

# Scientific Program

## 4th International Workshop on Ultraviolet Materials and Devices (IWUMD4)

September 9-13, 2019, Saint-Petersburg, Russia

### Monday, September 9

*Registration* 17:00 - 19:00  
*Welcome reception* 19:00 - 22:00

### Tuesday, September 10

*Registration* 8:00 - 18:00  
**Welcome greetings** 8:45 - 9:00  
**Plenary and Keynotes Session** 9:00 - 10:45  
Session Chair: Bernard Gil

**Tu-1P** 9:00 - 9:45  
**Boron Nitride and Boron-Containing Nitride Alloys (*plenary*)**  
Chris G. Van de Walle  
*University of California, Santa Barbara, USA*

**Tu-1K** 9:45 - 10:15  
**Deep-UV Optical Properties of Ultrathin GaN/AlN Quantum Wells (keynote)**  
Alexey Toropov  
*Ioffe Institute, Russia*

**Tu-2K** 10:15 – 10:45  
**Problems and Latest Achievements in AlGaIn-Based Deep-UV LEDs (keynote)**  
Hideki Hirayama  
*RIKEN, Japan*

*Coffee Break* 10:45 - 11:15

**Session 1 “Oxides Growth and Fundamental Properties”**

11:15 - 12:40

Session Chair: Tatiana Shubina

**Tu-1i** 11:15 - 11:35

**Thermal Conductivity, Elasticity, Phonon Modes, and Optical Band Gap of Gallium Oxide Polymorphs (*invited*)**

Markus R. Wagner, H. Tornatzky, S. Kalinowski, S.T. Jagsch, N. Jankowski, L. Grote, T. Kure, F. Nippert, A. Hoffmann, R. Gillen, B. Graczykowski, J.S. Reparaz  
*Technical University of Berlin, Germany & Friedrich-Alexander-Universität Erlangen-Nürnberg, Germany & Max Planck Institute for Polymer Research, Germany & ICMA-B-CSIC, Spain*

**Tu-2i** 11:35 - 11:55

**Observation of Deep-UV Cathodoluminescence from Rocksalt-Structured MgZnO Alloys (*invited*)**

Takeyoshi Onuma, M. Ono, K. Kudo, K. Ishii, K. Kaneko, S. Fujita, and T. Honda  
*Kogakuin University & Kyoto University, Japan*

**Tu-1o** 11:55 – 12:10

**$\alpha$ -Ga<sub>2</sub>O<sub>3</sub>: a Novel WBG Semiconductor for UV Optoelectronics and Power Electronic Devices**

V.I. Nikolaev, A.I. Pechnikov, S.I. Stepanov, A.Y. Polyakov  
*Perfect Crystals LLC, Russia & Ioffe Institute, Russia & National University of Science and Technology MISiS, Russia*

**Tu-2o** 12:10 – 12:25

**Effects of Different Plasma Treatments on Deep Traps Spectra and Leakage Current of Ga<sub>2</sub>O<sub>3</sub> Crystals and Films**

A.Y. Polyakov, I.-H. Lee, N.B. Smirnov, E.B. Yakimov, I.V. Shchemerov, A.V. Chernykh, A.I. Kochkova, A.A. Vasilev, F. Ren, P. Carey, S.J. Pearton  
*National University of Science and Technology MISiS, Russia & Institute of Microelectronics Technology and High Purity Materials, Russia & Seoul University, Korea & University of Florida, USA*

**Tu-3o** 12:25 – 12:40

**HVPE Growth and Characterisation of  $\alpha$ -,  $\beta$ -,  $\epsilon$ -Ga<sub>2</sub>O<sub>3</sub> Epitaxial Films**

S.I. Stepanov, V.I. Nikolaev, A.I. Pechnikov, O.S. Medvedev, M.P. Sheglov, A.V. Chikiryaka, S.V. Shapenkov, E.V. Ubyivovk, O.F. Vyvenko  
*Perfect Crystals LLC & Ioffe Institute, Russia & St. Petersburg State University, Russia*

- Lunch** 12:40 - 14:00
- Session 2 “AlGaN Bulk Substrates and Templates”** 14:00 - 15:45  
Session Chair: Hiroshi Fujioka
- Tu-3i** 14:00 – 14:20  
**Preparation of High-Quality AlN Templates for Deep UV Devices (*invited*)**  
Hideto Miyake, K. Shojiki, K. Uesugi, S. Xiao, H. Koizumi, and S. Kuboya  
*Mie University, Japan*
- Tu-4i** 14:20 – 14:40  
**Al(Ga)N/Sapphire Template Technologies for Deep UV LEDs (*invited*)**  
Markus Weyers, S. Hagedorn, A. Knauer, S. Walde  
*Ferdinand-Braun-Institut, Leibniz-Institut fuer Hoechstfrequenztechnik, Germany*
- Tu-5i** 14:40 – 15:00  
**AlN Growth Behavior on Ni-Al Liquid Solution (*invited*)**  
Masayoshi Adachi, S. Sonoko, A. Kanbara, L.G. Wilson, B.G. Pierce, A.M. Karimi, R.H. French, J.L.W. Carter, and H. Fukuyama  
*Tohoku University, Japan & Case Western Reserve University, USA*
- Tu-4o** 15:00 – 15:15  
**2-Inch AlN Substrates for UV Devices**  
R. Dalmau, J. Britt, R. Schlessler  
*HexaTech, Inc., USA*
- Tu-5o** 15:15 – 15:30  
**High Quality AlN Growth by Ammonia-Free High Temperature MOVPE**  
X.Q. Shen, K. Kojima, and H. Okumura  
*National Institute of Advanced Industrial Science and Technology (AIST), Japan*
- Tu-6o** 15.30 - 15.45  
**Vertically Oriented Graphene Nanowall Assisted-Growth of AlN Film and Its Heat Dissipation for Ultraviolet Light-Emitting Diodes**  
T. Wei, H. Ci, H. Chang, J. Yan, P. Gao, J. Wang, J. Li, and Zh. Liu  
*Institute of Semiconductors, CAS, China & College of Chemistry and Molecular Engineering, Peking University, China*

