SYMPOSIUM ED3

Physics, Chemistry and Materials for Beyond Silicon Electronics
April 18 - April 21, 2017

Symposium Organizers
Kah-Wee Ang, National University of Singapore
Nadine Collaert, IMEC
Rinus Lee, GLOBALFOUNDRIES
Tony Low, University of Minnesota

Symposium Support
Applied Materials
Kokusai Semiconductor Equipment Corporation

Proceedings Statement
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* Invited Paper

SESSION ED3.1: 2D Device Technology
Session Chairs: Kah-Wee Ang and Nadine Collaert
Tuesday Morning, April 18, 2017
PCC North, 100 Level, Room 127 C

10:30 AM *ED3.1.01
From Black Phosphorus to Phosphorene and Beyond Peide P. Ye; Purdue University, United States.

11:00 AM ED3.1.02
Adatoms Doping Effects on the Thermal Stability of Black Phosphorus Formed on High-K Gate Dielectric Xuewei Feng; National University of Singapore, Singapore.

11:15 AM ED3.1.03
Intrinsic Bipolar Molybdenum Disulfide via One Dimensional Electrical Contact Zheng Yang; SKKU Advanced Institute of Nano Technology, Korea (the Republic of).

11:30 AM ED3.1.04
Carrier Density Modulation and Polarity Control of MoTe2 via Electron Beam Irradiation Min Sup Choi1, 2; Sungkyunkwan University, Korea (the Republic of); SKKU Advanced Institute of Nano-Technology, Korea (the Republic of).

11:45 AM ED3.1.05
Surface Functionalization of Graphene via the Controlled Assembly of 2D Micelles Benjamin Robinson; Lancaster University, United Kingdom.

SESSION ED3.2: Wafer Scale 2D Electronics
Session Chairs: Kah-Wee Ang and Tony Low
Tuesday Afternoon, April 18, 2017
PCC North, 100 Level, Room 127 C

1:30 PM *ED3.2.01
Two-Dimensional Materials: From Properties to Applications Steven J. Koester; University of Minnesota, United States.

2:00 PM ED3.2.02
Interface Control of 2D Materials to Enable Wafer Scale Transfer and Tuning of Electronic Properties Daniele Chiappe; imec Leuven & Hasselt University, Belgium.

2:15 PM ED3.2.03
Growth of Continuous Graphene by Open Roll-to-Roll Chemical Vapour Deposition Xinrui Wu; University of Cambridge, United Kingdom.

2:30 PM ED3.2.04
High n-Type Conduction in Si-Doped AlxGa1-xN Epilayers for Deep Ultraviolet Emitters Talal Al Tahtamouni; Qatar University, Qatar.

2:45 PM BREAK

SESSION ED3.3: New Electronics Materials and Design
Session Chairs: Kah-Wee Ang and Tony Low
Tuesday Afternoon, April 18, 2017
PCC North, 100 Level, Room 127 C

3:15 PM *ED3.3.01
Exploring the 2-D Material Design Space through Ab Initio Device Simulation Mathieu Luisier; ETH Zurich, Switzerland.

3:45 PM ED3.3.02
Electrical Resistivity of Mesoporous and Quasi-Monocrystalline Germanium Meghan Beattie; University of Ottawa, Canada.

4:00 PM ED3.3.03
Zintl Layer Formation during Atomic Layer Deposition of Crystalline Perovskites on Ge (001) John G. Ekerdt; University of Texas at Austin, United States.

4:15 PM ED3.3.04
Ternary Oxide Nanowires for Ultraviolet Photosensing Applications Xingyi Wu; Nanyang Technological University, Singapore.

4:30 PM ED3.3.05
Theory of Magneto-Resistance of Organic Molecular Tunnel Junctions with Non-Magnetic Electrodes Shu Shi; University of Minnesota, United States.

4:45 PM ED3.3.06
Photoemission Electron Microscopy as a New Tool to Study the Electronic Properties of 2D Crystals on Silicon Oxide Taisuke Ohta; Sandia National Laboratories, United States.

SESSION ED3.4: Poster Session
Tuesday Afternoon, April 18, 2017
8:00 PM - 10:00 PM
Sheraton, Third Level, Phoenix Ballroom

ED3.4.01
Low Energy Ion Implantation and Annealing of Au/Ni/Ti Contacts to n-SiC Patrick W. Leech; RMIT University, Australia.

ED3.4.02
Redox Properties, Charge Transport and Device Performance in WO3 Electrolyte-Gated Thin-Films Transistors Martin S. Barbosa1, 2; UNESCO, Brazil; 1Montreal Polytechnique, Canada.

