana Remesh, Abheek Bardhan, Nragaboopathy Mohan, Rangarajan Muralidharan, Digbijoy N. Nath and Srinivasan Raghavan; Indian Institute of Science, India.

#### IP02.02

**Electron/hole Injections in p-GaN/AlGaIn/GaN HEMTs under Forward Gate Bias and their Effects on Device Behaviors** Xi Tang<sup>1,2,3</sup>, Nam-Trung Nguyen<sup>2</sup>, Sima Dimitrijević<sup>2</sup>, Jiannong Wang<sup>3</sup> and Baikui Li<sup>1</sup>; <sup>1</sup>Shenzhen University, China; <sup>2</sup>Queensland Micro- and Nanotechnology Centre, Australia; <sup>3</sup>The Hong Kong University of Science and Technology, Hong Kong.

#### IP02.03

**Study of P-Type Doping of Hexagonal Boron Nitride Grown by MOCVD** Adama Mballo<sup>1</sup>, Suresh Sundaram<sup>1,2</sup>, Phuong Vuong<sup>1</sup>, Ashutosh Srivastava<sup>1,3</sup>, Soufiane Karakchou<sup>1,3</sup>, Taha Ayari<sup>1,2</sup>, Yacine Halfaya<sup>1</sup>, Simon Gautier<sup>4</sup>, Paul Voss<sup>1,3</sup>, Jean Paul Salvestrini<sup>1,2</sup> and Abdallah Ougazzaden<sup>1,3</sup>; <sup>1</sup>CNRS, UMI 2958, GT-CNRS, France; <sup>2</sup>GT-Lorraine, France; <sup>3</sup>Georgia Institute of Technology, France; <sup>4</sup>Institut Lafayette, France.

#### IP02.04

**Contactless Electroreflectance Studies of the Surface Fermi Level in GaN/AlN Heterostructures with Buried 2D Hole Gas** Lukasz Janicki<sup>1</sup>, Reet Chaudhuri<sup>2</sup>, Samuel J. Bader<sup>3</sup>, Grace Xing<sup>2,4,5</sup>, Debdeep Jena<sup>2,4,5</sup> and Robert Kudrawiec<sup>1</sup>; <sup>1</sup>Wroclaw University of Science and Technology, Poland; <sup>2</sup>Cornell University, United States; <sup>3</sup>Cornell University, United States; <sup>4</sup>Cornell University, United States; <sup>5</sup>Cornell University, United States.

#### IP02.05

**Investigation of Hexagonal Inclusions in Zincblende GaN Using Cathodoluminescence and Electron Backscatter Diffraction in the SEM** Jochen Bruckbauer<sup>1</sup>, Dale Waters<sup>1</sup>, Ben Hourahine<sup>1</sup>, Menno Kappers<sup>2</sup>, Martin Frentrup<sup>2</sup>, David Wallis<sup>2,3</sup>, Carol Trager-Cowan<sup>1</sup> and Aimo Winkelmann<sup>1,4</sup>; <sup>1</sup>University of Strathclyde, United Kingdom; <sup>2</sup>University of Cambridge, United Kingdom; <sup>3</sup>University of Cardiff, United Kingdom; <sup>4</sup>Laser Zentrum Hannover e.V., United Kingdom.

#### IP02.06

**Functional Metal-GaN Micro-Stripe Structures for Infrared and Ultraviolet Regions** Yoshihiro Ishitani<sup>1</sup>, Tsubasa Yamakawa<sup>1</sup>, Bojin Lin<sup>1</sup>, Kensuke Oki<sup>1</sup>, Bei Ma<sup>1</sup>, Ken Morita<sup>1</sup>, Yusuke Hayashi<sup>2</sup>, Hideto Miyake<sup>2</sup> and

Kazuhiro Ohkawa<sup>2</sup>; <sup>1</sup>Chiba University, Japan; <sup>2</sup>Mie University, Japan; <sup>3</sup>King Abdullah University of Science and Technology, Saudi Arabia.

#### IP02.07

**Growth of Non-Polar GaN Nanowires—Ultrashort Carrier Dynamics of Semi-Polar (11-22) GaN/InGaN Multiple Quantum Well Co-Axial Nanowires** Muhammad A. Johar<sup>1</sup>, Hyun-Gyu Song<sup>2</sup>, Aadil Waseem<sup>1</sup>, Jin Ho Kang<sup>1,3</sup>, Yong-Hoon Cho<sup>2</sup> and Sang-Wan Ryu<sup>1</sup>; <sup>1</sup>Chonnam National University, Korea (the Republic of); <sup>2</sup>Korea Advanced Institute of Science and Technology, Korea (the Republic of); <sup>3</sup>Yale University, United States.

#### IP02.08

**Photoluminescence Characterization of Undoped GaN Exposed to NH<sub>3</sub> Plasma** Naoto Kumagai<sup>1,2</sup>, Hirotomo Itagaki<sup>3</sup>, Tokio Takahashi<sup>2</sup>, Jaeho Kim<sup>2,1</sup>, Hisato Ogiso<sup>3</sup>, Shingo Hirose<sup>3</sup>, Hajime Sakakita<sup>2,1</sup>, Xuelun Wang<sup>1,2,4</sup> and Mitsuaki Shimizu<sup>1,4</sup>; <sup>1</sup>AIST, Japan; <sup>2</sup>AIST, Japan; <sup>3</sup>AIST, Japan; <sup>4</sup>Nagoya University, Japan.

#### IP02.09

**The Significant Effect of Carbon and Oxygen Contaminants at Pd/p-GaN Interface on its Ohmic Contact Characteristics** Sunan Ding and Zhengcheng Li; Suzhou Institute of Nano-Tech and Nano-Bionics, CAS, China.

#### IP02.10

**Fractional Dimensional Treatment of III-N Electronic and Optoelectronic Devices** Vikas Pendem, Tarni Aggarwal, Ankit Udai, Pratim K. Saha, Shonal Chouksey, Swaroop Ganguly and Dipankar Saha; Indian Institute of Technology Bombay, India.

#### IP02.11

**Optical and Structural Characterization of Ultra-Thin In(Ga)N/GaN Multi Quantum Wells—The Impact of Growth Parameters** Yurii Maidaniuk<sup>1</sup>, Yuriy Mazur<sup>1</sup>, Chen Li<sup>1</sup>, Andrian Kuchuk<sup>1</sup>, Mourad Benamara<sup>1</sup>, Peter Lytvyn<sup>2</sup> and Gregory Salamo<sup>1</sup>; <sup>1</sup>University of Arkansas, United States; <sup>2</sup>National Academy of Sciences of Ukraine, Ukraine.

#### IP02.12

**Structural and Optical Properties of InGaN/InGaN Structures with Extremely Thin Quantum Wells, Grown on InGaN Pseudosubstrates by Metal-Organic Vapor Phase Epitaxy** Grzegorz Staszczak<sup>1</sup>, Ewa Grzanka<sup>1,2</sup>, Grzegorz Targowski<sup>1,2</sup>, Julita Smalc-Koziorowska<sup>1</sup> and Tadeusz Suski<sup>1</sup>; <sup>1</sup>Institute of High Pressures Physics, UNIPRESS, Poland; <sup>2</sup>TopGaN, Poland.

#### IP02.13

**On the Yellow Luminescence of BGaN Alloys** Emil M. Pavelescu; IMT-Bucharest, Romania.

#### IP02.14

**Photoelectrochemical Analysis of Carrier Concentrations in (In,Al)GaN Nanowires for Photonic Devices** Huafan Zhang<sup>1</sup>, Mohamed Ebaïd<sup>1,2</sup>, Chao Zhao<sup>1,4</sup>, Jung-Wook Min<sup>1</sup>, Guangyu Liu<sup>1</sup>, Bilal Janjua<sup>1,3</sup>, Tien Khee Ng<sup>1</sup>, Boon S. Ooi<sup>1</sup> and Jorge A. Holguin-Lerma<sup>1</sup>; <sup>1</sup>King Abdullah University of Science & Technology, Saudi Arabia; <sup>2</sup>Lawrence Berkeley National Laboratory, United States; <sup>3</sup>University of Toronto, Canada; <sup>4</sup>RWTH Aachen University/Forschungszentrum Jülich Peter Gruenberg Institute (PGI-9), Germany.

#### IP02.15

**Analysis of Leakage Current, Shunt Resistance and Correlation of PL to EL in Green Micro-LEDs by Micro-Photocurrent and Other Optical Methods** Kyuheon Kim<sup>1</sup>, Junghoon Song<sup>1</sup>, Gunwoo Jung<sup>1</sup>, Chanmi Choi<sup>1</sup>, Ukkeun Gang<sup>1</sup>, Taehwan Park<sup>1</sup>, Boram Jeon<sup>1</sup>, Jeong Tak<sup>2</sup> and Youngbo Moon<sup>3</sup>; <sup>1</sup>Kongju National University, Korea (the Republic of); <sup>2</sup>LED Device Research Center, Korea Photonics Technology Institute, Korea (the Republic of); <sup>3</sup>UJL Ltd., Korea (the Republic of).

#### IP02.16

**Possibility of Single Optical Site of Eu and Mg Codoped GaN** Hiroto Sekiguchi<sup>1</sup>, Masaru Sakai<sup>2</sup> and Akihiro Wakahara<sup>1</sup>; <sup>1</sup>Toyohashi University of Technology, Japan; <sup>2</sup>University of Yamanashi, Japan.

#### IP02.17

**Polarisation and Carrier Density Dependent Optical Gain of InGaN/GaN Quantum Well for an Enhanced Performance** Ankit Udai, Vikas Pendem, Tarni Aggarwal and Dipankar Saha; Indian Institute of Technology Bombay, India.

#### IP02.18

**Electrical Characteristics of Directly Growth Graphene on p-GaN** Zongyao Li<sup>1</sup>, Yu Xu<sup>2,1</sup>, Haijian Zhong<sup>2</sup>, Bing Cao<sup>3</sup>, Chunyu Zhang<sup>2</sup>, Jianfeng Wang<sup>2,1</sup> and Ke Xu<sup>2,1</sup>; <sup>1</sup>Suzhou Nanowin Science and Technology Co., Ltd, China; <sup>2</sup>Suzhou Institute of Nano-Tech and Nano-Bionics (SINANO), China; <sup>3</sup>Soochow University, China.

#### IP02.19

**MIS Capacitance Effect of AlN/ZrO<sub>2</sub> Gate Dielectrics on Zinc-Tin Oxide Thin-Film Transistors** Hunho Kim and Woon-Seop Choi; Hoseo University, Korea (the Republic of).

#### IP02.20

**Study of Temperature Dependent Photoluminescence from Swift Heavy Ion Irradiated and as-Deposited Si Rich a-SiN<sub>x</sub>:H Thin Films** Harsih Gupta<sup>1</sup>, Olivier Plantevin<sup>2</sup>, Ravi K. Bommal<sup>3</sup>, Santanu Ghosh<sup>1</sup> and Pankaj Srivastava<sup>1</sup>; <sup>1</sup>Indian Institute of Technology Delhi, India; <sup>2</sup>MC HDR Université Paris-Sud, France; <sup>3</sup>Institute of Physics, India.

#### IP02.21

**Quantitative Evaluation of Interfacial Charges at GaN/AlGaIn Interfaces** Takuya Hoshii<sup>1</sup>, Akira Nakajima<sup>2</sup>, Shin-ichi Nishizawa<sup>3</sup>, Hiromichi Ohashi<sup>1</sup>, Kuniyuki Kakushima<sup>1</sup>, Hitoshi Wakabayashi<sup>1</sup> and Kazuo Tsutsui<sup>1</sup>; <sup>1</sup>Tokyo Institute of Technology, Japan; <sup>2</sup>National Institute of Advanced Industrial Science and Technology (AIST), Japan; <sup>3</sup>Kyushu University, Japan.

### SESSION JP02: Poster Session II: Defect Characterization and Engineering

Tuesday Afternoon, July 9, 2019

6:30 PM - 8:30 PM

Grand Ballroom, Second Floor

#### JP02.01

**Improvement of Lattice Curvature of GaN Film on Sapphire Substrate Using Lattice Modulated InGaN Layer by Thermal Decomposition** Takushi Kaneko, Narihito Okada and Kazuyuki Tadatomo; Yamaguchi University, Japan.

#### JP02.02

**A Spatial Distribution of the E<sub>v</sub>+0.88 eV Trap in 2-Inch p-GaN Grown by MOVPE on GaN Substrate** Yutaka Tokuda<sup>1</sup>, Hikaru Yoshida<sup>1</sup>, Tetsuo Narita<sup>2</sup>, Kazuyoshi Tomita<sup>2</sup> and Tetsu Kachi<sup>3</sup>; <sup>1</sup>Aichi Institute of Technology, Japan; <sup>2</sup>Toyota Central R&D Labs., Inc., Japan; <sup>3</sup>Nagoya University, Japan.

#### JP02.03

**Analytical Formula for Quantum Efficiency of Radiation Considering Self Absorption Process** Hidehiro Asai<sup>1</sup>, Kazunobu Kojima<sup>2</sup>, Shigefusa F. Chichibu<sup>2</sup> and Koichi Fukuda<sup>1</sup>; <sup>1</sup>National Institute of Advanced Industrial Science and Technology (AIST), Japan; <sup>2</sup>Tohoku University, Japan.

#### JP02.04

**First-Principles Identification of Defect Complexes in the Mg+H-Codoped GaN** He Li, Menglin Huang and Shiyong Chen; East China Normal University, China.

#### JP02.05

**Effect of Wafer Off-Angles on Defect Formation in Drift Layers Grown on Freestanding GaN Substrates** Kenji Shiojima<sup>1</sup>, Fumimasa Horikiri<sup>2</sup>, Yoshinobu Narita<sup>2</sup>, Takehiro Yoshida<sup>2</sup> and Tomoyoshi Mishima<sup>3</sup>; <sup>1</sup>University of Fukui, Japan; <sup>2</sup>Sciocs Company Ltd., Japan; <sup>3</sup>Hosei University, Japan.

#### JP02.06

**Neutron Radiation Damage of Gallium Nitride with Different Growth Orientations** Sam C. Sprawls<sup>1</sup>, Farnood Mirkhosravi<sup>2</sup>, Joshua Gallagher<sup>3</sup>, Matthew Durbin<sup>3</sup>, Emily Mace<sup>4</sup>, Michael Scarpulla<sup>5,1</sup>, Daniel Feezell<sup>2,6</sup> and Azaree Lintereur<sup>2</sup>; <sup>1</sup>University of Utah, United States; <sup>2</sup>University of New Mexico, United States; <sup>3</sup>Penn State University, United States; <sup>4</sup>Pacific Northwest National Laboratory, United States; <sup>5</sup>University of Utah, United States; <sup>6</sup>University of New Mexico, United States.

#### JP02.07

**Interface Defects at p-GaN MO(I)S Capacitors** Liwen Sang; National Institute for Materials Science, Japan.

#### JP02.08

**Superior Reliability of Heavy Ion Irradiated AlInN/GaN HFETs** Nahuel A. Vega<sup>1,4</sup>, Seshagiri Rao Challa<sup>2</sup>, Romualdo Ferreyra<sup>3,4</sup>, Christian Kristukat<sup>3</sup>, Nahuel Müller<sup>1</sup>, Mario Debray<sup>1</sup>, Gordon Schmidt<sup>2</sup>, Florian Hörich<sup>2</sup>, Hartmut Witte<sup>2</sup>, Juergen Christen<sup>2</sup>, Armin Dadgar<sup>2</sup> and André Strittmatter<sup>2</sup>; <sup>1</sup>Gerencia de Investigación y Aplicaciones, CNEA, Argentina; <sup>2</sup>Otto-von-Guericke-Universität Magdeburg, Germany; <sup>3</sup>Universidad de San Martín, Argentina; <sup>4</sup>Consejo Nacional de Investigaciones Científicas y Tecnológicas (CONICET), Argentina.

#### JP02.09

**Minority Carrier Traps in Ion Implanted N-Type Homoepitaxial GaN** Giovanni Alfieri and Vinoth K. Sundaramoorthy; ABB, Switzerland.