- Coffee Break** 15:45 - 16:15
- Session 3 “UV Lasers and E-beam Emitters”** 16:15 - 17:40  
 Session Chair: Alex Toropov
- Tu-6i** 16:15 – 16:35  
**High Current Density Operation of UV-B Light-Emitting Devices Fabricated on High Quality and Relaxed AlGaN (invited)**  
Motoaki Iwaya, S. Yasue, K. Sato, Y. Sakuragi, Y. Ogino, S. Tanaka, S. Teramura, S. Iwayama, T. Takeuchi, S. Kamiyama, I. Akasaki, and H. Miyake  
*Meijo University, Japan & Asahi-Kasei Corporation, Japan & Mie University, Japan & Akasaki Research Center, Nagoya University, Japan*
- Tu-7i** 16:35 – 16:55  
**E-beam Pumped Deep UV Light Source Based on Ultrathin GaN QWs (invited)**  
Xinjiang Wang, Y.X. Wang, S.V. Ivanov, T. Wang, B. Sheng, S. Guo, H. Miyake, V.I. Kozlovsky, F. Bertram, H. Li, X. Rong, Z.X. Qin, J. Christen, and B. Shen  
*Peking University, China & Ioffe Institute, Russia & Advanced Micro-Fabrication Equipment Inc., China & Mie University, Japan & Lebedev Physical Institute, Russia Otto-von-Guericke-University Magdeburg, Germany*
- Tu-7o** 16:55 – 17:10  
**Light Confinement and Vertical Conduction over 40 kA/cm<sup>2</sup> with p-AlGaIn Composition-Graded Cladding Layer of UVB Laser Diode Structure**  
K. Sato, Sh. Yasue, Y. Ogino, Sh. Tanaka, M. Iwaya, T. Takeuchi, S. Kamiyama, and I. Akasaki  
*Asahi-Kasei Corporation, Japan & Meijo University, Japan & Akasaki Research Center, Nagoya University, Japan*
- Tu-8o** 17:10 - 17:25  
**Watt-Range E-Beam Pumped 245 nm-Emitter Based on GaN/AlN MQW Structures Grown by PA MBE on Sapphire**  
 N.A. Gamov, V.N. Jmerik, D.V. Nechaev, O.A. Koshelev, V.I. Kozlovsky, V.P. Martovitsky, D.E. Sviridov, Y.K. Skasyrsky, E.V. Zhdanova, M.M. Zverev, and S.V. Ivanov  
*MIREA – Russian Technological University, Russia & Ioffe Institute, Russia & P.N. Lebedev Physical Institute, Russia*

Tu-9o 17:25 – 17:40

**Engineering of Material Gain for Staggered Polar AlGa<sub>N</sub>/AlN  
Quantum Wells Dedicated for Deep UV Lasers**

M. Gladysiewicz, D. Hommel, R. Kudrawiec

*Wroclaw University of Science and Technology, Poland*

**Poster session I**

18:00 - 19:30

**Wednesday, September 11**

***Registration***

8:00 - 18:00

**Session 4 “UV LEDs & Photodetectors I”**

9:00 - 10:40

Session Chair: Hideki Hirayama

**We-1i** 9:00 - 9:20

**Improving the Reliability of UV LEDs by Analyzing  
Degradation Mechanisms (*invited*)**

Sven Einfeldt, J. Glaab, J. Ruschel, J. Rass, H.-K. Cho,  
N. Lobo Ploch, T. Kolbe, A. Knauer, S. Hagedorn, C. Stölmacker,  
K. Hilbrich, N. Susilo, L. Sulmoni, M. Guttmann, T. Wernicke,  
M. Weyers, M. Kneissl

*Ferdinand-Braun-Institut, Germany & Technische Universität Berlin,  
Germany*

**We-2i** 9:20 - 9:40

**Achieving Ultralow Resistance p-Contacts in Deep-UV LEDs  
(*invited*)**

Debdeep Jena

*Cornell University, USA*

**We-1o** 9:40 - 9:55

**Greatly Enhanced Performance of AlGa<sub>N</sub>-Based Deep  
Ultraviolet Light Emitting Diodes by Introducing a Polarization  
Modulated Electron Blocking Layer**

J. Lang, F. Xu, W. Ge, Y. Sun, N. Zhang, and B. Shen

*State Key Laboratory of Artificial Microstructure and Mesoscopic Physics,  
School of Physics, Peking University, China*