ED3.4.03
Black Phosphorus Quantum Dots for Holes Extraction of Typical Planar Hybrid Perovskite Solar Cells Zhubing HE; Southern University of Science and Technology, China.

ED3.4.04
Evolution of the Crystal Structure of BAlN Thin Films with Increasing Boron Concentration in the Gas Flow Shuo Wang; Arizona State University, United States.

ED3.4.05
Liquid Phase Epitaxy for Growth of High-Quality Crystalline Germanium (100) on Silicon (100) Wafers Saloni Chaurasia; Indian Institute of Science, India.

ED3.4.06
The Nontoxic Colloidal Quantum Dot-Based Light Emitting Devices Seonghoon Lee; Seoul National University, Korea (the Republic of).
ED3.4.07  
Low Temperature Germanium Surface Passivation Formed Using *In Situ* NH$_3$/N$_2$ PECVD Nitration for High Quality Ge-MOS Capacitors. Ghada H. Dushas. Masdar Institute, United Arab Emirates.

ED3.4.08  

ED3.4.10  

ED3.4.11  

ED3.4.12  
Photoemission Analysis of Oxygen Chemisorption and Electronic Structure of Epitaxial GaN Films Grown on Different Substrates. Monu Mishra$^{1,2}$; CSIR-National Physical Laboratory, India; $^2$Academy of Scientific and Innovative Research, India.

ED3.4.13  
Physical Vapor Deposition of Ge Nanostructures on Si Substrates Using Solid Ge Sources. Yize Li. California State Polytechnic University, United States.

ED3.4.14  
Low Temperature Plasma Heteroepitaxy of Si and SiGe on (100) GaAs Pere Roca i Cabarrocas. CNRS, Ecole Polytechnique, France.

ED3.4.15  
Capacitance—Voltage Measurement of Al/HZO/InGaAs MOS Capacitor on Silicon Substrate. Siiraj Chowdhury. IIT Kharagpur, India.

ED3.4.16  

ED3.4.17  
Microstructure Analysis and Multiple Photoluminescence in High Temperature Electronic Conducting InZrZnO Thin Films. Jayaram Peedivekala. MES Ponnani College, India.

ED3.4.18  
Gadolinium Substitution Effect on the Structural, Surface, Chemical Composition and Thermoelectric Properties of Ni$_5$B$_5$Co$_3$. Ramachandran Thiruvagiyil, Zamorins Guruvayurappan College, India.

ED3.4.19  

ED3.4.20  
Optical Characterization of Semipolar InGaN/GaN MQWs Grown on Si(001) Substrate. Hojun Lee. Nagoya University, Japan.

ED3.4.21  
Probing the Chemical Functionalization of Reduced Graphene Oxide with NEXAFS Spectroscopy. Chris McNeill. Monash University, Australia.

ED3.4.22  

ED3.4.23  

ED3.4.24  
Atomic Scale Simulations of Phosphorus-Vacancy-Nitrogen and Nitrogen-Self-Interstitial Complexes in Germanium. Piotr Spiewak. Warsaw University of Technology, Poland.

ED3.4.25  
Zirconium-Doped MgZnO Thin Film Deposited Using RF Magnetron Sputtering. Kuang-Po Hsueh. Vanung University, Taiwan.

ED3.4.26  

ED3.4.27  
Hydrothermal Growth Of Zinc Oxide. Leelu Singh$^{1,2}$; Indian Institute Of Technology Roorkee, India; $^2$IIT Roorkee, India.

ED3.4.28  
Reduced Graphene Oxide Synthesized by Intense Pulse Light on Colorless Polyimide Film for Wearable Chemical Sensors. Seong-In Choi$^{1,2}$; Korea Advanced Institute of Science and Technology, Korea (the Republic of); $^2$Korea Advanced Institute of Science and Technology, Korea (the Republic of).

ED3.4.29  

ED3.4.30  
GaAs(100) Surface Passivation with Sulfide and Fluoride Ions. Pawan Tyagi$^{1,2}$; University of District of Columbia, United States; $^2$Indian Institute of Technology, India.

ED3.4.31  
First-Principles Study of N-Type Doping in Amorphous In-Ga-Zn-O Semiconductors. Divya$^{1,2}$; Indian Institute of Technology Kanpur, India; $^2$Indian Institute of Technology, Kanpur, India.

ED3.4.32  
High Temperature Characteristics of Pt/TaS$_2$/Pt/W and Pt/Ti/W Diffusion Barriers for Ohmic Contacts on 4H-SiC. Robert Okojie. NASA Glenn Research Center, United States.