#### JP02.10

**Analysis of Gate Degradation Under Forward Bias in GaN-Based MIS-HEMTs with LPCVD-SiN<sub>2</sub> Gate Dielectric** Yawen Zhao<sup>1</sup>, Taotao Que<sup>1</sup>, Liang He<sup>1,3</sup>, Liuan Li<sup>1</sup>, Qiuling Qiu<sup>1</sup>, Xiaorong Zhang<sup>3</sup>, Yiqiang Ni<sup>1,3</sup>, Zhenxing Liu<sup>1</sup>, Jialin Zhang<sup>1</sup>, Xin Gu<sup>1</sup>, Jia Chen<sup>1</sup>, Ruihong Luo<sup>3</sup>, Jianguo Chen<sup>4</sup>, Zhiyuan He<sup>5</sup> and Yang Liu<sup>1,2,3</sup>; <sup>1</sup>School of Electronics and Information Technology, Sun Yat-Sen University, State Key Laboratory of Optoelectronic Materials and Technologies, China; <sup>2</sup>Zhuhai Key Technology Laboratory of Wide Bandgap Semiconductor Power Electronics, Sun Yat-Sen University, China; <sup>3</sup>Jiangsu Sinopower Semiconductor Co., Ltd, China; <sup>4</sup>Founder Microelectronics International Corporation, Ltd, China; <sup>5</sup>Science and Technology on Reliability Physics and Application of Electronic Component Laboratory, No.5 Electronics Research Institute of the Ministry of Industry and Information Technology, China.

#### JP02.11

**Defects Evolution of GaN Films van der Waals Epitaxy on Graphene** Anlin Luo; Key Lab of Advanced Optical Manufacturing Technologies of Jiangsu Province and Key Lab of Modern Optical Technologies of Education Ministry of China, Soochow University, China.

#### JP02.12

**Detection of Yield Impacting Defects on GaN Substrate and Epitaxy Wafers** Varun Gupta, Akash Nanda, Michael Walker and Mukundkrishna Raghunathan; KLA Corporation, United States.

SESSION LP01: Poster Session: Theory and Simulation  
Tuesday Afternoon, July 9, 2019  
6:30 PM - 8:30 PM  
Grand Ballroom, Second Floor

#### LP01.01

**Study of Polymer Formation in AlGaIn MOVPE by Numerical Analysis** Kazuhiro Ohkawa<sup>1</sup>, Kenichi Nakamura<sup>2</sup> and Daisuke Iida<sup>3</sup>; <sup>1</sup>King Abdullah University of Science and Technology, Saudi Arabia; <sup>2</sup>Tokyo University of Science, Japan.

#### LP01.02

**High-Throughput First-Principles Screening of I-III-IV<sub>2</sub>-V<sub>4</sub> Quaternary Compound Semiconductors Derived from GaN** Tao Zhang and Shiyu Chen; East China Normal University, China.

#### LP01.03

**Improved Simulation of MOCVD Growth of AlN by Using Data Assimilation** Masafumi Jo, Yuri Itokazu, Shunsuke Kuwaba and Hideki Hirayama; RIKEN, Japan.

#### LP01.04

**Studies of Stress Effects on the Electrical Performance of AlGaIn/GaN HEMTs through *ab initio* Calculation and TCAD Simulation** Hui Yung Wong<sup>1</sup>, Nelson Braga<sup>2</sup>, Jie Liu<sup>2</sup> and R. V. Miclevicius<sup>2</sup>; <sup>1</sup>San Jose State University, United States; <sup>2</sup>Synopsys, Inc., United States.

#### LP01.05

**Effective Schottky Barrier Height Model for Ga- and N-Polar GaN by Polarization-Induced Surface Charges with Finite Depth** Tetsuya Suemitsu<sup>1</sup> and Isao Makabe<sup>2</sup>; <sup>1</sup>Tohoku University, Japan; <sup>2</sup>Sumitomo Electric Industries, Ltd., Japan.

#### LP01.06

**The Effect of Nonlinear Deformation in Large Size GaN/Sapphire Bilayer System** Mengda Li<sup>1</sup>, Tongjun Yu<sup>1</sup>, Jiejun Wu<sup>1</sup>, Jimin He<sup>2</sup>, Nanliu Liu<sup>3</sup>, Tong Han<sup>1</sup> and Guoyi Zhang<sup>1,2,3</sup>; <sup>1</sup>Peking University, China; <sup>2</sup>Sino Nitride Semiconductor CO., LTD, China; <sup>3</sup>Dongguan Institute of Optoelectronics, Peking University, China.

#### LP01.07

**Electronic Properties of Edge-Functionalized Zigzag GaN Nanoribbons—A First-Principles Study** Naresh Alaal and Iman Roqan; King Abdullah University of Science and Technology, Saudi Arabia.

#### LP01.08

**Influence of Polycrystalline Parasitic Growth on AlN Single Crystal PVT Growth Through von-Mises Thermal Stress Simulations** Qikun Wang, Jiali Huang, Yinting Zhao, Danyang Fu, Guangdong He, Dan Lei and Jason Wu; Ultratrend Technologies Inc., China.

#### LP01.09

**First-Principles Mechanism Study on the Etching of Silicon Nitride (Si<sub>3</sub>N<sub>4</sub>) by Aqueous Phosphoric Acid (H<sub>3</sub>PO<sub>4</sub>) Solution** Hyunwook Jung, Junyeop Kim and Byungchan Han; Yonsei University, Korea (the Republic of).

#### LP01.10

**First Principle Prediction of Effective Two Dimensional Buffer Layer for High Quality Gallium Nitride Based Semiconductors** Zhiming Shi, Xiaojuan Sun, Yuping Jia and Dabing Li; Changchun Institute of Optics, Fine Mechanics and Physics, Chinese Academy of Sciences, China.

#### LP01.11

**Photodetectors AlGaIn Heterostructure Optimization** Oleg Rabinovich, Sergey Didenko, Marina Orlova, Alexander Savchuk, Sergey Marenkin, Alexey Ril and Svetlana Podgornaya; NUST MISIS, Russian Federation.

SESSION MP02: Poster Session II: New Materials and Device Concepts  
Tuesday Afternoon, July 9, 2019  
6:30 PM - 8:30 PM  
Grand Ballroom, Second Floor

#### MP02.01

**Steep-Slope AlGaIn/GaN HEMT with Oxide Based Threshold Switching Device** Xuanqi Huang<sup>1</sup>, Runchen Fang<sup>1</sup>, Chen Yang<sup>1</sup>, Kai Fu<sup>1</sup>, Houqiang Fu<sup>1</sup>, Hong Chen<sup>1</sup>, Tsung-Han Yang<sup>1</sup>, Jingan Zhou<sup>1</sup>, Jossue Montes<sup>1</sup>, Michael Kozicki<sup>1</sup>, Hugh Barnaby<sup>1</sup>, Baoshun Zhang<sup>2</sup> and Yuji Zhao<sup>3</sup>; <sup>1</sup>Arizona State University, United States; <sup>2</sup>Suzhou Institute of Nano-Tech and Nano-Bionics (SINANO), China.

#### MP02.02

**Novel Field Emitter Based on an In-Plane-Gate AlGaIn/GaN 2DEG Structure** Pao-Chuan Shih and Tomas Palacios; Massachusetts Institute of Technology, United States.

#### MP02.03

**Synthesis of New Quaternary Nitride Alloys with Mg by Plasma-Assisted Molecular Beam Epitaxy** Iulian Gherasoiu<sup>1</sup>, Kin M. Yu<sup>2</sup>, Michael Hawkridge<sup>3</sup> and Wladek Walukiewicz<sup>2</sup>; <sup>1</sup>SUNY Polytechnic Institute, United States; <sup>2</sup>City University of Hong Kong, China; <sup>3</sup>PANalytical, United States; <sup>4</sup>Lawrence Berkeley National Laboratory, United States.

#### MP02.04

**Wet Thermal Oxidation of AlInN** Matthew R. Peart, Xiongliang Wei, Damir Borovac, Sun Wei, Nelson Tansu and Jonathan Wierer; Lehigh University, United States.

#### MP02.05

**Surface Charge of GaN as a Function of pH Probed by Atomic Force Microscopy Imaging of Adsorbed Ionic Surfactants** Jianan Wang<sup>1</sup>, Xing Zhang<sup>1</sup>, Constance Wang<sup>2</sup>, Hua Li<sup>1</sup>, Brett Nener<sup>1</sup>, Giacinta Parish<sup>1</sup> and Rob Atkin<sup>1</sup>; <sup>1</sup>The University of Western Australia, Australia; <sup>2</sup>University of Washington, United States.

#### MP02.06

**Real-Time *in situ* Monitoring of III-Nitride ALD Processes via Multi-Wavelength Ellipsometry—Analysis of Self-Limiting Surface Reaction Mechanisms of Metal Alkyl Precursors and Nitrogen Plasma Species** Neemi Biyikli<sup>1</sup>, Adnan Mohammad<sup>1</sup>, Deepa Shukla<sup>2</sup>, Saidjafarzoda Ilhom<sup>1</sup>, Blaine Johs<sup>3</sup>, Brian Willis<sup>4</sup> and Ali K. Okyay<sup>5</sup>; <sup>1</sup>University of Connecticut, United States; <sup>2</sup>University of Connecticut, United States; <sup>3</sup>Film Sense LLC, United States; <sup>4</sup>University of Connecticut, United States; <sup>5</sup>Stanford University, United States.

#### MP02.07

**The Importance of Electrical Isolation Between GaN Monolithically Integrated Devices** Xiao Ma, Kwai Hei Li and Hoi Wai Choi; The University of Hong Kong, Hong Kong.

#### MP02.08

**Photoluminescence and Electrical Properties of GaN Grown on Natural Graphite Sheet by MBE** Takashi Inoue<sup>1</sup>, Hoshito Murakawa<sup>2</sup>, Go Sajiki<sup>2</sup>, Toshihiro Hosokawa<sup>1</sup>, Akiyoshi Takeda<sup>1</sup> and Hiroshi Okano<sup>2</sup>; <sup>1</sup>Toyo Tanso Co., Ltd., Japan; <sup>2</sup>National Institute of Technology, Kagawa College, Japan.

#### MP02.09

**High-Mobility and High-Stability Thin-Film Transistors Fabricated by Zinc Nitride Based Semiconductors** Hyoun-Do Kim and Hyun-Suk Kim; Chungnam National University, Korea (the Republic of).



# WEDNESDAY PRESENTATIONS

\* Invited Paper

## SESSION A07: Deep UV LEDs

Session Chairs: Abdallah Ougazzaden and Zlatko Sitar  
Wednesday Morning, July 10, 2019  
Evergreen Ballroom E-F, Lobby Level

### 8:30 AM A07.01

**Current Status and Future Directions of High Power AlGaIn-Based UVB LEDs with Emission of 280nm-320nm** M. A. Khan<sup>1,2</sup> and Hideki Hirayama<sup>1,2</sup>; <sup>1</sup>RIKEN, Japan; <sup>2</sup>RIKEN, Japan.

### 8:45 AM A07.02

**High-Efficiency Tunnel-Injection Deep Ultraviolet LEDs at 265 nm** Ayush Pandey, Walter J. Shin and Zetian Mi; University of Michigan, Ann Arbor, United States.

### 9:00 AM A07.03

**AlGaIn-Based Deep UV LEDs Grown on High Temperature Annealed Epitaxially Laterally Overgrown AlN/Sapphire** Norman Susilo<sup>1</sup>, Eviathar Ziffer<sup>1</sup>, Sylvia Hagedorn<sup>2</sup>, Leonardo Cancellara<sup>3</sup>, Carsten Netzel<sup>2</sup>, Sebastian Metzner<sup>4</sup>, Bettina Belde<sup>1</sup>, Frank Bertram<sup>4</sup>, Priti Gupta<sup>1</sup>, Sebastian Walde<sup>2</sup>, Luca Sulmoni<sup>1</sup>, Martin Guttmann<sup>1</sup>, Tim Wernicke<sup>1</sup>, Juergen Christen<sup>4</sup>, Martin Albrecht<sup>4</sup>, Markus Weyers<sup>2</sup> and Michael Kneissl<sup>1,2</sup>; <sup>1</sup>Technische Universität Berlin, Germany; <sup>2</sup>Leibniz-Institut für Höchstfrequenztechnik, Germany; <sup>3</sup>Leibniz-Institut für Kristallzüchtung, Germany; <sup>4</sup>Otto-von-Guericke-University Magdeburg, Germany.

### 9:15 AM A07.04

**Cathodoluminescence Investigation of AlGaIn-Based Deep UV MQWs Grown on AlN/Sapphire Template and Native AlN Substrate—Impact of Defect Density and Inhomogeneity on Luminescence Properties** Sebastian Metzner<sup>1</sup>, Mohammad T. Mazraehno<sup>2</sup>, Christian Brandl<sup>2</sup>, Marc P. Hoffmann<sup>2</sup>, Gordon Schmidt<sup>1</sup>, Frank Bertram<sup>1</sup>, Hans-Juergen Lugauer<sup>2</sup> and Juergen Christen<sup>1</sup>; <sup>1</sup>Otto-von-Guericke University Magdeburg, Germany; <sup>2</sup>OSRAM Opto Semiconductors, Germany.

### 9:30 AM A07.05

**Enhancement of Light Extraction Efficiency of Tunnel-Injected Deep UV LEDs** Walter J. Shin, Ayush Pandey, Xianhe Liu, Kishwar Mashooq and Zetian Mi; University of Michigan, Ann Arbor, United States.

### 9:45 AM A07.06

**Impact of the Growth Substrate on the Efficiency of Deep UV LEDs** Gwénolé Jacopin<sup>1</sup>, Mohammad T. Mazraehno<sup>2</sup>, Georg Rossbach<sup>2</sup>, Christian Brandl<sup>2</sup>, Marc P. Hoffmann<sup>2</sup> and Hans-Juergen Lugauer<sup>2</sup>; <sup>1</sup>CNRS, France; <sup>2</sup>OSRAM Opto Semiconductors GmbH, Germany.

### 10:00 AM A07.07

**Influence of Substrate Off-Cut Angle on the Performance of 310 nm Light Emitting Diodes** Tim Kolbe<sup>1,2</sup>, Arne Knauer<sup>1</sup>, Johannes Enslin<sup>3</sup>, Sylvia Hagedorn<sup>1</sup>, Anna Mogilatenko<sup>1</sup>, Tim Wernicke<sup>3</sup>, Sven Einfeld<sup>1</sup>, Michael Kneissl<sup>1,3</sup> and Markus Weyers<sup>1</sup>; <sup>1</sup>Ferdinand-Braun-Institut, Leibniz-Institut für Höchstfrequenztechnik, Germany; <sup>2</sup>UVphotonics NT GmbH, Germany; <sup>3</sup>Technische Universität Berlin, Institute of Solid State Physics, Germany.

### 10:15 AM BREAK

SESSION A08: Visible Laser Diodes  
Session Chairs: Ulrich Schwarz and Thomas Wunderer  
Wednesday Morning, July 10, 2019  
Evergreen Ballroom E-F, Lobby Level

### 10:45 AM \*A08.01

**GaN-Based Distributed Feedback and Distributed Bragg Reflection Laser Diodes with High-Order Surface Gratings** Sven Einfeld<sup>1</sup>, Ji-Hye Kang<sup>1</sup>, Hans Wenzel<sup>1</sup>, Erik Freier<sup>1</sup>, Veit Hoffmann<sup>1</sup>, Mathias Matalla<sup>1</sup>, Maria Norman-Reiner<sup>1</sup>, Alexander Kuelberg<sup>1</sup>, Olaf Brox<sup>1</sup>, Joerg Fricke<sup>1</sup>, Ralph-Stephan Unger<sup>1</sup>, Luca Sulmoni<sup>2</sup>, Markus Weyers<sup>1</sup>, Tim Wernicke<sup>2</sup> and Michael Kneissl<sup>1,3</sup>; <sup>1</sup>Ferdinand-Braun-Institut, Leibniz-Institut fuer Hoechstfrequenztechnik, Germany; <sup>2</sup>Technische Universitaet Berlin, Germany.

### 11:15 AM A08.02

**Narrow-Line Emission at Green Wavelengths—Distributed Feedback (DFB) Grating on InGaIn/GaN Laser Diodes** Jorge A. Holguin-Lerma, Tien Khee Ng and Boon S. Ooi; King Abdullah University of Science and Technology, Saudi Arabia.

### 11:30 AM A08.03

**III-N Tunnel Junctions as an Enabling Technology for Efficient Distributed Feedback Laser Diodes** Grzegorz Muziol<sup>1</sup>, Henryk Turski<sup>1</sup>, Mateusz Hajdel<sup>1</sup>, Marcin Siekacz<sup>1</sup>, Krzesimir Nowakowski-Szkudlarek<sup>1</sup>, Kazuki Nomoto<sup>2</sup>, Debdeep Jena<sup>2</sup>, Grace Xing<sup>2</sup> and Czeslaw Skierbiszewski<sup>1,3</sup>; <sup>1</sup>Institute of High Pressure Physics PAS, Poland; <sup>2</sup>Cornell University, United States; <sup>3</sup>TopGaN Ltd., Poland.