- We-2o 9:55 – 10:10  
**Degradation Effects in AlGaIn-Based Deep-Ultraviolet Light-Emitting Diodes Emitting near 233 nm**  
J. Glaab, J. Ruschel, H. K. Cho, M. Lapeyrade, J. Rass, F. Mehnke, L. Sulmoni, M. Guttmann, T. Wernicke, M. Weyers, S. Einfeldt, M. Kneissl  
*Ferdinand-Braun-Institut, Germany & Leibniz-Institut für Höchstfrequenztechnik, Germany*
- We-3o 10:10 – 10:25  
**Van der Waals Epitaxy of Nitrides Material and Deep-UV Light Emitting Diodes**  
Zhiqiang Liu, T. Wei, J. Yan, Y. Wang, Zh. Chen, X. Yi, J. Wang, P. Gao, J. Li, and Zh. Liu  
*State Key Laboratory of Solid-State Lighting, Institute of Semiconductors, CAS, China & College of Chemistry and Molecular Engineering, Peking University, China*
- We-4o 10:25 – 10:40  
**Solar-Blind UV-Photocathodes with Polarized p-Doped AlGaIn:Mg/AlN Heterostructures Grown by Plasma-Assisted MBE**  
P.S. Alkov, L.M. Balyasni, Yu.K.Gruzevich, O.V. Chistov, V.N. Jmerik, D.V. Nechaev, and S.V. Ivanov  
*JSC Science Production Unity "GEOFIZIKA-NV", Russia & Ioffe Institute, Russia*
- Coffee Break** 10:40 - 11:15
- Session 5 “Optical properties of BN”** 11:15 - 12:40  
Session Chair: Guillaume Cassabois
- We-3i 11:15 – 11:35  
**Pressure Dependence of the Electronic and Polar Phonon Contributions to the Dielectric Function of Hexagonal Boron Nitride (*invited*)**  
Alfredo Segura, R. Cuscó, T. Taniguchi, K. Watanabe, G. Cassabois, B. Gil, and L. Artús  
*Universitat de València, Spain & ICTJA-CSIC, Spain & National Institute for Materials, Japan & UMR 5221 CNRS-Université de Montpellier, France*

- We-4i** 11:35 – 11:55  
**Excitons in van der Waals Heterostructures: from Monolayer to Bulk Hexagonal Boron Nitride (*invited*)**  
Giorgia Fugallo  
*CNRS/LTEN University of Nantes, France*
- We-5o** 11:55 – 12:10  
**BAlN and BGeN for Lattice-Matched UV Optical Structures**  
F. AlQatari, M. Sajjad, R. Lin, K.-H. Li, U. Schwingenschlög, X. Li  
*Advanced Semiconductor Laboratory, KAUST, Saudi Arabia*
- We-6o** 12:10 – 12:25  
**Plasmonic Enhancement in h-BN Based UV Photodetectors**  
B. Mo, J. Yin, J. Li, D. Cai, Jing Li, and J. Kang  
*Xiamen University, China*
- We-7o** 12:25 – 12:40  
**Reflectivity of Hexagonal Boron-Nitride in Deep UV**  
Ch. Elias, P. Valvin, T. Peline, A. Summerfield, C.J. Mellor,  
T.S. Cheng, L. Eaves, C.T. Foxon, P.H. Beton, S.V. Novikov,  
B. Gil, G. Cassabois  
*Laboratoire Charles Coulomb, UMR5221 CNRS-Université de Montpellier,  
France & University of Nottingham, UK*
- Lunch** 12:40 - 14:00
- Session 6 “BN Growth and Properties” & Post deadline** 14:00 - 15:45  
Session Chair: Xinqiang Wang
- We-5i** 14:00 - 14:20  
**High-Temperature MBE of Hexagonal Boron Nitride for DUV Applications (*invited*)**  
T.S. Cheng, A. Summerfield, C.J. Mellor, C. Elias, P. Valvin,  
T. Peline, B. Gil, G. Cassabois, L. Eaves, C.T. Foxon, P.H. Beton,  
and Sergei Novikov  
*University of Nottingham, UK & UMR5221 CNRS-Université de  
Montpellier, France*
- We-6i** 14:20 - 14:40  
**Observation of Impurity Incorporated Regions in Hexagonal Boron Nitride Single Crystals (*invited*)**  
Kenji Watanabe and Takashi Taniguchi  
*National Institute for Materials Science, Japan*

- We-7i** 14:40 – 15:00  
**Wafer-Scale and Selective-Area Growth of High-Quality h-BN by MOVPE (*invited*)**  
H. Jeong, D.Y. Kim, J. Kim, S. Moon, and Jong Kyu Kim  
*POSTECH, Republic of Korea*
- We-8o** 15:00 – 15:15  
**Exceed 20% Boron of Single-Phase Wurtzite in BAlN Film Grown Using MOCVD**  
T.B. Tran, H.-L. Che, F. AlQatari, and X. Li  
*King Abdullah University of Science and Technology (KAUST), Saudi Arabia*
- We-9o** 15:15 – 15:30  
**Resistance Switching Behavior of B(Al)N Film Fabricated by Sputtering**  
Q. Li, X. Qin, and F. Yun  
*Xi'an Jiaotong University, China*
- We-10o** 15:30 – 15:45 **Post deadline paper**  
**Performance Enhancement of Deep Ultraviolet AlGaN Based Nanostructures**  
K. Huang, S. Ge, J. Dai, N. Gao, S. Lu, P. Li, B. Liu, J. Kang, R. Zhang & Y. Zheng  
*Xiamen University, China*