SESSION ED3.5: III-V Growth and Interfaces  
Session Chairs: Nadine Collaert and Rinus Lee
Wednesday Morning, April 19, 2017  
PCC North, 100 Level, Room 127 C

8:15 AM *ED3.5.01  

8:45 AM ED3.5.02  
Electrical Properties of GaAs, InAs, InGaAs Epitaxially Grown on 300 mm Si(001) Substrate by MOCVD. Reynald Alcotte. CNRS, France.

9:00 AM ED3.5.03  
Native Point Defect Formation Energies in Binary Compound Semiconductors. Ashutosh Kumar. $^1$The Ohio State University, United States; $^2$Synopsys Inc., United States.

9:15 AM ED3.5.04  
III-V Semiconductor/Oxide Interfaces upon Thermal Oxidation and High-K ALD Investigated by XPS. Andrea Trojan. Lund University, Sweden.

9:30 AM BREAK
10:00 AM *ED3.6.01
Surface Transfer Doping—A Novel Alternative to Classical Doping in Semiconductor Electronics
Vidhya Chakrapani; Rensselaer Polytechnic Institute, United States.

10:30 AM ED3.6.02
Controlling MLD Dopant Diffusion in Group IV Materials Using Inorganic Spacers
Giuseppe Alessio Verni; University College Cork, Ireland; Tyndall Research Institute, Ireland.

10:45 AM ED3.6.03
Beryllium-Doped Indium Gallium Arsenide—An Ab Initio Study for the Explanation of Anomalous Dopant Diffusion Behavior
Sergej Manzhos; National University of Singapore, Singapore.

11:00 AM *ED3.6.04
Temperature Dependent Transport at Silicide/Silicon Interfaces
LeighAnn S. Larkin; University of Virginia, United States.

11:15 AM ED3.6.05
Investigation of n-type Germanium Doping by Melting Laser Annealing
Karim Huet; LASSE, SCREEN Semiconductor Solutions Co., Ltd., France.

11:30 AM ED3.6.06
Germanium Junctions for Beyond-Si Node Using Flash Lamp Annealing (FLA)
Hideaki Tanimura; SCREEN Semiconductor Solutions Co., Ltd., Japan.

11:45 AM ED3.6.07
Ab Initio Simulation of Metal Contacts to 2D Semiconductors with Electron-Phonon Interactions
Wushi Dong; The University of Chicago, United States; Argonne National Laboratory, United States.

11:00 AM *ED3.7: Process Technologies for beyond Si
Session Chairs: Nadine Collaert and Rinus Lee
Wednesday Afternoon, April 19, 2017
PCC North, 100 Level, Room 127 C

1:30 PM *ED3.7.01
CIM Challenges for Advanced Technology Nodes beyond Si
John H. Zhang; GLOBALFOUNDRIES, United States.

2:00 PM ED3.7.02
Surface Chemistry and Atomic Layer Etching of III-V Semiconductors in Acidic Solutions for NS Technology Nodes and Beyond
Dennis H. Van Dop; IMEC Leuven & Hasselt University, Belgium.

2:15 PM ED3.7.03
Enhanced UV-Detection with Etching Induced Ordered Nanostructures on Polar and Non-Polar Epitaxial GaN Films
Govind Gupta; National Physical Laboratory, India; Academy of Scientific and Innovative Research, India.

2:30 PM BREAK

3:00 PM ED3.7.04
Enabling Scaling of Quantum Computers: Fabrication of Superconducting Qubits with Low Variability at 300mm Wafer Scale
Sutavolu S. Papa Rao; SEMATECH, United States.

3:30 PM *ED3.8: New Electronics
Session Chairs: Nadine Collaert and Rinus Lee
Wednesday Afternoon, April 19, 2017
PCC North, 100 Level, Room 127 C

4:00 PM ED3.8.01
High-Throughput Computational Search for Transparent Semiconducting Materials
Geoffroy Hautier; University of Catholique-Louvain, Belgium.

4:15 PM ED3.8.03
BAs—A Competitor for Diamond in Thermal Conductivity?
Yaxian Wang; The Ohio State University, United States.

4:30 PM ED3.8.04
Interface and Thermal Characterisation of Diamond on CMOS Devices—CVD Diamond on HEMT
Rajesh Ramaneti; Institute for Materials Research (IMR), Hasselt University, Belgium; IMEC, Belgium.