### 11:45 AM A08.04

**Monolithically Inverted Laser Diodes and Light Emitting Diodes Grown by Plasma Assisted MBE** Henryk Turski<sup>1</sup>, Shyam Bharadwaj<sup>2</sup>, Marcin Siekacz<sup>1</sup>, Grzegorz Muziol<sup>1</sup>, Mikolaj Zak<sup>1</sup>, Mikolaj Chlipala<sup>1</sup>, Mateusz Hajdel<sup>1</sup>, Krzesimir Nowakowski-Szkudlarek<sup>1</sup>, Grace Xing<sup>2</sup>, Debdeep Jena<sup>2</sup> and Czeslaw Skierbiszewski<sup>1</sup>; <sup>1</sup>Institute of High Pressure Physics Polish Academy of Sciences, Poland; <sup>2</sup>Cornell University, United States.

### 12:00 PM A08.05

**Randomness in Mode Distribution in Modulated (Al,In)GaN Laser Diodes** Lukas Uhlig, Matthias Wachs and Ulrich Schwarz; Chemnitz University of Technology, Germany.

### 12:15 PM A08.06

**Optically Pumped GaN-Based Laterally Coupled Distributed-Feedback Semiconductor Lasers with 3rd-Order Surface Gratings Grown on Pendeo-Epitaxy GaN** Tsuyoshi Ando<sup>1</sup>, Kenta Takagi<sup>1</sup>, Yoshiki Morioka<sup>2</sup>, Masahiro Uemukai<sup>2</sup>, Ryuji Katayama<sup>2</sup>, Daichi Imai<sup>1</sup> and Takao Miyajima<sup>1</sup>; <sup>1</sup>Meijo University, Japan; <sup>2</sup>Osaka University, Japan.

## SESSION B07: High Voltage Devices

Session Chairs: Ron Birkhahn and Marianne Germain  
Wednesday Morning, July 10, 2019  
Cedar Ballroom, Second Floor

### 8:30 AM \*B07.01

**Towards Higher Voltage in III-Nitride Devices** Farid Medjdoub; IEMN-CNRS, France.

### 9:00 AM B07.02

**Record Small-Signal RF and Off-State Breakdown Characteristics in AlN/GaN/AlN HEMTs** Austin L. Hickman, Reet Chaudhuri, Samuel J. Bader, Kazuki Nomoto, Debdeep Jena and Grace Xing; Cornell University, United States.

### 9:15 AM B07.03

**n-AlN MESFETs with Graded AlGaIn Contact Layer** Masanobu Hiroki and Kazuhide Kumakura; NTT Basic Research Labs., Japan.

### 9:30 AM B07.04

**Al<sub>0.75</sub>Ga<sub>0.25</sub>N/Al<sub>0.6</sub>Ga<sub>0.4</sub>N Heterojunction Field Effect Transistor with MBE-Regrown Contacts** Hao Xue<sup>1</sup>, Choong Hee Lee<sup>1</sup>, Kamal Hussain<sup>2</sup>, Towhidur Razzak<sup>1</sup>, Md Abdullah-Al Mamun<sup>2</sup>, Zhanbo Xia<sup>1</sup>, Shahadat H. Sohel<sup>1</sup>, Asif Khan<sup>2</sup>, Siddharth Rajan<sup>1</sup> and Wu Lu<sup>1</sup>; <sup>1</sup>The Ohio State University, United States; <sup>2</sup>University of South Carolina, United States.

### 9:45 AM B07.05

**AllInN Power Diodes** Matthew R. Peart, Damir Borovac, Sun Wei, Nelson Tansu and Jonathan Wierer; Lehigh University, United States.

### 10:00 AM B07.06

**Enhanced Breakdown Voltage in Vertical Schottky Diodes on Compensated GaN Drift Layer Grown on Free-Standing GaN** Abhinav Sandupatla<sup>1</sup>, Arulkumar Subramaniam<sup>2,3</sup>, Geok Ing Ng<sup>1,2</sup>, Kumud Ranjan<sup>1,2</sup>, Manato Deki<sup>3</sup>, Shugo Nitta<sup>3</sup>, Yoshio Honda<sup>3</sup> and Hiroshi Amano<sup>3</sup>; <sup>1</sup>NTU, Singapore; <sup>2</sup>Temasek Labs@NTU, Singapore; <sup>3</sup>Nagoya University, Japan.

### 10:15 AM BREAK

## SESSION E01: Mg Activation and P-N Junctions

Session Chairs: Tetsuo Narita and Yuji Zhao

Wednesday Morning, July 10, 2019

Cedar Ballroom, Second Floor

### 10:45 AM E01.01

#### Clear Evidence of P-Type Formation by Hall-Effect Measurements of Mg-Ion Implanted GaN Activated with Ultra-High-Pressure Annealing

Hideki Sakurai<sup>1,2,3</sup>, Masato Omori<sup>1</sup>, Shinji Yamada<sup>1,2,3</sup>, Akihiko Koura<sup>3</sup>, Hideo Suzuki<sup>3</sup>, Tetsuo Narita<sup>4</sup>, Keita Kataoka<sup>4</sup>, Masahiro Horita<sup>1,2</sup>, Michal Boćkowski<sup>1,5</sup>, Jun Suda<sup>1,2</sup> and Tetsu Kachi<sup>1</sup>; <sup>1</sup>Nagoya University, Japan; <sup>2</sup>Nagoya University, Japan; <sup>3</sup>ULVAC, Inc, Japan; <sup>4</sup>Toyota Central R&D Labs, Inc., Japan; <sup>5</sup>Institute of High Pressure Physics Polish Academy of Sciences, Poland.

### 11:00 AM E01.02

**Pulsed-Laser Activation of Implanted Mg Acceptors in GaN Grown on a GaN Substrate** Takao Miyajima<sup>1</sup>, Yusuke Yamada<sup>1</sup>, Takato Ichikawa<sup>1</sup>, Daichi Imai<sup>1</sup> and Toshiyuki Sameshima<sup>2</sup>; <sup>1</sup>Meijo University, Japan; <sup>2</sup>Tokyo University of Agriculture and Technology, Japan.

### 11:15 AM E01.03

**Toward Selective Activation of Mg doped GaN—Impact of Pulsed and Continuous Gyrotron Annealing** Kasey Hogan<sup>1</sup>, Emma Rocco<sup>1</sup>, Sean A. Tozier<sup>1</sup>, Vincent Meyers<sup>1</sup>, Benjamin McEwen<sup>1</sup>, Isra Mahaboob<sup>1</sup>, Michael Shevelev<sup>2</sup>, Vlad Skylar<sup>2</sup>, Randy Tompkins<sup>3</sup>, Michael Derenge<sup>3</sup>, Jamie Hart<sup>4</sup>, Kenneth Jones<sup>3</sup>, Mitra Taheri<sup>4</sup>, Woongje Sung<sup>1</sup> and Fatemeh (Shadi) Shahedipour-Sandvik<sup>1</sup>; <sup>1</sup>SUNY Polytechnic Institute, United States; <sup>2</sup>Gyrotron Technology Inc., United States; <sup>3</sup>Army Research Laboratory, United States; <sup>4</sup>Drexel University, United States.

### 11:30 AM E01.04

**Photoluminescence Studies of Sequentially Mg and H Ion-Implanted GaN with Various Implantation Depths and Crystallographic Planes** Kohei Shima<sup>1</sup>, Hiroko Iguchi<sup>2</sup>, Tetsuo Narita<sup>2</sup>, Keita Kataoka<sup>2</sup>, Kazunobu Kojima<sup>1</sup>, Akira Uedono<sup>3</sup> and Shigefusa F. Chichibu<sup>1,4,5</sup>; <sup>1</sup>Tohoku University, Japan; <sup>2</sup>Toyota Central R&D Labs, Inc., Japan; <sup>3</sup>University of Tsukuba, Japan; <sup>4</sup>IMaSS, Nagoya University, Japan; <sup>5</sup>RCIQE, Hokkaido University, Japan.

### 11:45 AM E01.05

**Nonuniform Mg Doping in GaN Epilayers Grown on Mesa Structures** Hanxiao Liu<sup>1</sup>, Houqiang Fu<sup>2</sup>, Kai Fu<sup>2</sup>, Shanthan Reddy Alugubelli<sup>1</sup>, Po-Yi Su<sup>1</sup>, Yuji Zhao<sup>2</sup> and Fernando Ponce<sup>1</sup>; <sup>1</sup>Arizona State University, United States; <sup>2</sup>Arizona State University, United States.

### 12:00 PM E01.06

**Demonstration of High-Voltage Regrown Nonpolar *m*-Plane *p-n* Diodes for Selective-Area-Doped Power Electronics** Morteza Monavarian<sup>1</sup>, Gregory Pickrell<sup>2</sup>, Andrew A. Aragon<sup>1</sup>, Isaac Stricklin<sup>1</sup>, Mary Crawford<sup>2</sup>, Andrew Allerman<sup>2</sup>, Kimberlee Celio<sup>3</sup>, Francois Leonard<sup>3</sup>, Alec Talin<sup>3</sup>, Andrew Armstrong<sup>2</sup> and Daniel Feezell<sup>1</sup>; <sup>1</sup>Center for High-Technology Materials, The University of New Mexico, United States; <sup>2</sup>Sandia National Laboratories, United States; <sup>3</sup>Sandia National Laboratories, United States.

### 12:15 PM E01.07

**Demonstration of Mechanically Exfoliated  $\beta$ -Ga<sub>2</sub>O<sub>3</sub>/GaN p-n Heterojunction** Chen Yang, Jossue Montes, Houqiang Fu, Tsung-Han Yang, Kai Fu, Hong Chen, Jingan Zhou, Xuanqi Huang and Yuji Zhao; Arizona State University, United States.

## SESSION H04: Quantum Dot and Single Photon Emission

Session Chairs: Dong Seon Lee and Maria Vladimirova

Wednesday Morning, July 10, 2019

Evergreen Ballroom A-C, Lobby Level

### 8:30 AM H04.01

**Room Temperature Single Photon Emission from Planar GaN/AIN Quantum Dot Samples Grown by MBE** Gordon Callsen, Sebastian Tamariz and Nicolas Grandjean; École Polytechnique Fédérale de Lausanne (EPFL), Switzerland.

### 8:45 AM H04.02

**Bright Single Photon Source Based on an InGaN Quantum Dot in a Site-Controlled Optical Horn Structure** Xiaoxiao Sun<sup>1</sup>, Ping Wang<sup>1</sup>, Tao Wang<sup>1</sup>, Duo Li<sup>1</sup>, Zhaoying Chen<sup>1</sup>, Ling Chen<sup>1</sup>, Kang Gao<sup>2</sup>, Weikun Ge<sup>1</sup>, Yasuhiko Arakawa<sup>2</sup>, Bo Shen<sup>1</sup>, Mark J. Holmes<sup>2</sup> and Xinqiang Wang<sup>1</sup>; <sup>1</sup>Peking University, China; <sup>2</sup>Institute for Nano Quantum Information Electronics, Japan.

### 9:00 AM H04.03

**Self-Organized Desorption Induced GaN Quantum Dot Formation on Top of a Wavelength Matched Deep-UV AlN/AlGaIn Distributed Bragg Reflector** Hannes Schürmann<sup>1</sup>, Gordon Schmidt<sup>1</sup>, Christoph Berger<sup>1</sup>, Sebastian Metzner<sup>1</sup>, Peter Veit<sup>1</sup>, Jürgen Bläsing<sup>1</sup>, Frank Bertram<sup>1</sup>, Armin Dadgar<sup>1</sup>, André Strittmatter<sup>1</sup>, Juergen Christen<sup>1</sup>, Stefan Kalinowski<sup>2</sup>, Stefan Jagsch<sup>2</sup>, Markus R. Wagner<sup>2</sup> and Axel Hoffmann<sup>2</sup>; <sup>1</sup>Otto-von-Guericke-University Magdeburg, Germany; <sup>2</sup>Technical University Berlin, Germany.

### 9:15 AM H04.04

**Optical Characterization of Single InGaN Quantum Dot with Self-Aligned Two-Photon Plasmonic Nanofocusing** Su-Hyun Gong, Hwan-Seop Yeo, Kie Young Woo, Sejeong Kim, Je-Hyung Kim and Yong-Hoon Cho; Korea Advanced Institute of Science and Technology, Korea (the Republic of).

### 9:30 AM H04.05

**Design of AlGaIn/AlN Dot-in-a-Wire Heterostructures UV Emitters** Ioanna Dimkou<sup>1</sup>, Akhil Ajay<sup>2</sup>, Edith Bellet-Amalric<sup>2</sup>, Martien I. den Hertog<sup>3</sup>, Fabrice Donatini<sup>3</sup>, Nicolas Mollard<sup>3</sup>, Catherine Bougerol<sup>3</sup>, Eva Monroy<sup>2</sup> and Stephen Purcell<sup>4</sup>; <sup>1</sup>CEA-Leti, France; <sup>2</sup>University Grenoble-Alpes, CEA-IRIG-DEPHY-PHELIQS, France; <sup>3</sup>University Grenoble-Alpes, CNRS-Institut Néel, France; <sup>4</sup>University Lyon, Université Claude Bernard Lyon 1, CNRS, Institut Lumière Matière, France.

### 9:45 AM H04.06

**Spatial Distribution and Temporal Evolution of GaN QD Emissions—Blinking Phenomenon Under Cathodoluminescence Excitation** Gordon Schmidt, Sebastian Metzner, Hannes Schürmann, Frank Bertram, Silvio Neugebauer, Christoph Berger, Armin Dadgar, André Strittmatter and Juergen Christen; Otto-von-Guericke University Magdeburg, Germany.

## 10:00 AM LATE NEWS

## 10:15 AM BREAK

## SESSION G07: Growth on Silicon, Integration and Quantum Dot

Session Chairs: Jung Han and Xinqiang Wang

Wednesday Morning, July 10, 2019

Evergreen Ballroom A-C, Lobby Level

### 10:45 AM \*G07.01

**Heteroepitaxy of GaN-Based Materials and Devices on Si** Qian Sun; Suzhou Institute of Nano-Tech and Nano-Bionics, Chinese Academy of Sciences, China.

### 11:15 AM G07.02

**Wafer-Scale Crack-Free 10- $\mu$ m-Thick GaN with a Dislocation Density of  $5.8 \times 10^7$  cm<sup>-2</sup> Grown on Si** Jianxun Liu, Yingnan Huang, Xiujian Sun, Meixin Feng, Yu Zhou, Qian Sun and Hui Yang; Key Laboratory of Nano-Devices and Applications, Suzhou Institute of Nano-Tech and Nano-Bionics, Chinese Academy of Sciences, China.

### 11:30 AM G07.03

**Monolithic On-Chip Integration of HEMTs/Green LEDs** Y Cai, Y Gong, Jie Bai, X Yu, C Zhu, V Esendag, Kean Boon Lee and T Wang; University of Sheffield, United Kingdom.

### 11:45 AM G07.04

**Pendeo-Epitaxy of GaN on Nano-Patterned SOI Substrates—A New Si-Compatible Platform for Micro-Display Applications** Roy Dagher<sup>1</sup>, Philippe de Mierry<sup>2</sup>, Blandine Alloing<sup>2</sup>, Virginie Brandli<sup>2</sup>, Hubert Bono<sup>3</sup>, Maximilien Cottat<sup>4</sup>, Cécile Gourgon<sup>4</sup>, Jesus Zuniga-Perez<sup>2</sup> and Guy Feuillet<sup>1</sup>; <sup>1</sup>CEA Leti, France; <sup>2</sup>Université Cote d'Azur, France; <sup>3</sup>CEA Leti, France; <sup>4</sup>Université Grenoble Alpes, France.

### 12:00 PM G07.05

**Density Control of GaN Quantum Dots on AlN Single Crystal** Sebastian Tamariz, Gordon Callsen and Nicolas Grandjean; EPFL, Switzerland.

### 12:15 PM G07.06

**MOCVD Growth and Characterization of InN and InGaIn Quantum Dots** Caroline Reilly<sup>1</sup>, Shuji Nakamura<sup>1,2</sup>, Steven P. DenBaars<sup>1,2</sup> and Stacia Keller<sup>2</sup>; <sup>1</sup>University of California, Santa Barbara, United States; <sup>2</sup>University of California, Santa Barbara, United States.

SESSION J01: Defects in GaN and In-Containing Materials

Session Chairs: Robert Martin and Tadeusz Suski

Wednesday Morning, July 10, 2019

Regency Ballroom E-G, Second Floor

8:30 AM J01.01

**Suppression of Polar-Optical Phonon Emission Due to Minigap Formation by Stacking Faults Increases the Hot-Carrier Relaxation Time and Mean-Free Path in GaN—Explanation of the Accumulation of Hot Electrons at 1 eV Above the Conduction-Band Minimum** Kelsey Mengle<sup>1</sup>, John Lyons<sup>2</sup>, Qimin Yan<sup>3</sup>, Dylan Bayer<sup>1</sup>, Suk Hyun Sung<sup>1</sup>, Jonathan Schwartz<sup>1</sup>, Robert Hovden<sup>1</sup>, Zetian Mi<sup>4</sup>, Chris G. Van de Walle<sup>5</sup> and Emmanouil Kioupakis<sup>1</sup>; <sup>1</sup>University of Michigan, United States; <sup>2</sup>U.S. Naval Research Lab, United States; <sup>3</sup>Temple University, United States; <sup>4</sup>University of Michigan, United States; <sup>5</sup>University of California, Santa Barbara, United States.