**Coffee Break** 15:45 - 16:15

**Session 7 “Oxides-Based UV Photonic Devices”** 16:15 - 17:35  
Session Chair: Markus Wagner

- We-8i** 16:15 – 16:35  
**Solar-Blind UV Detectors Based on Ga<sub>2</sub>O<sub>3</sub> Films (*invited*)**  
Vera Kalygina  
*Tomsk State University, Russia*

- We-11o** 16:35 – 16:50  
**Enhanced DUV Solar-Blind Self-Powered Photodetector Based on Novel ZnO Quantum Dot/ CuO Micro-Pyramid p–n Junction”**  
N. Alwadai, S. Mitra, M. N. Hedhili, H. Alamoudi, B. Xin, and I.S. Roqan  
*KAUST, Saudi Arabia & Princess Nourah bint Abdulrahman University, Saudi Arabia*



- We-12o 16:50 – 17:05  
**Fabrication of Planar ZnO Microcavities for Near Ultraviolet Polariton Laser Operating at Room Temperature**  
K. Shima, K. Furusawa, K. Kojima, and S.F. Chichibu  
*Tohoku University, Japan*
- We-13o 17:05 - 17:20  
**Solution Processed Self-Powered Solar-Blind Photodetector by Amorphous Core-Shell Gallium Oxide Nanoparticles**  
S. Mitra, D.R. Almalawi, Y. Pak, N. Wehbe, I.S. Roqan  
*KAUST, Saudi Arabia*
- We-14o 17:20 – 17:35  
**Effects of Annealing Process on Electrical Conductivity of MgZnO**  
M. Kushimoto, T. Sakai, M. Deki, Y. Honda, and H. Amano  
*Nagoya University, Japan*

**Poster session II** 18:00 - 19:30

## Thursday, September 12

- Registration** 8:00 - 12:00
- Session 8 “AlGaN Growth, Defects and Doping”** 9:00 - 10:45  
 Session Chair: Valentin Jmerik
- Th-1i 9:00 - 9:20  
**Surface Rehybridization Effects of B Incorporation at GaN and AlN Surfaces: a Potential Route to Overcome Bulk Solubility Limits (*invited*)**  
Liverios Lymparakis  
*Max-Planck-Institut für Eisenforschung GmbH, Germany*
- Th-2i 9:20 - 9:40  
**In/Mg Codoping of p-type AlN Nanowires for UV-C LEDs Realization (*invited*)**  
 A.-M. Siladie, G. Jacopin, A. Cros, N. Garro, E. Robin, D. Calliste, P. Pochet, F. Donatini, J. Pernot, and Bruno Daudin  
*Université Grenoble Alpes, France & CEA, Grenoble, France & Institut Néel, CNRS, France & Universidad de Valencia, Spain*

- Th-3i** 9:40 - 10:00  
**Role of Al-Vacancy Complexes in AlN and High AlN Mole Fraction AlGaN Alloys (*invited*)**  
Shigefusa Chichibu, H. Miyake, and A. Uedono  
*Tohoku University, Japan & Mie University, Japan & University of Tsukuba, Japan*
- Th-1o** 10:00 - 10:15  
**Study of Dislocations in Homo- and Hetero-Epitaxially Grown AlN Layer**  
K. Goto, Y. Shimizu, T. Nagashima, R. Yamamoto, N. Takekawa, G. Pozina, R. Dalmau, R. Schlessler, R. Collazo, B. Monemar, Z. Sitar, and Y. Kumagai  
*Tokyo University of Agriculture and Technology, Japan & Tokuyama Corporation, Japan & Linköping University, Sweden & HexaTech, Inc. & North Carolina State, USA*
- Th-2o** 10:15 - 10:30  
**High-Temperature Ammonia MBE - Real Way to Improve Crystal Quality of AlGaN Based Device Heterostructures**  
S.I. Petrov, A.N. Alexeev, V.V. Mamaev, S.A. Novikov, E.V. Lutsenko, M.V. Rzhetski  
*SemiTEq JSC, Russia & Stepanov Institute of Physics, NASB, Belarus*
- Th-3o** 10:30 – 10:45  
**Structural Recovery of Si-Ion-Implantation Damage of AlN Surfaces by High Temperature Heat Treatment**  
Y. Kumagai, Y. Shimizu, D. Saito, T. Nagashima, R. Yamamoto, N. Takekawa, K. Goto, and B. Monemar  
*Tokyo University of Agriculture and Technology, Japan & Tokuyama Corporation, Japan & Linköping University, Sweden*
- Coffee Break** 10:45 - 11:15
- Session 9 “UV LEDs and Photodetectors II”** 11:15 - 12:40  
 Session Chair: Michael Kneissl
- Th-4i** 11:15 – 11:35  
**Detailed Mechanism of High Performance DUV-LEDs Fabricated on the AlN Underlayer with Dense Macrosteps (*invited*)**  
 Yosuke Nagasawa and Akira Hirano  
*UV Craftory Co., Japan*