4:45 PM ED3.8.05
Science and Technology of Polycrystalline Diamond Films on Silicon Substrates Integrated into Schottky Diodes as an Alternative to Crystalline Diamond-Based Diodes for Electronic Power Devices
Jesus J. Alcantar-Pena; University of Texas-Dallas, United States; University of Sonora, Mexico.

8:00 AM *ED3.9.01
Contact Resistance of Emerging Semiconductors Formed with Two Dimensional Materials
Won Jong You; Sungkyunkwan University, Korea (the Republic of).

8:30 AM ED3.9.02
Characterization of Solid-Supported Graphene, Metals and Other Nanoscale Films and Molecular Interactions Using MP-SPR
Annika Jokinen; BioNavis Ltd., Finland.

8:45 AM ED3.9.03
Scalable Planar Fabrication Processes for Chalcogenide-Based Topological Insulators
Peter A. Sharma; Sandia National Laboratories, United States.

9:00 AM ED3.9.04
Chelent Enhanced Solution Processing for Wafer Scale Synthesis of Transition Metal Dichalcogenide Thin Films
Robert Ionescu; University of California, Riverside, United States.

9:15 AM ED3.9.05
Phosphorus Substitutional Doping of Ultrathin Metal Dichalcogenides by Plasma-Assisted Chemical Vapor Deposition
Inyong Moon; Sungkyunkwan University, Korea (the Republic of).

9:30 AM BREAK

10:00 AM *ED3.10: 2D and Oxide Electronics
Session Chairs: Kah-Wee Ang and Tony Low
Thursday Morning, April 20, 2017
PCC North, 100 Level, Room 127 C

10:15 PM ED3.10.01
On the Performance of Two-Dimensional Material Devices for Electronic Applications
Granluca Fiori; University of Pisa, Italy.

10:30 AM ED3.10.02
Anisotropy of Electron Transport in Monolayer GaO3
Krishnendu Ghosh; University of Buffalo, United States.

10:45 AM ED3.10.03
Mechanical Exfoliation of Ultra-Wide Band Gap β-Ga2O3 and Its Contact Properties
Jinho Bae; Institute of Applied Research, Vilnius University, Lithuania.

11:00 AM ED3.10.04
Growth and Characterisation of Non-Polar and Semi-Polar GaN on Si with Er2O3 Interlayer
Tomas Grinys; Institute of Applied Research, Vilnius University, Lithuania.

11:15 AM ED3.10.05
Transparent and Flexible Tin Oxide Electrolyte-Gated Transistors
Fabio Cicoira; Polytechnique Montreal, Canada.
SESSION ED3.11: III-V/N Electronics
Session Chairs: Nadine Collaert and Rinus Lee
Thursday Afternoon, April 20, 2017
PCC North, 100 Level, Room 127 C

1:30 PM *ED3.11.01
Monolithic Integration of III-V Materials on Si for Nano- and Optoelectronic Applications Stephan Wirths; IBM Research GmbH, Switzerland.

2:00 PM ED3.11.02
Conformal GaN HEMTs for Flexible RF Power Amplifiers Nicholas Glavin; Air Force Research Laboratory, United States.

2:15 PM ED3.11.03
Vertical GaN Schottky Barrier Diodes with Record High Current I_on/I_off (~2.3×10^10) on Free-Standing GaN Wafer Xinke Liu; Shenzhen University, China.

2:30 PM ED3.11.04
Analysis of Reverse Breakdown and Leakage Mechanisms of AlN Schottky Diodes Operating at Elevated Temperature Houqiang Fu; Arizona State University, United States.

SESSION ED3.12: 2D Electronics and Physics
Session Chairs: Kah-Wee Ang and Tony Low
Friday Morning, April 21, 2017
PCC North, 100 Level, Room 127 C

8:30 AM *ED3.12.01
Engineering Quantum Confinement in Semiconducting van der Waals Heterostructure Philip Kim; Harvard University, United States.

9:00 AM ED3.12.02
Understanding Graphene’s Interface with Different Dielectrics in Graphene Devices Mona A. Ebrish; IBM, United States; 1University of Minnesota, United States.

9:15 AM ED3.12.03
Intrinsic Roughness in Suspended van der Waals Heterostructures Joachim Dahl Thomsen; Technical University of Denmark, Denmark.

9:30 AM ED3.12.04
THz-TDS Carrier Mobility Mapping of Graphene—Defects and Scattering Dynamics Peter Boggild; Technical University of Denmark, Denmark.

9:45 AM ED3.12.05
High Electrical Filed Transport and Related Thermal Spreading in van der Waals Heterostructures Faisal Ahmed; Sungkyunkwan University, Korea (the Republic of).

10:00 AM BREAK