8:45 AM J01.02

**Mapping of n-GaN Schottky Contacts Formed on Facet-Growth Substrates Using Scanning Internal Photoemission Microscopy** Kenji Shiojima<sup>1</sup>, Masataka Maeda<sup>1</sup> and Kaori Kurihara<sup>2</sup>; <sup>1</sup>University of Fukui, Japan; <sup>2</sup>Mitsubishi Chemical, Japan.

9:00 AM J01.03

**Determination Methods of HI Trap Concentration in N-Type GaN Schottky Barriers via Sub-Bandgap-Light Isothermal Capacitance Transient Spectroscopy** Kazutaka Kanegae<sup>1</sup>, Tetsuo Narita<sup>2</sup>, Kazuyoshi Tomita<sup>2</sup>, Tetsu Kachi<sup>3</sup>, Masahiro Horita<sup>1,3</sup>, Tsunenobu Kimoto<sup>1</sup> and Jun Suda<sup>1,3</sup>; <sup>1</sup>Kyoto University, Japan; <sup>2</sup>Toyota Central R&D Labs. Inc., Japan; <sup>3</sup>Nagoya University, Japan.

9:15 AM J01.04

**Temperature Dependence of Polarized Photoluminescence from c-Plane InGaN/GaN Multiple Quantum Wells Grown on Sapphire Nano-Membrane** Jongmyeong Kim<sup>1</sup>, Seungmin Lee<sup>1</sup>, Jehong Oh<sup>1</sup>, Jungel Ryu<sup>1</sup>, Yongjo Park<sup>1</sup>, Seung-Hwan Park<sup>2</sup> and Euijoon Yoon<sup>1,3,4</sup>; <sup>1</sup>Seoul National University, Korea (the Republic of); <sup>2</sup>Catholic University of Daegu, Korea (the Republic of); <sup>3</sup>Research Institute of Advanced Materials, Korea (the Republic of); <sup>4</sup>Inter-University Semiconductor Research Center, Korea (the Republic of).

9:30 AM J01.05

**Improvement of Thermal Stability of InGaN Quantum Wells by Si and Mg Doping** Artur Lachowski<sup>1,2</sup>, Julita Smalc-Koziorowska<sup>1,3</sup>, Ewa Grzanka<sup>1,3</sup>, Szymon Grzanka<sup>1,3</sup>, Lucja Marona<sup>1,3</sup>, Robert Czernecki<sup>1,3</sup> and Mike Leszczynski<sup>1,3</sup>; <sup>1</sup>Polish Academy of Sciences, Poland; <sup>2</sup>Warsaw University of Technology, Poland; <sup>3</sup>TopGaN Ltd., Poland.

9:45 AM J01.06

**Indium Concentration Fluctuations in InGaN/GaN Quantum Wells** Pawel P. Michalowski<sup>3</sup>, Ewa Grzanka<sup>1,2</sup>, Grzegorz Staszczak<sup>1</sup>, Szymon Grzanka<sup>1,2</sup>, Artur Lachowski<sup>1</sup>, Jerzy Plesiewicz<sup>2</sup>, Mike Leszczynski<sup>1,2</sup> and Andrzej Turosz<sup>3,4</sup>; <sup>1</sup>Institute of High Pressure Physics, Poland; <sup>2</sup>TOPGaN, Poland; <sup>3</sup>Institute of Electronic Materials Technology, Poland; <sup>4</sup>National Centre for Nuclear Research, Poland.

10:00 AM J01.07

**Engineering the Nitrogen Plasma to Reduce Defects in InN Resulting in a 0.12 eV Moss-Burstein Shift Towards the Fundamental Bandgap** Evan A. Clinton<sup>1</sup>, Ehsan Vadice<sup>1</sup>, M.B. Tellekamp<sup>2</sup>, Zachary Engel<sup>1</sup>, Christopher M. Matthews<sup>1</sup> and William A. Doolittle<sup>1</sup>; <sup>1</sup>Georgia Institute of Technology, Georgia; <sup>2</sup>National Renewable Energy Laboratory, United States.

10:15 AM BREAK

SESSION H05: Properties of Nanostructures and Nano-Devices

Session Chairs: Ana Cros and Noelle Gogneau

Wednesday Morning, July 10, 2019

Regency Ballroom E-G, Second Floor

10:45 AM H05.01

**X-Ray to Revisit Inversion Domain Boundaries In MOVPE GaN Wires** Joël Eymery<sup>1</sup>, Frédéric Lançon<sup>3</sup>, Luigi Genovese<sup>3</sup> and Damien Salomon<sup>2</sup>; <sup>1</sup>CEA, IRIG-MEM-NRS, France; <sup>2</sup>ESRF, France; <sup>3</sup>CEA, IRIG-MEM-LSIM, France.

11:00 AM H05.02

**Which Morphology for Axial Nanowire Based InGaN LEDs by PA-MBE?** Marion Gruart<sup>1,2</sup> and Bruno Daudin<sup>1,2</sup>; <sup>1</sup>CEA / INAC, France; <sup>2</sup>Université Grenoble Alpes, France.

11:15 AM H05.03

**Position and Composition Controlled High Quality (In, Ga)N Nanowires Grown by HVPE** Mohammed Zeghouane<sup>6</sup>, Geoffrey Avit<sup>6</sup>, Yamina Andre<sup>1,7</sup>, Catherine Bougerol<sup>8</sup>, Evelyne Gil<sup>6,7</sup>, Pierre Ferret<sup>2</sup>, Dominique Castellucci<sup>6</sup>, Eric Tournic<sup>3</sup>, Thierry Taliercio<sup>4</sup>, Yoann Robin<sup>5</sup>, Vladimir Dubrovskii<sup>7</sup>, Hiroshi Amano<sup>5</sup> and Agnes Trassoudaine<sup>6</sup>; <sup>1</sup>Institut Pascal, France; <sup>2</sup>CEA-LETI, France; <sup>3</sup>IES, University Montpellier, France; <sup>4</sup>IMaSS, Nagoya University, Japan; <sup>5</sup>Université Clermont Auvergne, CNRS, SIGMA Clermont, Institut Pascal, France; <sup>6</sup>ITMO University, Russian Federation; <sup>7</sup>CNRS, Institut Néel, France.

11:30 AM H05.04

**Solution Processable RGB III-Nitride Light Emitters Enabled by Large Area Photoelectrochemical Lift-Off and Colloidal Lithography** Lesley Chan<sup>1,2</sup>, Pavel Shapturenka<sup>1,2</sup>, Christopher Pynn<sup>2,3</sup>, Tal Margalith<sup>2</sup>, Steven P. DenBaars<sup>2,3</sup> and Michael J. Gordon<sup>1,2</sup>; <sup>1</sup>University of California, Santa Barbara, United States; <sup>2</sup>University of California, Santa Barbara, United States; <sup>3</sup>University of California, Santa Barbara, United States.

11:45 AM H05.05

**Supercontinuum Generation from Dispersion Engineered AlN Nanophotonic Waveguide Arrays** Hong Chen, Jingan Zhou, Xuanqi Huang, Houqiang Fu, Kai Fu, Tsung-Han Yang, Jossue Montes, Chen Yang and Yuji Zhao; Arizona State University, United States.

12:00 PM LATE NEWS

12:15 PM LATE NEWS

SESSION M02: Novel Materials, Diodes and Optical Devices

Session Chairs: Juergen Christen and Maria Tchernycheva

Wednesday Morning, July 10, 2019

Regency Ballroom A-C, Second Floor

8:30 AM M02.01

**Demonstration of GaN Monolithic Doubly-Resonant Microcavity SHG Device** Masahiro Uemukai<sup>2</sup>, Tomoaki Nambu<sup>2</sup>, Takumi Nagata<sup>2</sup>, Toshiki Hikosaka<sup>3</sup>, Shinya Nunoue<sup>3</sup>, Keishi Shiomi<sup>2</sup>, Yasufumi Fujiwara<sup>2</sup>, Kazuki Ohnishi<sup>1</sup>, Tomoyuki Tanikawa<sup>1</sup> and Ryuji Katayama<sup>2</sup>; <sup>1</sup>Tohoku University, Japan; <sup>2</sup>Osaka University, Japan; <sup>3</sup>Toshiba Corporation, Japan.

8:45 AM M02.02

**Quasi-Phase-Matched Second Harmonic Generation of UV Light Using AlN Waveguides** Ronny Kirste<sup>1,2</sup>, Dorian Alden<sup>2,4</sup>, Tinkara Troha<sup>3</sup>, Seiji Mita<sup>1,2</sup>, Qiang Guo<sup>2</sup>, Axel Hoffmann<sup>4</sup>, Marko Zgonik<sup>3</sup>, Ramón Collazo<sup>2</sup> and Zlatko Sitar<sup>2</sup>; <sup>1</sup>Adroit Materials, United States; <sup>2</sup>North Carolina State University, United States; <sup>3</sup>University of Ljubljana, Slovenia; <sup>4</sup>TU Berlin, Germany.

9:00 AM M02.03

**Monolithically Integrated GaN Vertical LED/Quasi-Vertical Power UMOSFET Pairs Using Selective Epi Removal** Zhibo Guo<sup>1</sup>, Collin Hitchcock<sup>1</sup>, Christian Wetzel<sup>2</sup>, Robert F. Karlicek<sup>1</sup>, Piao Guanxi<sup>3</sup>, Yoshiaki Yano<sup>3</sup>, Shuuichi Koseki<sup>3</sup>, Toshiya Tabuchi<sup>3</sup>, Koh Matsumoto<sup>3</sup>, Mayank Bulsara<sup>4</sup> and T. Paul Chow<sup>1</sup>; <sup>1</sup>Rensselaer Polytechnic Institute, United States; <sup>2</sup>Rensselaer Polytechnic Institute, United States; <sup>3</sup>Taiyo Nippon Sanso Corporation, Japan; <sup>4</sup>MATHESON Tri-Gas, United States.

9:15 AM M02.04

**Whispering-Gallery Mode Optically-Pumped Lasing from InGaN/GaN Microdisks on GaN Substrate** Hui Zi<sup>1</sup>, Kwai Hei Li<sup>1</sup>, Hoi Wai Choi<sup>1</sup>, Farsaneh Tabataba-Vakili<sup>2,3</sup>, Stéphanie Rensson<sup>4</sup>, Benjamin Damilano<sup>4</sup>, Eric Frayssinet<sup>4</sup>, Jean-Yves Duboz<sup>4</sup>, Fabrice Semon<sup>4</sup>, Lactitia Doyennette<sup>5</sup>, Christelle Brimont<sup>5</sup>, Thierry Guillet<sup>5</sup>, Bruno Gayral<sup>3</sup> and Philippe Boucaud<sup>4</sup>; <sup>1</sup>The University of Hong Kong, Hong Kong; <sup>2</sup>Centre de Nanosciences et de Nanotechnologies, CNRS, University Paris-Sud, Université Paris-Saclay, France; <sup>3</sup>CEA, INAC-PHELIQS, Nanophysique et semiconducteurs group, University Grenoble Alpes, France; <sup>4</sup>Université Côte d'Azur, CRHEA-CNRS, France; <sup>5</sup>Laboratoire Charles Coulomb (L2C), Université de Montpellier, France.

9:30 AM M02.05

**Investigating the Signature of Antimony into Dilute-Antimonide (Sb<1%) III-Nitrides Using Micro-Raman Spectroscopy** Mohammad F. Chowdhury<sup>1,2</sup>, Hong Guo<sup>2</sup> and Zetian Mi<sup>1,3</sup>; <sup>1</sup>McGill University, Canada; <sup>2</sup>McGill University, Canada; <sup>3</sup>University of Michigan, United States.

**9:45 AM M02.06**

**First Demonstration of Negative Differential Resistance in  $\text{Al}_x\text{Ga}_{1-x}\text{N}$  Homojunction Tunnel Diodes up to  $x=0.19$  and High Reverse Bias Tunneling up to  $x=0.58$  to Enable Ultraviolet Optoelectronics** Evan A. Clinton, Ehsan Vadiée, Zachary Engel, Christopher M. Matthews and William A. Doolittle; Georgia Institute of Technology, Georgia.

**10:00 AM M02.07**

**Epitaxial  $\beta\text{-Ga}_2\text{O}_3/\text{Al}_{0.45}\text{Ga}_{0.55}\text{N}$  Heterojunction-Based Schottky Barrier Diodes for Room and High Temperature Broadband Deep-Ultraviolet Optoelectronics** Anisha Kalra, Shashwat Rathkanthiwar, Sandeep Vura, Rangarajan Muralidharan, Srinivasan Raghavan and Dignbijoy N. Nath; Indian Institute of Science, India.

**10:15 AM BREAK**

SESSION M03: Transition Metal and Other Novel Nitrides  
Session Chairs: Kazuhiro Ohkawa and Stefan Schulz  
Wednesday Morning, July 10, 2019  
Regency Ballroom A-C, Second Floor

**10:45 AM \*M03.01**

**ScAlN-Based Ferroelectric and Piezoelectric Electro Acoustic Devices** Oliver Ambacher<sup>1,2</sup>, Agne Zukauskaitė<sup>1</sup>, A. Ding<sup>1</sup>, Lutz Kirste<sup>1</sup>, N. Kurz<sup>2</sup>, N. Feil<sup>2</sup>, D. Urban<sup>3</sup> and B. Heinz<sup>4</sup>; <sup>1</sup>Fraunhofer Institute for Applied Solid State Physics, Germany; <sup>2</sup>Institut für Sustainable Systems Engineering, Germany; <sup>3</sup>Fraunhofer IWM, Germany; <sup>4</sup>Evattec, Switzerland.

**11:15 AM \*M03.02**

**Epitaxial Transition-Metal Nitrides—ScAlN, NbN<sub>x</sub>, and TaN<sub>x</sub> for Next-Generation Electronic Devices** Matthew T. Hardy, Scott Katzer, Brian P. Downey, Neeraj Nepal, Mario Ancona, Eric N. Jin, David Storm and David Meyer; Naval Research Laboratory, United States.

**11:45 AM M03.03**

**Prediction and Synthesis of Mg-Sb-N Ternary Nitrides with Wurtzite-Derived and Antiperovskite Structures** Karen Heinselman, Stephan Lany, John Perkins and Andriy Zakutayev; National Renewable Energy Laboratory, United States.

**12:00 PM M03.04**

**A Map of New Ternary Metal Nitride Semiconductors** Wenhao Sun; Lawrence Berkeley National Labs, United States.

**12:15 PM M03.05**

**MOCVD Growth and Characterization of ZnGeN<sub>2</sub>-GaN Alloy Films** Benthara H. Jayatunga<sup>1</sup>, Md Rezaul Karim<sup>2</sup>, Kathleen Kash<sup>1</sup> and Hongping Zhao<sup>2</sup>; <sup>1</sup>Case Western Reserve University, United States; <sup>2</sup>Ohio State University, United States.

**SESSION A09: Micro LEDs**

Session Chairs: Kate Kelchner and Jong Kyu Kim  
Wednesday Afternoon, July 10, 2019  
Evergreen Ballroom E-F, Lobby Level

**2:00 PM \*A09.01**

**Self-Passivated High-Efficiency c-Plane Micro-LED Array without Singulation Fabricated on Sapphire Nano-Membrane Structures** Seungmin Lee<sup>1</sup>, Jongmyeong Kim<sup>1</sup>, Jehong Oh<sup>1</sup>, Jungel Ryu<sup>1</sup>, Yongjo Park<sup>1</sup> and Euijoon Yoon<sup>2,3,4</sup>; <sup>1</sup>Seoul National University, Korea (the Republic of); <sup>2</sup>Research Institute of Advanced Materials, Seoul National University, Korea (the Republic of); <sup>3</sup>Inter-University Semiconductor Research Center, Seoul National University, Korea (the Republic of).

**2:30 PM A09.02**

**Efficient Green Semipolar (11-22) InGaN Micro-Light-Emitting Diodes on (11-22) GaN/Sapphire Template** Matthew Wong<sup>1</sup>, Michel Houry<sup>1</sup>, Hongjian Li<sup>1</sup>, Bastien Bonef<sup>1</sup>, Haojun Zhang<sup>2</sup>, Aidan A. Taylor<sup>1</sup>, Jared A. Kearns<sup>1</sup>, Philippe de Mierry<sup>3</sup>, James Speck<sup>1</sup>, Shuji Nakamura<sup>1,2</sup> and Steven P. DenBaars<sup>1,2</sup>; <sup>1</sup>University of California, Santa Barbara, United States; <sup>2</sup>University of California, Santa Barbara, United States; <sup>3</sup>CNRS-CRHEA, France.