<b>Th-5i</b>	11:35 - 11:55 <b>Research and Development of UV LEDs in China (<i>invited</i>)</b> <u>Junxi Wang</u> , J. Yan, H. Chen, J. Li <i>Institute of Semiconductors, CAS, China &amp; University of Chinese Academy of Sciences, China</i>
<b>Th-4o</b>	11:55 - 12:10 <b>UVB LEDs Using (Al,Ga)N Quantum Dots and Tunnel Junctions</b> <u>J. Brault</u> , S. Matta, M. Al Khalfioui, T.-H. Ngo, P. Valvin, M. Leroux, B. Damilano, S. Chenot, J. Y. Duboz, J. Massies, C. Chaix, S. Juillaguet, S. Contreras, B. Gil <i>CNRS-CRHEA, France &amp; University of Montpellier, France &amp; RIBER SA, France</i>
<b>Th-5o</b>	12:10 - 12:25 <b>MBE Grown p-Type AlGaIn and Deep Ultraviolet Light Emitting Diodes</b> <u>K. Wang</u> , N. Maeda, M.A. Khan, Zh. Li, Y. Wu, T. Tao, B. Liu, R. Zhang, H. Hirayama <i>Nanjing University, China &amp; RIKEN, Japan</i>
<b>Th-6o</b>	12:25 – 12:40 <b>Performance Modulation for Back-Illuminated AlGaIn Ultraviolet Avalanche Photodiodes Based on Multiplication Scaling</b> <u>Q. Cai</u> , D. Chen, H. Lu, R. Zhang, and Y. Zheng <i>Nanjing University, China</i>
<b>Lunch</b>	12:40 - 14:00
<b>Social Program</b>	14:00 - 19:00
<b>Workshop Dinner</b>	19:30 - 23:00

## Friday, September 13

### Session 10 “Optical Properties of III-Nitride Nanostructures”

9:00 - 10:45

Session Chair: Shigefusa Chichibu

**Fr-1i** 9:00 - 9:20

#### **Carrier Recombination in AlGa<sub>N</sub> Quantum Wells (*invited*)**

F. Nippert, C. Frankerl, M.T. Mazraehno, M.J. Davies, M.P. Hoffmann, N. Susilo, T. Wernicke, H.-J. Lugauer, T. Kure, M. Kneissl, M.R. Wagner, and Axel Hoffmann  
*Technical University of Berlin, Germany & OSRAM Opto Semiconductors GmbH, Germany*

**Fr-2i** 9:20 - 9:40

#### **Quantum Optical Application of Nitride Semiconductor: DUV Laser and Quantum Computer (*invited*)**

Ryuji Katayama, M. Uemukai, and T. Tanikawa  
*Osaka University, Japan*

**Fr-3i** 9:40 - 10:00

#### **Advanced Nanoscale Characterization of AlGa<sub>N</sub> Quantum Structures Using Liquid-He-Temperature TEM Cathodoluminescence (*invited*)**

Juergen Christen  
*Magdeburg University, Germany*

**Fr-1o** 10:00 – 10:15

#### **Purcell Effect and Strong Coupling in GaN Planar Hexagonal Microcavities**

G. Pozina, A.V. Belonovski, I.V. Levitskii, M.I. Mitrofanov, E.I. Girshova, K.A. Ivanov, S.N. Rodin, K.M. Morozov, V.P. Evtikhiev, M.A. Kaliteevski  
*Linköping University, Sweden & St.Petersburg Academic University, Russia & ITMO University & Ioffe Institute, Russia*

**Fr-2o** 10:15 – 10:30

#### **Photoluminescence and Stimulated Emission of Ultrathin GaN/AlN Quantum Wells”**

E.V. Lutsenko, M.V. Rzheutski, A.V. Nahorny, A.V. Danilchuk, D.V. Nechaev, V.N. Jmerik, S.V. Ivanov  
*Stepanov Institute of Physics, NASB, Belarus & Ioffe Institute, Russia*

Fr-3o 10:30 – 10:45  
**Achievement of Internal Quantum Efficiency up to 53% at 326nm-UVA Emission from AlGa<sub>N</sub> QWs with Engineering of Highly Relaxed Buffer Layer**  
M.A. Khan, R. Takeda, H. Miyoshi, Y. Yamada, S. Fujikawa,  
N. Maeda, M. Jo, and H. Hirayama  
*RIKEN Center for Advanced Photonics, Japan & Yamaguchi University,  
Japan & Tokyo Denki University, Japan*

**Coffee Break** 10:45 - 11:15

**Session 11 “Fundamentals of AlGa<sub>N</sub> nanostructures”** 11:15 - 12:40  
Session Chair: Debdeep Jena

Fr-4i 11:15 – 11:35  
**Understanding and Mitigating the Efficiency Challenges of Deep-UV Light Emitters with Atomistic Calculations (*invited*)**  
Emmanouil Kioupakis  
*University of Michigan, USA*

Fr-5i 11:35 – 11:55  
**Watt’s in AlN/GaN/AlN Quantum Well HEMTs? (*invited*)**  
Grace Xing  
*Cornell University, USA*

Fr-4o 11:55 – 12:10  
**Currents in Nitride Tunnel Junctions**  
J.-Y. Duboz, V. fan Arcara, and B. Vinter  
*Université Côte d'Azur, France & CRHEA-CNRS, France*

Fr-5o 12:10 – 12:25  
**Engineering the Orbital-State Coupling for the Quantum Confinement in the Valence Band for High Al Content AlGa<sub>N</sub>**  
W. Lin, L. Chen, Y. Wu, C. Zhang, Zh. Wu, Y. Dong, and J. Kang  
*Fujian Provincial Key Laboratory of Semiconductors and Applications,  
Department of Physics, Xiamen University, China*

Fr-6o 12:25 – 12:40  
**Numerical Modeling and Experimental Demonstration for Nitride-Based Optoelectronic Devices**  
Z.-H. Zhang and H.-C. Kuo  
*Hebei University of Technology, China*

**Lunch** 12:40 - 14:00

## Plenary and Keynotes Session II

14:00 - 15:45

Session Chair: Sergey Ivanov

**Fr-1K** 14:00 - 14:30

**Development of  $\beta$ -Ga<sub>2</sub>O<sub>3</sub> and  $\beta$ -(Al<sub>x</sub>Ga<sub>1-x</sub>)<sub>2</sub>O<sub>3</sub>/Ga<sub>2</sub>O<sub>3</sub> Heterostructures by Plasma-Assisted MBE (keynote)**

Akhil Mauze, James Speck

*University of California, Santa Barbara, USA*

**Fr-2K** 14:30 - 15:00

**Deep UV Emission in Hexagonal Boron Nitride: from Bulk to Monolayer (keynote)**

Guillaume Cassabois

*University of Montpellier, CNRS, France*

**Fr-1P** 15:00 – 15:45

**The Prospects of AlGaN-Based Deep UV LED Technologies (plenary)**

Michael Kneissl

*Technische Universität Berlin & Ferdinand-Braun-Institut, Germany*

**Closing remarks**

15:45 - 16:00

# POSTER SESSION I

Tuesday, September 10

18:00- 19:30

- Tu-1p      **Optical Properties of AlGa<sub>N</sub> Bulk Films Grown throughout the Composition Range by Plasma Assisted Molecular Beam Epitaxy**  
S. Sen, Ch. Singha, A. Saha, P. Pramanik, A. Bhattacharyya  
*Centre for Research in Nanoscience and Nanotechnology, University of Calcutta, India*
- Tu-2p      **Stress Evolution During Growth of AlN Templates on c-Al<sub>2</sub>O<sub>3</sub> Substrates by Plasma-Ssisted Molecular Beam Epitaxy**  
O.A. Koshelev, D.V. Nechaev, V.V. Ratnikov, P.N. Brunkov, S.V. Ivanov and V.N. Jmerik  
*Ioffe Institute, Russia*
- Tu-3p      **Raman Scattering in AlN Crystals Grown on SiC and AlN Substrates by Sublimation Method**  
I.D. Breev, A.K. Simonyan, A.N. Anisimov, P.G. Baranov, E.N. Mokhov  
*Ioffe Institute, Russia*
- Tu-4p      **5.6-micron-Thick Crack-Free AlN with Low TDD Grown on Sputtered AlN/Sapphire**  
Ch. He, W. Zhao, H. Wu, Sh. Zhang, K. Zhang, L. He, N. Liu, Zh. Chen, B. Shen  
*Guangdong Institute of Semiconductor Industrial Technology, Guangdong Academy of Sciences, China & School of Physics & Electronic Engineering, Guangzhou University, China & State Key Laboratory of Artificial Microstructure and Mesoscopic Physics, School of Physics, Peking University, China*
- Tu-5p      **High-Quality AlN Template on Patterned Sapphire Substrates for Deep Ultra-Violet Light Sources**  
S.-J. Lee, S.-R. Jeon, H.-Y. Lee, Y.-J. Choi, S.-G. Hong  
*Korea Photonics Technology Institute, Korea & LumiGNtech Co., Ltd., Korea & Chungnam National University, South Korea*
- Tu-6p      **AlN Templates Grown By Ammonia MBE on c-Al<sub>2</sub>O<sub>3</sub> Substrates for AlGa<sub>N</sub>-Based Heterostructures**  
E. Lutsenko, M. Rzhautski, A. Vainilovich, I. Svitsiankou, A. Nahorny, V. Zubialevich, G. Yablonskii, S. Petrov, A. Alexeev  
*Institute of Physics of the NASB, Belarus & Tyndall National Institute, Ireland & SemiTEq JSC, Russia*

- Tu-7p **Crack-Free thick AlN Grown on  $\mu$ -Cone Patterned Sapphire Substrates with Sputter-Deposited Annealed AlN film by Hydride Vapor-Phase Epitaxy**  
Sh. Xiao, K. Shojiki, K. Uesugi, and H. Miyake  
*Mie University, Grad. School of RIS, Japan & Mie University, Grad. School of Eng., Japan & Mie University, SPORR, Japan*
- Tu-8p **High-Speed Homoepitaxial Growth of AlN above 100  $\mu\text{m/h}$  by Hydride Vapor Phase Epitaxy**  
N. Takekawa, Y. Shimizu, D. Saito, T. Nagashima, R. Yamamoto, K. Goto, B. Monemar, and Y. Kumagai  
*Department of Applied Chemistry, Tokyo University of Agriculture and Technology, Japan & Tsukuba Research Laboratories, Tokuyama Corporation, Tsukuba, Japan & Department of Physics, Chemistry and Biology (IFM), Linköping University, Sweden & Institute of Global Innovation Research, Tokyo University of Agriculture and Technology, Japan*
- Tu-9p **2-inch Bulk AlN Crystals for DUV LED Application**  
E. Mohov, A. Usikov, O. Kazarova, S. Nagalyk, O. Avdeev, G. Fan, L. Zhao, H. Helava, Yu. Makarov  
*Ioffe Institute, Russia & Nitride Crystals Inc., USA & ITMO University, Russia & Nitride Crystals Group Ltd., Russia & School of Chemistry and Chemical Engineering, Harbin Institute of Technology, China*
- Tu-10p **High Quality AlN/Sapphire Templates with High Growth Rates by MOCVD**  
H. Wu, C. He, W. Zhao, K. Zhang, L. He, N. Liu, Q. Liao, Y. Liu, and Zh. Chen  
*Guangdong Institute of Semiconductor Industrial Technology, Guangdong Academy of Sciences, Guangzhou, China*
- Tu-11p **Optical Properties of (Al)GaNAs Alloys and Quantum Wells Dedicated for UV Emitters**  
R. Kudrawiec, E. Zdanowicz, P. Ciechanowicz, K. Opolczynska, D. Majchrzak, J.-G. Rousset, E. Piskorska-Hommel, M. Grodzicki, K. Komorowska, and D. Hommel  
*Lukasiewicz Research Network – PORT Polish Center for Technology Development, Poland & Faculty of Fundamental Problems of Technology, Wrocław University of Science and Technology, Poland & Institute of Experimental Physics, University of Wrocław, Poland & Institute of Low Temperature and Structure Research PAS, Poland*