**2:45 PM A09.03**

**Near-Complete Elimination of Size-Dependent Efficiency Decrease of GaN Micro-LEDs by Using Neutral-Beam Etching** Xuelun Wang<sup>1,2,3</sup>, Jun Zhu<sup>3</sup>, Tokio Takahashi<sup>3</sup>, Kazuhiko Endo<sup>4</sup>, Daisuke Ohori<sup>5</sup> and Seiji Samukawa<sup>3,6,4</sup>; <sup>1</sup>National Institute of Advanced Industrial Science and Technology, Japan; <sup>2</sup>Nagoya University, Japan; <sup>3</sup>National Institute of Advanced Industrial Science and Technology, Japan; <sup>4</sup>National Institute of Advanced Industrial Science and Technology, Japan; <sup>5</sup>Tohoku University, Japan; <sup>6</sup>Tohoku University, Japan.

**3:00 PM A09.04**

**Blue MicroLED Arrays on Flexible Metal Foils** Abdelrahman T. Elshafiey<sup>1</sup>, Kenneth Davico<sup>1</sup>, Ashwin K. Rishinaramangalam<sup>1</sup>, Christopher Sheehan<sup>1</sup>, Vladimir Matias<sup>2</sup> and Daniel Feezell<sup>1</sup>; <sup>1</sup>University of New Mexico, United States; <sup>2</sup>Beam Materials, United States.

**3:15 PM LATE NEWS****3:30 PM LATE NEWS****3:45 PM BREAK**

SESSION A10: Intra Center, UV and BN Emitters  
Session Chairs: Nicolas Grandjean and Jennifer Hite  
Wednesday Afternoon, July 10, 2019  
Evergreen Ballroom E-F, Lobby Level

**4:15 PM \*A10.01**

**Development of Semiconductors Intra-Center Photonics** Yasufumi Fujiwara, Keishi Shioimi, Yutaka Sasaki, Tomohiro Inaba, Shuhei Ichikawa and Jun Tatebayashi; Osaka University, Japan.

**4:45 PM A10.02**

**Design of Composition-Graded p-AlGaIn Cladding Layer for UVB Laser Diode Structure** Kosuke Sato<sup>1,2</sup>, Shinji Yasue<sup>2</sup>, Yuya Ogino<sup>2</sup>, Shunya Tanaka<sup>2</sup>, Motoaki Iwaya<sup>2</sup>, Tetsuya Takeuchi<sup>2</sup>, Satoshi Kamiyama<sup>2</sup> and Isamu Akasaki<sup>2,3</sup>; <sup>1</sup>Asahi-Kasei, Japan; <sup>2</sup>Meiji University, Japan; <sup>3</sup>Nagoya University, Japan.

**5:00 PM A10.03**

**Realization of High Light Output Power in AlGaIn-Based UVB LED at 310±2nm Emission Using Highly Relaxed (50%) n-AlGaIn Electron Injection Layer** M. A. Khan<sup>1,2,3</sup>, Noritoshi Maeda<sup>1</sup>, Masafumi Jo<sup>1</sup>, Sachie Fujikawa<sup>1,2</sup>, Eriko Matsuura<sup>1,3</sup>, Yukio Kashima<sup>1,3</sup>, Yoichi Yamada<sup>4</sup> and Hideki Hirayama<sup>1</sup>; <sup>1</sup>Riken, Japan; <sup>2</sup>Tokyo Denki University, Japan; <sup>3</sup>Marubun Corporation, Japan; <sup>4</sup>Yamaguchi University, Japan.

**5:15 PM A10.04**

**Boron Nitride Deep Ultraviolet Light Emitters Grown by Ultra-High-Temperature Molecular Beam Epitaxy** David A. Laleyan<sup>1</sup>, Eric T. Reid<sup>1</sup>, Kelsey Mengle<sup>2</sup>, Emmanouil Kioupakis<sup>2</sup> and Zetian Mi<sup>1</sup>; <sup>1</sup>University of Michigan, United States; <sup>2</sup>University of Michigan, United States.

**5:30 PM A10.05**

**First Principles Calculations of Boron Alloyed Group III Nitrides for Higher Efficiency UV and Visible LEDs** Logan D. Williams<sup>1</sup>, Kevin Greenman<sup>2</sup> and Emmanouil Kioupakis<sup>1</sup>; <sup>1</sup>University of Michigan, United States; <sup>2</sup>University of Michigan, United States.

**5:45 PM A10.06**

**Time-Resolved Luminescence Studies of Indirect Excitons in *h*-BN Epitaxial Films Grown by Chemical Vapor Deposition Using Carbon-Free Precursors** Shigefusa F. Chichibu<sup>1,2,3</sup>, Naoki Umehara<sup>4</sup>, Keisuke Takiguchi<sup>5</sup>, Kohei Shima<sup>1</sup>, Kazunobu Kojima<sup>1</sup>, Yoshihiro Ishitani<sup>5</sup> and Kazuhiko Hara<sup>4</sup>; <sup>1</sup>Tohoku University, Japan; <sup>2</sup>Nagoya University, Japan; <sup>3</sup>Hokkaido University, Japan; <sup>4</sup>Shizuoka University, Japan; <sup>5</sup>Chiba University, Japan.

SESSION B08: MOS Transistors and Diodes  
Session Chairs: Martin Kuball and Matteo Meneghini  
Wednesday Afternoon, July 10, 2019  
Cedar Ballroom, Second Floor

**2:00 PM \*B08.01**

**Interface Control of Al<sub>2</sub>O<sub>3</sub>-Based MOS Structures for Advanced GaN Transistors** Tamotsu Hashizume and Taketomo Sato; Hokkaido University, Japan.

**2:30 PM B08.02**

**Gate-Channel Mobility Enhancement by Using AlN Interlayer in Recessed-Gate GaN-MOSFETs** Akira Mukai, Daimotsu Kato, Yousuke Kajiwara, Hiroshi Ono, Aya Shindome and Masahiko Kuraguchi; Toshiba Corporation, Japan.

**2:45 PM B08.03**

**Control of MOS Channel Characteristics of GaN-DIMOSFETs Formed by Mg Ion Implantation** Ryo Tanaka<sup>1</sup>, Shinya Takashima<sup>1</sup>, Katsunori Ueno<sup>1</sup>, Hideaki Matsuyama<sup>1</sup>, Masaharu Edo<sup>1</sup> and Kiyokazu Nakagawa<sup>2</sup>; <sup>1</sup>Fuji Electric Co., Ltd., Japan; <sup>2</sup>University of Yamanashi, Japan.

**3:00 PM B08.04**

**Impact of Gamma-Ray Irradiation on Capacitance-Voltage Characteristics of Al<sub>2</sub>O<sub>3</sub>/GaN MOS Diodes with Post-Metallization Annealing** Keito Aoshima<sup>1</sup>, Masahiro Horita<sup>1,2</sup>, Shota Kaneki<sup>3</sup>, Jun Suda<sup>1,2</sup> and Tamotsu Hashizume<sup>3</sup>; <sup>1</sup>Nagoya University, Japan; <sup>2</sup>Nagoya University, Japan; <sup>3</sup>Hokkaido University, Japan.

**3:15 PM B08.05**

**Integrable Quasi-Vertical GaN UMOSFETs for Power and Optoelectronic ICs** Zhibo Guo<sup>1</sup>, Collin Hitchcock<sup>1</sup>, Piao Guanxi<sup>2</sup>, Yoshiki Yano<sup>2</sup>, Shuuichi Koseki<sup>2</sup>, Toshiya Tabuchi<sup>2</sup>, Koh Matsumoto<sup>2</sup>, Mayank Bulsara<sup>3</sup> and T. Paul Chow<sup>1</sup>; <sup>1</sup>Rensselaer Polytechnic Institute, United States; <sup>2</sup>Taiyo Nippon Sanso Corporation, Japan; <sup>3</sup>MATHESON Tri-Gas, United States.

**3:30 PM B08.06**

**Exploring the Electrical Properties of Gate Dielectrics on (000-1) N-Polar GaN** Islam Sayed, Wenjian Liu, Silvia Chan, Chirag Gupta, Haoran Li, Matthew Guidry, Stacia Keller and Umesh K. Mishra; University of California, Santa Barbara, United States.

**3:45 PM BREAK**

SESSION B09: Electronic Device Characterization  
Session Chairs: Kei May Lau and Enrico Zanoni  
Wednesday Afternoon, July 10, 2019  
Cedar Ballroom, Second Floor

**4:15 PM \*B09.01**

**Impact of Deep Levels on GaN HEMTs** Michael J. Uren and Martin Kuball; University of Bristol, United Kingdom.

**4:45 PM B09.02**

**Dependence of the Current Collapse of GaN HEMTs on Quiescent Gate Voltage** Takashi Matsuda<sup>1</sup>, Shigeo Yamabe<sup>2</sup>, Eiji Yagyu<sup>1</sup> and Mikio Yamamuka<sup>1</sup>; <sup>1</sup>Mitsubishi Electric Corporation, Japan; <sup>2</sup>MELCO Semiconductor Engineering Corporation, Japan.

**5:00 PM B09.03**

**Dopant Profiling in p-i-n GaN Structures Using Secondary Electrons** Shanthan Reddy Alugubelli<sup>1</sup>, Hanxiao Liu<sup>1</sup>, Houqiang Fu<sup>2</sup>, Kai Fu<sup>2</sup>, Yuji Zhao<sup>2</sup> and Fernando Ponce<sup>1</sup>; <sup>1</sup>Arizona State University, United States; <sup>2</sup>Arizona State University, United States.

**5:15 PM B09.04**

**Impact of n-GaN Cap Layer on Gate Leakage Behavior in AlGaN/GaN Heterostructures Grown on Si and GaN Substrates** Junji Kotani, Atsushi Yamada and Norikazu Nakamura; Fujitsu Limited, Japan.

**5:30 PM B09.05**

**High Temperature Reverse Bias (HTRB) Tests on GaN Lateral HEMTs** Xiang Zhou and T. Paul Chow; Rensselaer Polytechnic Institute (RPI), United States.

**5:45 PM B09.06**

**Impact of Gamma-Ray Irradiation on Device Characteristics of p-GaN/AlGaN/GaN Normally-Off High-Electron-Mobility Transistors** Koki Tsurimoto<sup>1</sup>, Masahiro Horita<sup>1,2</sup> and Jun Suda<sup>1,2</sup>; <sup>1</sup>Nagoya University, Japan; <sup>2</sup>Nagoya University, Japan.

SESSION F03: Bulk and HVPE Growth  
Session Chairs: Rafael Dalmau and Yusuke Mori  
Wednesday Afternoon, July 10, 2019  
Regency Ballroom A-C, Second Floor

**2:00 PM \*F03.01**

**High Pressure in Physics and Technology of Bulk GaN Crystallization and Wafer Processing** Izabella Grzegory; Institute of High Pressure Physics PAS Unipress, Poland.

**2:30 PM F03.02**

**Crystallization of GaN by HVPE Method with Controlled Lateral Growth** Tomasz Sochacki, Slawek Sakowski, Boleslaw Lucznik, Mikolaj Amilusik, Michal Fijalkowski, Malgorzata Iwinska, Aneta Sidor, Izabella Grzegory and Michal Boćkowski; Institute of High Pressure Physics PAS, Poland.

**2:45 PM F03.03**

**HVPE-GaN Doped with Carbon and/or Manganese** Malgorzata Iwinska, Tomasz Sochacki, Mikolaj Amilusik, Boleslaw Lucznik, Michal Fijalkowski, Marcin Zajac, Elzbieta Litwin-Staszewska, Ryszard Piotrkowski, Leszek Koczewicz, Aneta Sidor, Kacper Sierakowski, Izabella Grzegory and Michal Boćkowski; Institute of High Pressure Physics Polish Academy of Sciences (Unipress), Poland.

**3:00 PM F03.04**

**Growth of High Crystalline Quality GaN with High Growth Rate by THVPE** Akira Yamaguchi<sup>1</sup>, Daisuke Oozeki<sup>2</sup>, Naoya Kawamoto<sup>2</sup>, Nao Takekawa<sup>2</sup>, Mayank Bulsara<sup>3</sup>, Hisashi Murakami<sup>2</sup>, Yoshinao Kumagai<sup>2</sup>, Koh Matsumoto<sup>1</sup> and Akinori Koukitu<sup>2</sup>; <sup>1</sup>Taiyo Nippon Sanso Co., Japan; <sup>2</sup>Tokyo University of Agriculture and Technology, Japan; <sup>3</sup>Matheson Tri-Gas, Inc., United States.

**3:15 PM LATE NEWS****3:30 PM LATE NEWS****3:45 PM BREAK**

SESSION A11: Efficiency and Degradation in Light Emitters  
Session Chairs: Aurelien David and Martin Strassburg  
Wednesday Afternoon, July 10, 2019  
Regency Ballroom A-C, Second Floor

**4:15 PM A11.01**

**Physical Limits of Recombinations in III-Nitride LEDs** Aurelien David, Nathan Young, Cory Lund and Michael Craven; Soraa, United States.

**4:30 PM A11.02**

**Hot Carrier Generation—Without Efficiency Droop—In Low Radiative Efficiency MBE-Grown III-Nitride LEDs** Andrew C. Espenlaub<sup>1</sup>, Daniel J. Myers<sup>1</sup>, Erin C. Young<sup>1</sup>, Saulius Marcinkevicius<sup>2</sup>, Claude Weisbuch<sup>1</sup> and James Speck<sup>1</sup>; <sup>1</sup>University of California, Santa Barbara, United States; <sup>2</sup>KTH Royal Institute of Technology, Sweden.

**4:45 PM A11.03**

**Photon-Driven Degradation Processes in GaN-Based Optoelectronic Devices** Carlo De Santi<sup>1</sup>, Alessandro Caria<sup>1</sup>, Nicola Renzo<sup>1</sup>, Ezgi Dogmus<sup>2</sup>, Malek Zegaoui<sup>2</sup>, Farid Medjdoub<sup>2</sup>, Gaudenzio Meneghesso<sup>1</sup>, Enrico Zanoni<sup>1</sup> and Matteo Meneghini<sup>1</sup>; <sup>1</sup>University of Padova, Italy; <sup>2</sup>IEMN-CNRS, France.

**5:00 PM A11.04**

**Effects of Well Width Fluctuations on Green InGaN/GaN Quantum Wells Grown at Different Temperatures** Boning Ding, John Jarman, Menno Kappers and Rachel Oliver; University of Cambridge, United Kingdom.

**5:15 PM A11.05**

**Contribution of Polarization-Induced Barriers to Excess Forward Voltage in c-Plane Green LEDs** Cheyenne Lynsky<sup>1</sup>, Guillaume Lheureux<sup>1</sup>, Abdullah Alhassan<sup>1</sup>, Ryan White<sup>1</sup>, Bastien Bonef, Yuh-Renn Wu<sup>2</sup>, Claude Weisbuch<sup>3</sup>, Steven P. DenBaars<sup>1</sup>, Shuji Nakamura<sup>1</sup> and James Speck<sup>1</sup>; <sup>1</sup>University of California, Santa Barbara, United States; <sup>2</sup>National Taiwan University, Taiwan; <sup>3</sup>Ecole Polytechnique, CNRS, Université Paris Saclay, France.

**5:30 PM A11.06**

**Interwell Carrier Transport in InGaN/(In)GaN Multiple Quantum Wells** Saulius Marcinkevicius<sup>1</sup>, Rinat Yapparov<sup>1</sup>, Leah Kuritzky<sup>2</sup>, Shuji Nakamura<sup>2</sup>, Steven P. DenBaars<sup>2</sup> and James Speck<sup>2</sup>; <sup>1</sup>KTH Royal Institute of Technology, Sweden; <sup>2</sup>University of California, Santa Barbara, United States.

**5:45 PM A11.07**

**Measurements of Internal Quantum Efficiency in Various InGaN Single Quantum Wells with Different Qualities by Simultaneous Photoacoustic and Photoluminescence Spectroscopy** Keito Mori<sup>1</sup>, Yuchi Takahashi<sup>1</sup>, Atsushi A. Yamaguchi<sup>1</sup>, Yuya Kanitani<sup>2</sup>, Yoshihiro Kudo<sup>2</sup> and Shigetaka Tomiya<sup>2</sup>; <sup>1</sup>Kanazawa Institute of Technology, Japan; <sup>2</sup>SONY Corporations, Japan.

SESSION G08: Growth for Electronic Devices including C-Doping  
Session Chairs: Koh Matsumoto and Yan Tang  
Wednesday Afternoon, July 10, 2019  
Evergreen Ballroom A-C, Lobby Level

**2:00 PM G08.01**

**200 mm Industrial-Ready Dispersion-Free GaN-on-Si Buffer Technology for 650 V Rated Power Application** Ming Zhao<sup>1</sup>, Xiangdong Li<sup>1,2</sup> and Stefaan Decoutere<sup>1</sup>; <sup>1</sup>imec, Belgium; <sup>2</sup>KU Leuven, Belgium.