- Tu-12p      **Efficiency Evaluation Method Based on Optical Polarization Properties for AlGa<sub>N</sub> Deep-UV LEDs**  
H. Lu, H. Wang, T. Yu, and J. Wang  
*School of Computer and Communication Engineering, University of Science and Technology Beijing, China & The State Key Laboratory for Mesoscopic Physics, School of Physics, Peking University, China*
- Tu-13p      **Growth of Si-doped AlGa<sub>N</sub> on High-Temperature-Annealed MOVPE-Grown AlN Films on Vicinal Sapphire with Sputtered AlN Seed Layers**  
S. Kuboya, Y. Tezen, K. Uesugi, K. Norimatsu, K. Shojiki, and H. Miyake  
*Mie University, Japan*
- Tu-14p      **Development of 2-inch and 4-inch AlN Template for UVC LED by High Temperature MOCVD**  
B. Lee, S. Hong, H. Shin, T. Lim, and M. Choi  
*TOP Engineering, Korea*
- Tu-15p      **Suppressing the Compositional Nonuniformity of AlGa<sub>N</sub> Grown on a HVPE-AlN Template with Large Macro-Steps**  
D. Li, X. Sun, K. Jiang, and J. Ben  
*State Key Laboratory of Luminescence and Applications, Changchun Institute of Optics, Fine Mechanics and Physics, CAS, China & Center of Materials Science and Optoelectronics Engineering, University of CAS, China*
- Tu-16p      **Estimation of Radiative and Auger Recombination Constants for (0001)AlGa<sub>N</sub> Quantum Wells**  
S.Yu. Karpov  
*STR Group - Soft-Impact, Ltd., Russia*
- Tu-17p      **Impact of Nanoarrangement of Si-Doped AlGa<sub>N</sub> Layers and GaN/AlN Digital Alloys on the Free Electron Concentrations**  
A.N. Semenov, N.M. Shmidt, D.V. Nechaev, O.A. Koshelev, E.V. Gushcina, E.I. Shabunina, M.S. Dunaevsky, I.P. Smirnova, Yu.A. Guseva, D.S. Burenina, V.Yu. Davydov, A.N. Smirnov, S.V. Ivanov, V.N. Jmerik  
*Ioffe Institute, Russia*
- Tu-18p      **Growth Kinetics and Stress Evolution in Plasma-Assisted MBE of Monolayer-Thick GaN/AlN MQW Structures and Superlattices**  
D.V. Nechaev, O.A. Koshelev, A.N. Semenov, K.N. Orekhova, D.A. Kirilenko, P.N. Brunkov, M.V. Rzhetski, E.V. Lutsenko, S.V. Ivanov, and V.N. Jmerik  
*Ioffe Institute, Russia & Stepanov Institute of Physics, Belarus*

## POSTER SESSION II

Wednesday, September 11

18:00- 19:30

- We-1p      **Micro-Photoluminescence Imaging of Hexagonal Boron Nitride Crystal in the UV Range**  
T. Pelini, A. Dreau, C. Elias, P. Valvin, , G. Cassabois, B. Gil,  
V. Jacques, J. Li, J.H. Edgar  
*CNRS, Laboratoire Charles Coulomb UMR5221, France & Kansas State University, Tim Taylor Department of Chemical Engineering, USA*
- We-2p      **Effect of Oxygen on the Electrical Resistance of Gallium Oxide Thin Films of Doped With Chromium**  
A. Almaev, E. Chernikov, B. Kushnarev  
*National Research Tomsk State University, Russia*
- We-3p      **Low Temperature Growth of Tm Doped Gallium Oxide Films by Plasma-Assisted Pulsed Laser Deposition**  
Q. Guo, S. Motomura, K. Saito, T. Tanaka  
*Department of Electrical and Electronic Engineering, Synchrotron Light Application Center, Saga University, Japan*
- We-4p      **Effect of Substrate Material on Electrical Characteristics of Ga<sub>2</sub>O<sub>3</sub> films**  
V. Kalygina, T. Lygdenova, Y. Petrova, E. Chernikov  
*National Research Tomsk State University, Russia*
- We-5p      **Effects of C Contamination of Ga<sub>2</sub>O<sub>3</sub>:Si Target on PLD Thin Film Properties**  
P. Kirilenko, C.-H. Liao, X. Li, K.-H. Li  
*King Abdullah University of Science and Technology (KAUST), Advanced Semiconductor Lab, Saudi Arabia*
- We-6p      **Studies of Ga<sub>2</sub>O<sub>3</sub> Nanoparticles for Biocompatible Applications**  
G. Pozina, N. Abrikossova, C. Hemmingsson  
*Linköping University, Sweden*
- We-7p      **Performance Enhancement of AlGa<sub>N</sub>-Based DUV LEDs with Selective-Area Grown p-GaN Contact Layer**  
Y. Guo, J. Yan, Y. Zhang, J. Li, J. Wang  
*Institute of Semiconductors, CAS, China & University of CAS, China*

- We-8p      **Fabrication of High-Voltage Flip Chip Deep Ultraviolet LEDs**  
 Zh. Zhong, X. Zheng, J. Li, J. Zheng, W. Lin, Y. Zhou, and J. Kang  
*Fujian Provincial Key Laboratory of Semiconductors and Applications, Collaborative Innovation Center for Optoelectronic Semiconductors and Efficient Devices, Department of Physics, Xiamen University, China*
- We-9p      **Investigation of the Quantum Barrier Grading in Deep UV LED**  
Y. Lu, J. Yan, J. Li, X. Li  
*King Abdullah University of Science & Technology (KAUST), Advanced Semiconductor Laboratory, Saudi Arabia & Research and Development Center for Solid-State Lighting, Institute of Semiconductors, CAS, China*
- We-10p     **Modulation of Extracted Light Radiation Patterns In AlGaN-Based Deep-Ultraviolet Light-Emitting Diodes**  
H. Wang, H.M. Lu, T.J. Yu  
*State Key Laboratory for Artificial Microstructures and Mesoscopic Physics, School of Physics, Peking University, China & School of Computer and Communication Engineering, University of Science and Technology Beijing, China*
- We-11p     **Deep Ultraviolet Light-Emitting Diodes with Improved Performance via Nanoporous Template**  
 L. Zhang, J. Yan, Y. Guo, J. Li, and J. Wang  
*Institute of Semiconductors, CAS, China & University of CAS, China*
- We-12p     **Performance Improvement of Deep Ultraviolet Light Emitting Diode by Optimization of Electron Block Layer Thickness and Mg Concentration in p-GaN Contact Layer**  
A. Mishima, Y. Tomita, Y. Yamaoka, T. Arimura, S. Koseki, Y. Yano, K. Matsumoto, H. Hirayama  
*TNCSE, Tsukuba, Japan & Taiyo Nippon Sanso Corporation, Tsukuba; RIKEN, Japan*
- We-13p     **Wavelength Selective UV Photodetectors Based on Lateral Transport in GaN/AlGaN, AlGaN/AlGaN and AlGaN/AlN MQWs**  
P. Pramanik, S. Sen, C. Singha, A. Bhattacharyya  
*Institute of Radio Physics and Electronics, University of Calcutta, India & Centre for Research in Nanoscience and Nanotechnology, University of Calcutta, India*
- We-14p     **Design and Fabrication of High-performance 1-D Photonic Crystal UV Filter for Back-Illuminated AlGaN Solar-blind Photodetector**  
H. You, R. Yuan, D. Pan, Q. Cai, D. Chen, R. Zhang, Y. Zheng  
*Key Laboratory of Advanced Photonic and Electronic Materials, School of Electronic Science and Engineering, Nanjing University, China*

- We-15p **A Multiband Electron-Beam Pumped Deep Ultraviolet Light Source Based on Ultrathin GaN/AlN MQWs**  
Y.X. Wang, S.V. Ivanov, T. Wang, B. Sheng, S. Guo, V.I. Kozlovsky, F. Bertram, H. Li, X. Rong, Z.X. Qin, J. Christen, B. Shen and X.Q. Wang  
*State Key Laboratory of Artificial Microstructure and Mesoscopic Physics, School of Physics, Peking University, China & Ioffe Institute, Russia & Advanced Micro-Fabrication Equipment Inc., China & Lebedev Physical Institute, RAS, Russia*
- We-16p **Analysis of the Degradation Behaviour of 310 nm UVB LEDs by Temperature-Dependent Electroluminescence Spectroscopy**  
P. Gupta, J. Höpfner, M. Guttmann, J. Ruschel, J. Glaab, T. Kolbe, A. Knauer, T. Wernicke, M. Weyers, M. Kneissl  
*Technical University of Berlin, Institute of Solid State Physics, Germany & Ferdinand-Braun-Institute, Leibniz Institute for High Frequency Technology, Germany*
- We-17p **Simultaneous Emission-Detection Operation of Subwavelength Vertical-Structure LED**  
L. Wang, Y. Jiang, K. Fu, X. Gao, X. Xu, J. Yuan, and Y. Wang  
*Nanjing University of Posts and Telecommunications, China*
- We-18p **Threshold Reduced and Directional Single Mode Emission of Near UV Bend-up Microring Cavity**  
Y. Li, S. Zhang, M. Guo, Y. Zhang, F. Yun, X. Hou  
*Xi'an Jiaotong University, China*