**2:15 PM G08.02**

**Extrinsic Carbon Doped AlGaIn/AlN Super-Lattice Buffer for Power Electronic Applications Beyond 1000V** Dirk Fahlé, Matthias Marx, Hannes Behnenburg, Manuel Kortemeyer and Michael Heuken; AIXTRON SE, Germany.

**2:30 PM G08.03**

**Understanding GaN Homoepitaxial Growth and Substrate-Dependent Effects for Vertical Power Devices** Jennifer K. Hite, Travis J. Anderson, James C. Gallagher, Michael A. Mastro, Jaime Freitas, John Lyons, Karl Hobart, Charles R. Eddy Jr. and Francis J. Kub; U.S. Naval Research Laboratory, United States.

**2:45 PM G08.04**

**GaN Micropillar Schottky Diodes with High Breakdown Field Strength Fabricated by Selective-Area Growth** Arne Debal<sup>1</sup>, Simon Kotzea<sup>1</sup>, Michael Heuken<sup>1,2</sup>, Holger Kalisch<sup>1</sup> and Andrei Vescan<sup>1</sup>; <sup>1</sup>RWTH Aachen, Germany, Germany; <sup>2</sup>AIXTRON SE, Germany.

**3:00 PM G08.05**

**Compensation in Semi-Insulating Free-Standing GaN:C Substrates—A Carbon-Related Defect** Mary Ellen Zvanut<sup>1</sup>, Subash Paudel<sup>1</sup>, Malgorzata Iwinska<sup>2</sup>, Tomasz Sochacki<sup>2</sup> and Michal Boćkowski<sup>2</sup>; <sup>1</sup>University of Alabama at Birmingham, United States; <sup>2</sup>Polish Academy of Sciences, Poland.

**3:15 PM G08.06**

**Dependences of External Quantum Efficiency of Radiation and Photoluminescence Lifetime on the Carbon Concentration in GaN on GaN Structures** Kazunobu Kojima<sup>1</sup>, Fumimasa Horikiri<sup>2</sup>, Yoshinobu Narita<sup>2</sup>, Takehiro Yoshida<sup>2</sup> and Shigefusa F. Chichibu<sup>1</sup>; <sup>1</sup>Tohoku University, Japan; <sup>2</sup>Sciocs Co. Ltd., Japan.

**3:30 PM G08.07**

**Eutectic Formation and Polarity Inversion in Nitrides on Silicon** Alexandra Roshko, Matt Brubaker, Paul Blanchard, Todd Harvey and Kris Bertness; National Institute of Standards and Technology, United States.

**3:45 PM BREAK**

SESSION G09: Growth Kinetic and Theory  
Session Chairs: James Speck and Euijoon Yoon  
Wednesday Afternoon, July 10, 2019  
Evergreen Ballroom A-C, Lobby Level

**4:15 PM \*G09.01**

**A New Theoretical Approach to Nitride Crystal Growth—Impurity Incorporation Mechanism** Yoshihiro Kangawa<sup>1,2</sup>, Pawel Kempisty<sup>3,1,2</sup> and Kenji Shiraiishi<sup>2</sup>; <sup>1</sup>Kyushu University, Japan; <sup>2</sup>Nagoya University, Japan; <sup>3</sup>Polish Academy of Sciences, Poland.

**4:45 PM G09.02**

**Equilibrium Morphologies of Faceted GaN under Metalorganic Vapor Phase Epitaxy Condition—Wulff Construction Using Absolute Surface Energies** Yuki Seta, Abdul Pradipto, Toru Akiyama, Kohji Nakamura and Tomonori Ito; Mie University, Japan.

**5:00 PM G09.03**

**Control of Growth Kinetics Towards Enhanced Red Emissions from Strongly Excited Eu-Doped GaN** Shuhei Ichikawa, Jun Tatebayashi and Yasufumi Fujiwara; Osaka University, Japan.

**5:15 PM G09.04**

**Surface Kinetics of GaN Homoepitaxial Growth via MOCVD** Andrew Klump<sup>1</sup>, Pramod Reddy<sup>2</sup>, Yan Guan<sup>1</sup>, Shun Washiyama<sup>1</sup>, Seiji Mita<sup>2</sup>, Ramón Collazo<sup>1</sup> and Zlatko Sitar<sup>1</sup>; <sup>1</sup>North Carolina State University, United States; <sup>2</sup>Adroit Materials, United States.

**5:30 PM G09.05**

**Theoretical Study on Step Bunching Instability During Nitride Semiconductor Growth** Yuya Inatomi<sup>1</sup> and Yoshihiro Kangawa<sup>1,2,3</sup>; <sup>1</sup>Kyushu University, Japan; <sup>2</sup>RIAM, Kyushu University, Japan; <sup>3</sup>IMaSS, Nagoya University, Japan.

**5:45 PM G09.06**

**Shell Growth Mechanisms on GaN Fin Microstructures** Irene Mangano Clavero<sup>1,2</sup>, Christoph Margenfeld<sup>1,2</sup>, Hergo-Heinrich Wehmann<sup>1,2</sup>, Adrian Avramescu<sup>3</sup>, Hans-Juergen Lugauer<sup>3</sup> and Andreas Waag<sup>1,2</sup>; <sup>1</sup>Technische Universität Braunschweig, Germany; <sup>2</sup>Epitaxy Competence Center ec2, Germany; <sup>3</sup>Osram Opto Semiconductors GmbH, Germany.

SESSION J02: Structural Defects in Electronic Devices, GaN and AlN

Session Chairs: Ramón Collazo and Atsushi Tanaka  
Wednesday Afternoon, July 10, 2019  
Regency Ballroom E-G, Second Floor

**2:00 PM \*J02.01**

**Identification of Key-Defects in GaN Epitaxial Layers Relevant for the Performance and Reliability of a GaN Based Device** Elke Meissner<sup>1,2</sup>; <sup>1</sup>Fraunhofer Institute for Integrated Systems and Device Technology, Germany; <sup>2</sup>University of Erlangen-Nuremberg, Germany.

**2:30 PM J02.02**

**Dislocation Assisted Carrier Transport Mechanisms in Forward Bias GaN pn Junction Leakage** Christian A. Robertson, Kai Shek Qwah and James Speck; University of California, Santa Barbara, United States.

**2:45 PM J02.03**

**Quantitative Electron Beam Induced Current STEM Imaging of GaN-Ni Schottky Diodes** Zoey Warecki<sup>1</sup>, Andrew Armstrong<sup>2</sup>, Andrew Allerman<sup>2</sup>, Alec Talin<sup>2</sup> and John Cumings<sup>1</sup>; <sup>1</sup>University of Maryland College Park, United States; <sup>2</sup>Sandia National Laboratory, United States.

**3:00 PM J02.04**

**Direct Observation of V-Pit Induced Vertical N-Type Columns Disrupting Vertical Breakdown of AlGaIn/GaN-HEMT Heterostructures on Si** Sven Besendörfer<sup>1</sup>, Elke Meissner<sup>1</sup>, Alaleh Tajalli<sup>2</sup>, Matteo Meneghini<sup>2</sup>, Roland Poesche<sup>3</sup>, Joff Derluyn<sup>3</sup>, Farid Medjdoub<sup>4</sup>, Gaudenzio Meneghesso<sup>2</sup>, Enrico Zanon<sup>2</sup>, Jochen Friedrich<sup>1</sup> and Tobias Erlbacher<sup>1</sup>; <sup>1</sup>Fraunhofer IISB, Germany; <sup>2</sup>University of Padova, Italy; <sup>3</sup>EpiGaN, Belgium; <sup>4</sup>CNRS, France.

**3:15 PM J02.05**

**Investigating the Structural Properties of AlN Thin Films Grown on Nano-Patterned Sapphire Substrates in the Scanning Electron Microscope** Carol Trager-Cowan<sup>1</sup>, Aeshah Alasamari<sup>1</sup>, William Avis<sup>1</sup>, Pavlos Bozinakis<sup>1</sup>, Jochen Bruckbauer<sup>1</sup>, Gergely Ferenczi<sup>1</sup>, Ben Hourahine<sup>1</sup>, Gunnar Kusch<sup>1</sup>, Robert Martin<sup>1</sup>, Ryan McDermott<sup>1</sup>, G. Naresh Kumar<sup>1</sup>, Bohdan Starosta<sup>1</sup>, Arne Knauer<sup>2</sup>, Viola Kueller<sup>2</sup>, Sylvia Hagedorn<sup>2</sup>, Sebastian Walde<sup>2</sup>, Markus Weyers<sup>2</sup>, Pierre-Marie Coulon<sup>3</sup>, Philip Shields<sup>3</sup> and Aimo Winkelmann<sup>4,1</sup>; <sup>1</sup>University of Strathclyde, United Kingdom; <sup>2</sup>Ferdinand-Braun-Institut, Germany; <sup>3</sup>University of Bath, United Kingdom; <sup>4</sup>Laser Zentrum Hannover e.V., Germany.

**3:30 PM J02.06**

**A Novel Birefringent Observation for Analyzing Dislocations in GaN** Atsushi Tanaka<sup>1,3</sup>, Shunta Harada<sup>1</sup>, Kenji Hanada<sup>2</sup>, Yoshio Honda<sup>1</sup>, Toru Ujihara<sup>1</sup> and Hiroshi Amano<sup>1,3</sup>; <sup>1</sup>Nagoya University, Japan; <sup>2</sup>Aichi Synchrotron Radiation Center, Japan; <sup>3</sup>National Institute for Materials Science, Japan.

**3:45 PM BREAK**

SESSION K01: XRD Characterization and Point Defects

Session Chairs: Martin Albrecht and Jaime Freitas  
Wednesday Afternoon, July 10, 2019  
Regency Ballroom E-G, Second Floor

**4:15 PM K01.01**

**X-Ray Diffraction Characterization of III-Nitride Nanostructures** Hryhorii Stanchu<sup>1</sup>, Andrian Kuchuk<sup>1</sup>, Matthias Auf der Maur<sup>2</sup>, Yuriy Mazur<sup>1</sup>, Vasyil Kladko<sup>3</sup> and Gregory Salamo<sup>1</sup>; <sup>1</sup>University of Arkansas, United States; <sup>2</sup>University of Rome “Tor Vergata”, Italy; <sup>3</sup>V. Lashkaryov Institute of Semiconductor Physics, National Academy of Sciences of Ukraine, Ukraine.

**4:30 PM K01.02**

**Determination of Porosity and Layer Thickness of Porous Distributed Bragg Reflectors via High Resolution X-Ray Techniques** Alexander Hinz, Peter Griffin, Martin Frentrup, Tongtong Zhu and Rachel Oliver; University of Cambridge, United Kingdom.

**4:45 PM K01.03**

**Localized Defects, Electronics Bands and Charge Neutrality Levels in AlGa<sub>N</sub>—How Do They Move with Composition and Temperature?** Pramod Reddy<sup>1</sup>, Ji Kim<sup>2</sup>, Shun Washiyama<sup>2</sup>, Ronny Kirste<sup>1</sup>, Seiji Mita<sup>1</sup>, Douglas Irving<sup>2</sup>, Ramón Collazo<sup>2</sup> and Zlatko Sitar<sup>2</sup>; <sup>1</sup>Adroit Materials, Inc., United States; <sup>2</sup>North Carolina State University, United States.

**5:00 PM K01.04**

**Strain Manipulation of Donor Self-Compensation in AlN** Jonathon N. Baker, Joshua S. Harris, Kelsey J. Mirrielees, Ramón Collazo, Zlatko Sitar and Douglas Irving; North Carolina State University, United States.

**5:15 PM K01.05**

**Study of Optical Scattering Loss Induced by Crystalline Defects Inside AlN Waveguides Using Volume Current Method** Hong Chen, Houqiang Fu, Xuanqi Huang and Yuji Zhao; Arizona State University, United States.

**5:30 PM K01.06**

**Dislocation Recovery in Al-Rich Aluminum Gallium Nitride Layers by High Temperature Annealing** Shun Washiyama<sup>1</sup>, Yan Guan<sup>1</sup>, Ke Wang<sup>1</sup>, Pegah Bagheri<sup>1</sup>, Andrew Klump<sup>1</sup>, Qiang Guo<sup>1</sup>, James Tweedie<sup>2</sup>, Seiji Mita<sup>2</sup>, Ramón Collazo<sup>1</sup> and Zlatko Sitar<sup>1,2</sup>; <sup>1</sup>North Carolina State University, United States; <sup>2</sup>Adroit Materials, United States.

**5:45 PM K01.07**

**Effects of Stacking Faults on InGa<sub>N</sub> and AlGa<sub>N</sub> Alloy Compositions in Zincblende Ga<sub>N</sub> Heterostructures** Boning Ding<sup>1</sup>, Menno Kappers<sup>1</sup>, Martin Frentrup<sup>1</sup>, David Wallis<sup>1,2</sup> and Rachel Oliver<sup>1</sup>; <sup>1</sup>University of Cambridge, United Kingdom; <sup>2</sup>University of Cardiff, United Kingdom.

## RUMP SESSIONS

(Details available on-site)

**SESSION R01: Rump Session: Visible Emitters**

Wednesday Afternoon, July 10, 2019

Cedar Ballroom, Second Floor

6:30 pm – 8:30 pm

**SESSION R02: Rump Session: Electronic Devices**

Wednesday Afternoon, July 10, 2019

Regency Ballroom A-C, Second Floor

6:30 pm – 8:30 pm

**SESSION R03: Rump Session: UV Emitters**

Wednesday Afternoon, July 10, 2019

Regency Ballroom E-G, Second Floor

6:30 pm – 8:30 pm

# THURSDAY PRESENTATIONS

\* Invited Paper

SESSION A12: Semi- and Non-Polar LDs and LEDs

Session Chairs: Daniel Feezell and Yoshihiro Kangawa

Thursday Morning, July 11, 2019

Evergreen Ballroom E-F, Lobby Level

**8:00 AM \*A12.01**

**Watt-Class Operation of Green Laser Diodes on Semipolar {20-21} Gallium Nitride Substrates** Yusuke Nakayama<sup>1</sup>, Hideki Watanabe<sup>1</sup>, Masahiro Murayama<sup>1</sup>, Yasuhiro Kadowaki<sup>2</sup>, Yukihisa Kogure<sup>2</sup>, Takahiro Koyama<sup>1</sup>, Noriyuki Fuutagawa<sup>1</sup>, Hidekazu Kawanishi<sup>1</sup>, Toshiya Uemura<sup>3</sup> and Katsunori Yanashima<sup>1</sup>; <sup>1</sup>Sony Corporation, Japan; <sup>2</sup>Sony Semiconductor Manufacturing Corporation, Japan; <sup>3</sup>Toyota Gosei Co., Ltd., Japan.

**8:30 AM A12.02**

**Semipolar InGa<sub>N</sub> Distributed-Feedback Laser Diode with a First Order Surface Indium Tin Oxide Grating** Haojun Zhang<sup>1</sup>, Daniel Cohen<sup>2</sup>, Philip Chan<sup>2</sup>, Matthew Wong<sup>2</sup>, Shlomo Mehari<sup>2</sup>, Daniel Becerra<sup>2</sup>, Shuji Nakamura<sup>2,1</sup> and Steven P. DenBaars<sup>1,2</sup>; <sup>1</sup>University of California, Santa Barbara, United States; <sup>2</sup>University of California, Santa Barbara, United States.

**8:45 AM A12.03**

**High-Speed Nonpolar Ga<sub>N</sub>-Based Superluminescent Diodes for Visible-Light Communication** Ashwin K. Rishinaramangalam<sup>1</sup>, Arman Rashidi<sup>1</sup>, Morteza Monavarian<sup>1</sup>, Saadat Mishkat-Ul-Masabih<sup>1</sup>, Andrew A. Aragon<sup>1</sup>, Changmin Lee<sup>2</sup>, Steven P. DenBaars<sup>2</sup> and Daniel Feezell<sup>1</sup>; <sup>1</sup>University of New Mexico, United States; <sup>2</sup>University of California, Santa Barbara, United States.

**9:00 AM A12.04**

**Semipolar Ga<sub>N</sub> Optical Devices on Foreign Substrates** Michel Khoury<sup>1</sup>, Hongjian Li<sup>1</sup>, Haojun Zhang<sup>1</sup>, Matthew Wong<sup>1</sup>, Yi Chao Chow<sup>1</sup>, Bastien Bonef<sup>1</sup>, Philippe de Mierry<sup>2</sup>, James Speck<sup>1</sup>, Shuji Nakamura<sup>1</sup> and Steven P. DenBaars<sup>1</sup>; <sup>1</sup>University of California, Santa Barbara, United States; <sup>2</sup>CNRS, France.

**9:15 AM A12.05**

**Fabrication of Polar-Plane-Free Faceted InGa<sub>N</sub> LED Structures with Polychromatic Emission Properties** Yoshinobu Matsuda, Mitsuru Funato and Yoichi Kawakami; Kyoto University, Japan.

**9:30 AM BREAK**

SESSION B10: Transistors and Diodes

Session Chairs: Oliver Ambacher and Jun Suda

Thursday Morning, July 11, 2019

Evergreen Ballroom E-F, Lobby Level

**10:00 AM \*B10.01**

**Visible and Solar-Blind Photodetectors Using AlGa<sub>N</sub> High Electron Mobility Transistors with Nanodot-Based Floating Gate** Andrew Armstrong<sup>1</sup>, Brianna Klein<sup>1</sup>, Andrew Allerman<sup>1</sup>, Albert Baca<sup>1</sup>, Mary Crawford<sup>1</sup>, Jacob Podkaminer<sup>2</sup>, Carlos Perez<sup>1</sup>, Michael Siegal<sup>1</sup>, Erica Douglas<sup>1</sup>, Vincent Abate<sup>1</sup> and Francois Leonard<sup>3</sup>; <sup>1</sup>Sandia National Laboratories, United States; <sup>2</sup>Current Affiliation: 3M Corporate Research Labs, United States; <sup>3</sup>Sandia National Laboratories, United States.

**10:30 AM B10.02**

**Hot-Electron Trapping and Luminescence in Ga<sub>N</sub>-Based GITs and HD-GITs—An Extensive Analysis** Elena Fabris<sup>1</sup>, Matteo Meneghini<sup>1</sup>, Carlo De Santi<sup>1</sup>, Matteo Borga<sup>1</sup>, Yusuke Kinoshita<sup>2</sup>, Kenichiro Tanaka<sup>2</sup>, Hidetoshi Ishida<sup>2</sup>, Tetsuzo Ueda<sup>2</sup>, Gaudenzio Meneghesso<sup>1</sup> and Enrico Zanoni<sup>1</sup>; <sup>1</sup>University of Padova, Italy; <sup>2</sup>Panasonic Corporation, Japan.

**10:45 AM B10.03**

**Influence of Dislocation Distribution on Leakage Current in Schottky Diodes Fabricated on HVPE Ga<sub>N</sub> Free-Standing Substrates** Thi Huong Ngo<sup>1</sup>, Remi Comyn<sup>1</sup>, Eric Frayssinet<sup>1</sup>, Sébastien Chenot<sup>1</sup>, Benjamin Damilano<sup>1</sup>, Yvon Cordier<sup>1</sup>, Florian Tendille<sup>2</sup>, Hyonju Chauveau<sup>2</sup>, Bernard Beaumont<sup>2</sup>, Jean-Pierre Faurie<sup>2</sup> and Nabil Nahas<sup>2</sup>; <sup>1</sup>University Côte d'Azur CNRS-CRHEA, France; <sup>2</sup>Saint Gobain Lumilog, France.

**11:00 AM B10.04**

**Interface Properties of Lateral MISFETs Fabricated on *m*- and *c*-Plane** Yuto Ando<sup>1</sup>, Tohru Nakamura<sup>2</sup>, Manato Deki<sup>2</sup>, Shigeyoshi Usami<sup>1</sup>, Atsushi Tanaka<sup>2,3</sup>, Hirotaka Watanabe<sup>2</sup>, Maki Kushimoto<sup>1</sup>, Shugo Nitta<sup>2</sup>, Yoshio Honda<sup>2</sup> and Hiroshi Amano<sup>2,4,5</sup>; <sup>1</sup>Nagoya University, Japan; <sup>2</sup>Nagoya University, Japan; <sup>3</sup>National Institute for Materials Science, Japan; <sup>4</sup>Nagoya University, Japan; <sup>5</sup>Nagoya University, Japan.

**11:15 AM B10.05**

**Schottky Barrier Diode on *m*-plane AlN Crystal** Qin Zhou<sup>1</sup>, Honglei Wu<sup>1</sup>, Hui Li<sup>2</sup>, Xi Tang<sup>1</sup>, Ruisheng Zheng<sup>1</sup>, Jiannong Wang<sup>2</sup> and Baikui Li<sup>1</sup>; <sup>1</sup>Shenzhen University, China; <sup>2</sup>The Hong Kong University of Science and Technology, Hong Kong.

## SESSION C01: Photo Detectors and Solar Cells

Session Chair: Andrew Allerman  
Thursday Morning, July 11, 2019  
Cedar Ballroom, Second Floor

**8:00 AM C01.01**

**Towards AlGaIn Focal Plane Arrays for Solar-Blind Ultraviolet Detection** Robert Rehm, Rachid Driad, Lutz Kirste, Stefano Leone, Thorsten Passow, Frank Rutz and Lars Watschke; Fraunhofer Institute for Applied Solid State Physics IAF, Germany.

**8:15 AM C01.02**

**An Ultra-High-Gain Linear Mode Avalanche Photodiode Based on GaN/AlN Periodically-Stacked Structure with Improved Material Epitaxy and Device Fabrication** Xingzhao Wu<sup>1</sup>, Lai Wang<sup>1</sup>, Julien Brault<sup>2</sup>, Mohamed Al Khalifioui<sup>2</sup>, Maud Nemoz<sup>2</sup>, Zhibiao Hao<sup>1</sup>, Yi Luo<sup>1</sup>, Changzheng Sun<sup>1</sup>, Yanjun Han<sup>1</sup>, Bing Xiong<sup>1</sup>, Jian Wang<sup>1</sup>, Hongtao Li<sup>1</sup>, Mo Li<sup>3</sup>, Jianbin Kang<sup>3</sup> and Qian Li<sup>3</sup>; <sup>1</sup>Beijing National Research Center for Information Science and Technology, Department of Electronic Engineering, Tsinghua University, China; <sup>2</sup>Université Côte d'Azur, CNRS, CRHEA, France; <sup>3</sup>Microsystem & Terahertz Research Center, China Academy of Engineering Physics, China.

**8:30 AM C01.03**

**Polarization-Grading in p-AlGaIn to Realize Record High Zero-Bias External Quantum Efficiency of 88% for Al<sub>0.60</sub>Ga<sub>0.40</sub>N-Based p-i-n UV Detectors** Anisha Kalra, Shashwat Rathkanthiwar, Rangarajan Muralidharan, Srinivasan Raghavan and Digbijoy N. Nath; Indian Institute of Science, India.

**8:45 AM C01.04**

**Solar Blind High-k ZrO<sub>2</sub> Gate AlGaIn MOSFET Photodetector** Mohi Uddin Jewel, MD Didarul Alam, Shahab Mollah, Richard Floyd, Kamal Hussain, Mikhail Gaevski, Iftikhar Ahmad, Grigory Simin, Asif Khan and MVS Chandrashekar; University of South Carolina, United States.

**9:00 AM C01.05**

**III-Nitrides as Promising Platform for Superconducting Nanowire Single Photon Detectors** Houssaine Machhadani<sup>1</sup>, Julien Zichi<sup>2</sup>, Catherine Bougerol<sup>2</sup>, Stéphane Lequien<sup>1</sup>, Jean-Luc Thomassin<sup>1</sup>, Nicolas Mollard<sup>1</sup>, Anna Mukhtarova<sup>1</sup>, Val Zwiller<sup>3</sup>, Jean-Michel Gérard<sup>1</sup> and Eva Monroy<sup>1</sup>; <sup>1</sup>The French Alternative Energies and Atomic Energy Commission (CEA), France; <sup>2</sup>CNRS-Institut Néel, France; <sup>3</sup>KTH Stockholm, Department of Applied Physics, Sweden.

**9:15 AM C01.06**

**Effect of Al Content on Al<sub>1-x</sub>In<sub>x</sub>N-on-Silicon (x~0-0.6) Solar Cells Deposited by RF Sputtering** Rodrigo Blasco<sup>1</sup>, Daniel Montero<sup>2</sup>, Alejandro Braña<sup>2</sup>, Javier Olea<sup>2</sup>, Sirona Valdueza-Felip<sup>1</sup> and Fernando B. Naranjo<sup>1</sup>; <sup>1</sup>University of Alcalá, Spain; <sup>2</sup>University Complutense of Madrid, Spain; <sup>3</sup>University Autònoma of Madrid, Spain.

**9:30 AM BREAK**

SESSION C02: Photoelectrochemical Devices and Photodetectors  
Session Chairs: Johannes Herrnsdorf and Zetian Mi  
Thursday Morning, July 11, 2019  
Cedar Ballroom, Second Floor

**10:00 AM C02.01**

**A Large Scale GaN-Based Artificial Photosynthesis System for Unassisted High Efficiency Solar Fuel Generation** Mohammad F. Chowdhury<sup>1,2</sup>, Nhung H. Tran<sup>3</sup>, Roksana Rashid<sup>1</sup>, Hong Guo<sup>2</sup> and Zetian Mi<sup>1,3</sup>; <sup>1</sup>McGill University, Canada; <sup>2</sup>McGill University, Canada; <sup>3</sup>University of Michigan, United States.

**10:15 AM C02.02**

**InGa/Si Tandem Photocathode for High Efficiency Unassisted Solar Water Splitting** Srinivas Vanka<sup>1,2</sup>, Baowen Zhou<sup>1</sup>, Nick Pant<sup>1</sup>, Alexa Roberts<sup>1</sup>, Krishnamurthy Kulkarni<sup>1</sup> and Zetian Mi<sup>1</sup>; <sup>1</sup>University of Michigan, United States; <sup>2</sup>McGill University, Canada.

**10:30 AM C02.03**

**Modified III-Nitrides Structures as Efficient and Stable Photoanodes for PEC Hydrogen Generation and Broadband Photodetectors** Praveen Kumar<sup>1</sup>, Krishnendu Sarkar<sup>1</sup> and Pooja Devi<sup>2</sup>; <sup>1</sup>Indian Association for the Cultivation of Science, India; <sup>2</sup>Central Scientific Instruments Organization, India.

**10:45 AM C02.04**

**Towards Highly Efficient Photoelectrochemical Water-Splitting Devices via Hybrid GaN-Based Photoanodes** Mostafa Afi Hassan, Santosh S. Patil, Muhammad A. Johar and Sang-Wan Ryu; Chonnam National University, Korea (the Republic of).

**11:00 AM C02.05**

**Structural and Photoelectrochemical Properties of CoO/GaN Photoelectrodes for the Generation of H<sub>2</sub> from Water** Martin Velazquez-Rizo, Daisuke Iida and Kazuhiro Ohkawa; King Abdullah University of Science and Technology (KAUST), Saudi Arabia.

**11:15 AM C02.06**

**Impact of Surface Morphology on Performance Parameters of AlGaIn Based UV Photodetectors on Si (111) and Their Application in Solar-UV Monitoring** Shashwat Rathkanthiwar, Anisha Kalra, Rangarajan Muralidharan, Srinivasan Raghavan and Digbijoy N. Nath; Indian Institute of Science, India.

## SESSION D02: Advanced Sensors and Novel Materials

Session Chairs: Martin Eickhoff and Matthew Hardy  
Thursday Morning, July 11, 2019  
Regency Ballroom E-G, Second Floor

**8:00 AM \*D02.01**

**Group-III-Nitride Based Optoelectronics as Enabling Technology for Medical Implants** Ulrich Schwarz<sup>1,2</sup>, Christian Göbner<sup>2</sup>, Matthias Wachs<sup>1,2</sup>, Eric Klein<sup>3</sup>, Michael Schwaerzle<sup>3,4</sup>, Suleman Ayub<sup>3</sup>, Daniel Keppeler<sup>2,5</sup>, Alexander Dieter<sup>5</sup>, Tobias Moser<sup>2,5</sup> and Patrick Ruther<sup>3,4</sup>; <sup>1</sup>Chemnitz University of Technology, Germany; <sup>2</sup>OptoGenTech GmbH, Germany; <sup>3</sup>University of Freiburg, Germany; <sup>4</sup>University of Freiburg, Germany; <sup>5</sup>University Medical Center Göttingen, Germany.

**8:30 AM D02.02**

**Highly Sensitive Hydrogen Sulfide Gas Sensor Based on GaN/InGaIn Heterostructure** Jassim B. Shahbaz, Martin Schneidereit and Ferdinand Scholz; Institute of Functional Nanosystems, Germany.

**8:45 AM D02.03**

**External Control of the Band Bending at GaN(1-100) Surfaces Using Phosphonate Self-Assembled Monolayers** Thomas Auzelle<sup>5</sup>, Florian Ullrich<sup>1,2</sup>, Sebastian Hietzschold<sup>1,3</sup>, Chiara Sinito<sup>5</sup>, Stefan Brackmann<sup>3,1</sup>, Eric Mankel<sup>1,2</sup>, Wolfgang Kowalsky<sup>1,2,4</sup>, Oliver Brandt<sup>6</sup>, Robert Lovrincic<sup>1,3</sup> and Sergio Fernández-Garrido<sup>5,6</sup>; <sup>1</sup>InnovationLab, Germany; <sup>2</sup>Technische Universität Darmstadt, Germany; <sup>3</sup>Technische Universität Braunschweig, Germany; <sup>4</sup>Heidelberg University, Germany; <sup>5</sup>Paul-Drude-Institut für Festkörperelektronik, Germany; <sup>6</sup>Universidad Autónoma de Madrid, Spain.

**9:00 AM D02.04**

**GaN Schottky Diodes for Proton Beam Monitoring** Jean-Yves Duboz<sup>1</sup>, Julie Zucchi<sup>1</sup>, Eric Frayssinet<sup>1</sup>, Sébastien Chenot<sup>1</sup>, Jean-Claude Grini<sup>2</sup> and Joël Herault<sup>2</sup>; <sup>1</sup>CNRS, France; <sup>2</sup>Lacassagne, France.

**9:15 AM D02.05**

**Al<sub>5</sub>Si<sub>4</sub>N<sub>12</sub>, a New Nitride Semiconductor** Philippe Vennéguès<sup>1</sup>, Roy Dagher<sup>1</sup>, Liverios Lymperakis<sup>2</sup>, Vincent Delaye<sup>3</sup>, Ludovic Largeau<sup>4</sup> and Adrien Michon<sup>1</sup>; <sup>1</sup>Université Côte d'Azur, France; <sup>2</sup>Max-Planck-Institut für Eisenforschung GmbH, Germany; <sup>3</sup>Université Grenoble Alpes, France; <sup>4</sup>CNRS, France.

**9:30 AM BREAK**



SESSION E02: Thermal Transport and Contacts  
Session Chairs: Ryo Tanaka and Michael Uren  
Thursday Morning, July 11, 2019  
Regency Ballroom A-C, Second Floor

SESSION G11: Growth of In-Containing Alloys  
Session Chairs: Qian Sun and Akihiko Yoshikawa  
Thursday Morning, July 11, 2019  
Evergreen Ballroom A-C, Lobby Level

**10:00 AM E02.01**

**Influence of Doping on the Thermal Conductivity of HVPE Grown Single Crystal GaN** Pegah Bagheri<sup>1</sup>, Robert Rounds<sup>1</sup>, Qiang Guo<sup>1</sup>, Ji Kim<sup>1</sup>, Tomasz Sochacki<sup>2</sup>, Ronny Kirste<sup>3</sup>, Pramod Reddy<sup>3</sup>, Michal Boćkowski<sup>2</sup>, Zlatko Sitar<sup>1</sup> and Ramón Collazo<sup>1</sup>; <sup>1</sup>North Carolina State University, United States; <sup>2</sup>Institute of High Pressure Physics, Polish Academy of Sciences, Poland; <sup>3</sup>Adroit Materials, Inc., United States.

**10:15 AM E02.02**

**GaN Thermal Conductivity and Its Dependence on Threading Dislocations for Advanced Electronic and Photonic Device Designs** Kihoon Park and Can Bayram; University of Illinois at Urbana-Champaign, United States.

**10:30 AM E02.03**

**Ultrahigh Thermal Boundary Conductance Across GaN-SiC Heterogeneous Interfaces by Surface Activated Bonding** Zhe Cheng<sup>1</sup>, Fengwen Mu<sup>2</sup>, Tadatomu Suga<sup>2</sup> and Samuel Graham<sup>1</sup>; <sup>1</sup>Georgia Institute of Technology, United States; <sup>2</sup>University of Tokyo, Japan.

**10:45 AM E02.04**

**Superior Thermal Transport Across an Oxide-Free GaN/Si Heterojunction Interface Fabricated via Direct Wafer Bonding** Michael E. Liao<sup>1</sup>, Tingyu Bai<sup>1</sup>, Yekan Wang<sup>1</sup>, Kenny Huynh<sup>1</sup>, Viorel Dragoi<sup>2</sup>, Nasser Razek<sup>3,2</sup>, Eric Guiot<sup>4</sup>, Raphael Caulmilone<sup>4</sup>, Luke Yates<sup>5</sup>, Samuel Graham<sup>5</sup>, Jianguo Wen<sup>6</sup> and Mark Goorsky<sup>1</sup>; <sup>1</sup>University of California, Los Angeles, United States; <sup>2</sup>EV Group, Austria; <sup>3</sup>G-Ray Medical, Switzerland; <sup>4</sup>Soitec, France; <sup>5</sup>Georgia Institute of Technology, United States; <sup>6</sup>Argonne National Laboratory, United States.

**11:00 AM E02.05**

**Investigation of Pd/Ti/Al/Ti/Au Ohmic Contacts to N-Face GaN for Application in Vertical Schottky Diode on Ammono-GaN Substrates** Pawel Prystawko<sup>1,2</sup>, Mikolaj Grabowski<sup>1</sup>, Ewa Grzanka<sup>1</sup>, Piotr Kruszewski<sup>2,1</sup> and Julita Smalc-Koziorowska<sup>1</sup>; <sup>1</sup>Institute of High Pressure Physics PAS, Poland; <sup>2</sup>TopGaN Ltd, Poland.

**11:15 AM E02.06**

**Simple Wet-Etching for GaN Using an Electrodeless Photo-Assisted Electrochemical Reaction with a Luminous Array Film as the UV Source** Fumimasa Horikiri<sup>1</sup>, Noboru Fukuhara<sup>1</sup>, Hiroshi Ohta<sup>2</sup>, Naomi Asai<sup>2</sup>, Yoshinobu Narita<sup>1</sup>, Takehiro Yoshida<sup>1</sup>, Tomoyoshi Mishima<sup>2</sup>, Masachika Toguchi<sup>3</sup>, Kazuki Miwa<sup>3</sup> and Taketomo Sato<sup>3</sup>; <sup>1</sup>Sciocs Company Limited, Japan; <sup>2</sup>Hosei University, Japan; <sup>3</sup>Hokkaido University, Japan.

SESSION G10: Semi- and Non-Polar Growth  
Session Chairs: Peter Parbrook and Tim Wernicke  
Thursday Morning, July 11, 2019  
Evergreen Ballroom A-C, Lobby Level

**8:00 AM \*G10.01**

**Semipolar GaN for Lighting and Display—Will This Ever Become Real?** Jung Han; Yale University, United States.

**8:30 AM G10.02**

**Thin SOI—A Dedicated Substrate for Optimal Growth of Semi-Polar Nitrides and Heterostructures** Guy Feuillet<sup>1</sup>, Rami Mantach<sup>2,1</sup>, Philippe Vennégués<sup>2</sup>, Marc Portail<sup>2</sup>, Mathieu Leroux<sup>2</sup>, Philippe de Mierry<sup>2</sup> and Jesus Zuniga-Perez<sup>2</sup>; <sup>1</sup>CEA, France; <sup>2</sup>CNRS CRHEA, France.

**8:45 AM G10.03**

**Growth and Characterization of Untwinned (10-13) GaN Templates and InGaN/GaN Quantum Wells** Nan Hu<sup>1</sup>, Duc V. Dinh<sup>2</sup>, Markus Pristovsek<sup>2</sup>, Yoshio Honda<sup>2,1</sup> and Hiroshi Amano<sup>2,1,3</sup>; <sup>1</sup>Nagoya University, Japan; <sup>2</sup>Institute of Materials and Systems for Sustainability, Nagoya University, Japan; <sup>3</sup>Akasaka Research Center, Nagoya University, Japan.

**9:00 AM G10.04**

**Growth and Characterization of Germanium Doped Cubic Al<sub>x</sub>Ga<sub>1-x</sub>N Grown by Molecular Beam Epitaxy** Michael Deppe<sup>1</sup>, Tobias Henksmeier<sup>1</sup>, Jürgen W. Gerlach<sup>2</sup>, Dirk Reuter<sup>1</sup> and Donat J. As<sup>1</sup>; <sup>1</sup>University of Paderborn, Germany; <sup>2</sup>Leibniz Institute of Surface Engineering (IOM), Germany.

**9:15 AM LATE NEWS**

**9:30 AM BREAK**

**10:00 AM G11.01**

**Demonstration of High Quality Aluminum Indium Nitride Grown Via Metal Modulated Epitaxy and Application Towards Polar/Non-Polar Optical Devices** Zachary Engel, William A. Doolittle and Evan A. Clinton; Georgia Tech, United States.

**10:15 AM G11.02**

**Understanding and Avoiding Gallium Contamination in InAlN Layers in Close Coupled Showerhead MOVPE Reactors** Mrad Mrad, Joel Kanyandekwe, Yann Mazel, Victor R. Yon, Guy Feuillet and Matthew Charles; CEA - Grenoble/France, France.

**10:30 AM G11.03**

**Strain-Balanced Nonpolar InGaN/AlGaIn Heterostructures for Infrared Intersubband Devices** Alexander Senichev, Brandon Dzuba, Trang Nguyen, Yang Cao, Rosa Diaz, Michael Manfra and Oana Malis; Purdue University, United States.

**10:45 AM G11.04**

**In Situ XRD RSM Measurements in MBE Growth of GaInN at Different Temperatures** Tomohiro Yamaguchi<sup>1</sup>, Takuo Sasaki<sup>2</sup>, Masamitsu Takahashi<sup>2</sup>, Soichiro Ohno<sup>1</sup>, Tsutomu Araki<sup>3</sup>, Yasushi Nanishi<sup>3</sup>, Takeyoshi Onuma<sup>4</sup> and Tohru Honda<sup>1</sup>; <sup>1</sup>Kogakuin University, Japan; <sup>2</sup>National Institutes for Quantum and Radiological Science and Technology (QST), Japan; <sup>3</sup>Ritsumeikan University, Japan.

**11:00 AM G11.05**

**Pulsed InN-GaN Molecular Beam Epitaxy of (In,Ga)N on Partially Relaxed (In,Ga)N Buffer** Caroline Chêze<sup>1</sup>, Torsten Ernst<sup>1</sup>, Manfred Ramsteiner<sup>2</sup> and Raffaella Calarco<sup>2</sup>; <sup>1</sup>Paul-Drude-Institut für Festkörperelektronik Leibniz-Institut im Forschungsverbund Berlin e.V, Germany; <sup>2</sup>Paul-Drude-Institut für Festkörperelektronik Leibniz-Institut im Forschungsverbund Berlin e.V, Germany.

**11:15 AM G11.06**

**Influence of Homogenization Process of InGaN Quantum Wells at Elevated Temperatures on Their Optical Properties and on Decomposition** Ewa Grzanka<sup>1,2</sup>, Szymon Grzanka<sup>1,2</sup>, Julita Smalc-Koziorowska<sup>1,2</sup>, Artur Lachowski<sup>1</sup>, Lucja Marona<sup>1,2</sup>, Mikolaj Grabowski<sup>1</sup>, Roman Hrytsak<sup>1</sup>, Robert Czernecki<sup>1,2</sup> and Mike Leszczynski<sup>1,2</sup>; <sup>1</sup>Institute of High Pressure Physics, Poland; <sup>2</sup>TOPGaN, Poland.

SESSION I05: THz and Quantum Dots  
Session Chair: Eva Monroy  
Thursday Morning, July 11, 2019  
Regency Ballroom A-C, Second Floor

**8:00 AM I05.01**

**THz Quantum Cascade Devices Based on GaN/AlGaIn Step Quantum Wells Grown by Ammonia MBE and MOCVD on Si(111) and Si(110) Substrates** Arnaud Jollivet<sup>1</sup>, Maria Tchernycheva<sup>1</sup>, Francois H. Julien<sup>1</sup>, Virginie Trinité<sup>2</sup>, Eric Frayssinet<sup>3</sup>, Philippe de Mierry<sup>3</sup> and Yvon Cordier<sup>3</sup>; <sup>1</sup>University Paris-Sud, University Paris-Saclay, France; <sup>2</sup>III-V Lab, France; <sup>3</sup>Université Côte d'Azur, CNRS, CRHEA, France.

**8:15 AM I05.02**

**Intersubband Transition in m-Plane AlGaIn/GaN MQWs in Mid-Infrared Region** Xin Rong, Xinqiang Wang, Guang Chen, Ping Wang, Xiantong Zheng and Bo Shen; School of Physics, Peking University, China.

**8:30 AM I05.03**

**Ultrafast Spectroscopic Study of the Upper Conduction Band Valleys of InN** Blair C. Connelly, Chad S. Gallinat and Michael Wraback; U.S. Army Research Laboratory, United States.

**8:45 AM I05.04**

**Modeling the Dispersion of Waveguide Polaritons In GaN** Laetitia Doyennette<sup>1</sup>, Christelle Brimont<sup>1</sup>, Maria Vladimirova<sup>1</sup>, Thierry Guillet<sup>1</sup>, Geoffrey Kreyder<sup>2</sup>, Francois Réveret<sup>2</sup>, Pierre Dissieux<sup>2</sup>, Francois-Régis Médard<sup>2</sup>, Joel Leymarie<sup>2</sup>, Maksym Gromovyi<sup>3</sup>, Blandine Alloing<sup>3</sup>, Stéphanie Rennesson<sup>3</sup>, Fabrice Semon<sup>3</sup>, Jesus Zuniga-Perez<sup>3</sup>, Edmond Cambil<sup>3</sup> and Sophie Bouchoule<sup>4</sup>; <sup>1</sup>Université de Montpellier, France; <sup>2</sup>Université Clermont Auvergne, France; <sup>3</sup>CRHEA-CNRS, France; <sup>4</sup>Université Paris-Saclay, France.

# FRIDAY PRESENTATIONS

9:00 AM I05.05

**Realization of Linewidth Narrowing in a Single Photon Emitting GaN Quantum Dot** [Kang Gao](#)<sup>1</sup>, Munetaka Arita<sup>1</sup>, Mark J. Holmes<sup>2,1</sup> and Yasuhiko Arakawa<sup>1</sup>; <sup>1</sup>Institute for Nano Quantum Information Electronics, University of Tokyo, Japan; <sup>2</sup>Institute of Industrial Science, Japan.

9:15 AM I05.06

**Electrically Tunable Single Quantum Dot Emission in GaN/AlN Nanowires** [Maria Spies](#)<sup>1</sup>, Akhil Ajay<sup>2</sup>, Fabrice Donatini<sup>1</sup>, Martien I. den Hertog<sup>1</sup>, Eva Monroy<sup>2</sup> and Bruno Gayral<sup>2</sup>; <sup>1</sup>University Grenoble Alpes, CNRS, Institut Néel, France; <sup>2</sup>University Grenoble Alpes, CEA, IRIG-DEPHY-Phelips, France.

9:30 AM BREAK

SESSION J03: P-Doping and Defects  
Session Chairs: Anneli Munkholm and Shinya Takashima  
Thursday Morning, July 11, 2019  
Regency Ballroom E-G, Second Floor

10:00 AM J03.01

**Demonstration of p-Type Conductivity in GaN via Ion Implantation and High Pressure Annealing** [Mathew H. Breckenridge](#)<sup>1</sup>, Andrew Klump<sup>1</sup>, Shun Washiyama<sup>1</sup>, Qiang Guo<sup>1</sup>, Yan Guan<sup>1</sup>, Ji Kim<sup>1</sup>, Pramod Reddy<sup>2</sup>, Ronny Kirste<sup>2</sup>, Will Mccouch<sup>2</sup>, Seiji Mita<sup>2</sup>, James Tweedie<sup>2</sup>, Michal Boćkowski<sup>3</sup>, Ramón Collazo<sup>1</sup> and Zlatko Sitar<sup>1</sup>; <sup>1</sup>North Carolina State University, United States; <sup>2</sup>Adroit Materials, Inc., United States; <sup>3</sup>Polish Academy of Sciences, Poland.

10:15 AM J03.02

**High-Hole Mobility Lightly Mg-Doped p-GaN Grown on Si Substrates Realized by Reducing Residual Carbon and Threading Dislocation** [Toshiki Hikosaka](#), Jumpei Tajima, Hajime Nago, Toshiyuki Oka and Shinya Nunoue; Toshiba Corporation, Japan.

10:30 AM J03.03

**Point Defect Reduction in Smooth P-Type N-Polar GaN Grown via MOCVD** [Dennis E. Szymanski](#)<sup>1</sup>, Dolar Khachariya<sup>2</sup>, Ke Wang<sup>1</sup>, Andrew Klump<sup>1</sup>, Seiji Mita<sup>3</sup>, Pramod Reddy<sup>3</sup>, Spyridon Pavlidis<sup>2</sup>, Ramón Collazo<sup>1</sup> and Zlatko Sitar<sup>1</sup>; <sup>1</sup>North Carolina State University, United States; <sup>2</sup>North Carolina State University, United States; <sup>3</sup>Adroit Materials, United States.

10:45 AM J03.04

**Role of Capping Material on Mg Ion Implantation Activation in GaN** [Alan G. Jacobs](#)<sup>1</sup>, Boris N. Feigelson<sup>1</sup>, Jennifer K. Hite<sup>1</sup>, Cameron A. Gorsak<sup>2</sup>, Lunet Luna<sup>1</sup>, Travis J. Anderson<sup>1</sup> and Francis J. Kub<sup>1</sup>; <sup>1</sup>U.S. Naval Research Laboratory, United States; <sup>2</sup>University of Notre Dame, United States.

11:00 AM J03.05

**Point Defects in GaN:Mg Crystals Grown by Ammonobasic Method** [Marcin Zajac](#)<sup>1</sup>, Ryszard Piotrkowski<sup>1</sup>, Elzbieta Litwin-Staszewska<sup>1</sup>, Konrad Sakowski<sup>1</sup>, Dariusz Wasik<sup>2</sup>, Robert Kucharski<sup>1</sup> and Michal Boćkowski<sup>1,3</sup>; <sup>1</sup>Polish Academy of Sciences, Poland; <sup>2</sup>University of Warsaw, Poland; <sup>3</sup>Nagoya University, Japan.

11:15 AM J03.06

**Group III-Nitride Response to High Energy Radiation—A Multidisciplinary Study** [Miguel C. Sequeira](#)<sup>1</sup>, Henrique Vazquez<sup>2</sup>, Jean-Gabriel Mattei<sup>3</sup>, Flyura Djurabekova<sup>2</sup>, Kai Nordlund<sup>2</sup>, Shuo Zhang<sup>4</sup>, Isabelle Monnet<sup>3</sup>, Clara Grygiel<sup>3</sup>, Christian Wetzel<sup>5</sup>, Pablo Mota-Santiago<sup>6</sup>, Patrick Kluth<sup>6</sup>, Eduardo Alves<sup>1</sup> and Katharina Lorenz<sup>1</sup>; <sup>1</sup>Instituto Superior Técnico, Portugal; <sup>2</sup>University of Helsinki, Finland; <sup>3</sup>CEA-CNRS-ENSICAEN-UNICAEN, France; <sup>4</sup>Lanzhou University, China; <sup>5</sup>Rensselaer Polytechnic Institute, United States; <sup>6</sup>Australian National University, Australia.

\* Invited Paper

SESSION PL02: Plenary Session II  
Session Chairs: Stacia Keller and Christian Wetzel  
Friday Morning, July 12, 2019  
Evergreen Ballroom E-I, Lobby Level

8:30 AM \*PL02.01

**Conventional and N-Polar GaN HEMTs for High Frequency and High Power Applications** [Umesh K. Mishra](#)<sup>1,2</sup>; <sup>1</sup>University of California, Santa Barbara, United States; <sup>2</sup>Transphorm, United States.

9:15 AM \*PL02.02

**Impact of Vacancy Complexes on the Nonradiative Recombination Processes in III-N Devices** [Shigefusa F. Chichibu](#)<sup>1,2,3</sup>, Kohei Shima<sup>1</sup>, Kazunobu Kojima<sup>1</sup>, Shoji Ishibashi<sup>4</sup> and Akira Uedono<sup>5</sup>; <sup>1</sup>Tohoku University, Japan; <sup>2</sup>Nagoya University, Japan; <sup>3</sup>Hokkaido University, Japan; <sup>4</sup>AIST, Japan; <sup>5</sup>University Tsukuba, Japan.

10:00 AM BREAK

10:30 AM \*PL02.03

**Industrial LED Development—From UV to Red and from Efficient Components to Smart Devices** [Martin Strassburg](#); OSRAM Opto Semiconductors GmbH, Germany.

11:15 AM \*PL02.04

**How do we make AlGaIn into a useful semiconductor?** [Zlatko Sitar](#); North Carolina State University, United States.

12:00 PM

**Closing Ceremony by W. Alan Doolittle, Georgia Institute of Technology; Stacia Keller, University of California, Santa Barbara and Christian Wetzel, Rensselaer Polytechnic Institute**