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 $MoTe_2$ via Electron Beam Irradiation Min Sup Choi[1,2]; [1]Sungkyunkwan University, Korea (the Republic of); [2]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 Xingyi Wu; University of Cambridge, United Kingdom.

2:30 PM ED3.2.04
High n-Type Conduction in Si-Doped $Al_{0.84}Ga_{0.16}N$ 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 Jiangxin Wang; Nanyang Technological University, Singapore.

4:30 PM ED3.3.05
Theory of Magneto-Resistance of Organic Molecular Tunnel Junctions with Non-Magnetic Electrodes Sha 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 WO_3 Electrolyte-Gated Thin-Films Transistors Martin S. Barbosa[1,2]; [1]UNESP, Brazil; [2]Montreal 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. Dushaq; Masdar Institute, United Arab Emirates.

ED3.4.08
Amorphous IZTO Thin-Film Transistor Stability Improvement via Oxygen Vacancy Reduction Jinhee Park; University of California, Los Angeles, United States.

ED3.4.10
Thin Silicon Films Grown Using Ultra-High-Vacuum Evaporation and Conventional Plasma Enhanced Chemical Vapor Deposition Means—The Potential for Device Applications Stephen K. O'Leary; University of British Columbia, Canada.

ED3.4.11
Challenges to Overcome in Graphene Synthesis for New Generation Electronics Selcuk Temiz; University of California, Riverside, United States.

ED3.4.12
Photoemission Analysis of Oxygen Chemisorption and Electronic Structure of Epitaxial GaN Films Grown on Different Substrates Monu Mishra[1, 2]; [1]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 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/HfO_2/InGaAs MOS Capacitor on Silicon Substrate Sisir Chowdhury; IIT Kharagpur, India.

ED3.4.16
Single GaAs Nanowire/Graphene Hybrid Devices Fabricated by a Position Controlled Micro Transfer and Imprinting Technique for Embedded Structure Anjan Mukherjee; Norwegian University of Science and Technology (NTNU), Norway.

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

ED3.4.18
Gadolinium Substitution Effect on the Structural, Surface, Chemical Composition and Thermoelectric Properties of Ni0.5 GdxBi0.5-x CoO3 Ramachandran Thuruthiyil ; Zamorins Guruvayurappan College, India.

ED3.4.19
MoS_2/Graphene In-Plane Heterostructure—Synthesize, Electronic Properties and Interface Characteristics Amirhossein Behranginia; University of Illinois at Chicago, United States.

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
Synthesis of Few-Layer Rhenium Disulfide via Chemical Vapor Deposition Michael D. Valentin; University of California, Riverside, United States.

ED3.4.23
Investigation on the Synthesis and Properties of Single-Crystalline Nickel Silicide Nanowires Kuo-Chang Lu; National Cheng Kung University, Taiwan.

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
Single Element Device Using SnO Micro Discs for Gas Sensor Application Marcelo O. Orlandi; UNESP, Brazil.

ED3.4.27
Hydrothermal Growth Of Zinc Oxide Leeju Singh[2, 1]; [1]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 Seon-Jin Choi[2, 1]; [1]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
Effect of Plasma Power on Properties of Amorphous Silicon Carbide Hard Mask Films Deposited by Plasma Enhanced Chemical Vapor Deposition Sungwoo Lee; TES, Korea (the Republic of).

ED3.4.30
GaAs(100) Surface Passivation with Sulfide and Fluoride Ions Pawan Tyagi[1, 2]; [1]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]; [1]Indian Institute of Technology Kanpur, India; [2]Indian Institute of Technology, Kanpur, India.

ED3.4.32
High Temperature Characteristics of Pt/$TaSi_2$/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
Addressing Challenges of III-V on Si Integration by Developing High Productivity Epi Process in Compatible 300mm MOCVD System Zia Karim; Aixtron Inc, United States.

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[2, 1]; [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 Troian; Lund University, Sweden.

9:30 AM BREAK

SESSION ED3.6: Semiconductor Doping
Session Chairs: Nadine Collaert and Rinus Lee
Wednesday Morning, April 19, 2017
PCC North, 100 Level, Room 127 C

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[1, 2]; [1]University College Cork, Ireland; [2]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 Sergei 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[1, 2]; [1]The University of Chicago, United States; [2]Argonne National Laboratory, United States.

SESSION 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
CMP 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 N5 Technology Nodes and Beyond Dennis H. Van Dorp; 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[1, 2]; [1]National Physical Laboratory, India; [2]Academy of Scientific and Innovative Research, India.

2:30 PM BREAK

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

3:30 PM *ED3.8.01
Enabling Scaling of Quantum Computers: Fabrication of Superconducting Qubits with Low Variability at 300mm Wafer Scale Satyavolu S. Papa Rao; SEMATECH, United States.

4:00 PM ED3.8.02
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[1, 2]; [1]Institute for Materials Research (IMO), Hasselt University, Belgium; [2]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[1, 2]; [1]University of Texas-Dallas, United States; [2]University of Sonora, Mexico.

SESSION ED3.9: 2D Electronics and Growth
Session Chairs: Kah-Wee Ang and Tony Low
Thursday Morning, April 20, 2017
PCC North, 100 Level, Room 127 C

8:00 AM *ED3.9.01
Contact Resistance of Emerging Semiconductors Formed with Two Dimensional Materials Won Jong Yoo; 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
Chelant 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

SESSION 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

10:00 AM *ED3.10.01
On the Performance of Two-Dimensional Material Devices for Electronic Applications Gianluca Fiori; University of Pisa, Italy.

10:30 AM ED3.10.02
Anisotropy of Electron Transport in Monoclinic β-Ga_2O_3 Krishnendu Ghosh; University at Buffalo, United States.

10:45 AM ED3.10.03
Mechanical Exfoliation of Ultra-Wide Band Gap β-Ga_2O_3 and Its Contact Properties Jinho Bae; Korea University, Korea (the Republic of).

11:00 AM ED3.10.04
Growth and Characterisation of Non-Polar and Semi-Polar GaN on Si with Er_2O_3 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.

11:30 AM ED3.10.06
Highly Reliable Devices Using Crystalline-Indium-Tin-Zinc-Oxide Thin Film Transistors Solah Park; Yonsei University, Korea (the Republic of).

11:45 AM ED3.10.07
Characterization of Plasma-Enhanced Atomic Layer Deposited Ga_2O_3 Using Gallium(iii) Acetylacetonate Mei Hao; Arizona State University, United States.

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} Ratio (~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[1,2]; [1]IBM, United States; [2]University 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

SESSION ED3.13: 2D Optoelectronics
Session Chairs: Kah-Wee Ang and Tony Low
Friday Morning, April 21, 2017
PCC North, 100 Level, Room 127 C

10:30 AM *ED3.13.01
Strong Index Control in Graphene and TMDs for Electrooptic Modulation Volker J. Sorger; George Washington University, United States.

11:00 AM ED3.13.02
High Performance Photovoltaic Based on Black Phosphorus p-n Homojunction Diode Yuanda Liu[1,3]; [1]National University of Singapore, Singapore; [3]Nanjing University, China.

11:15 AM ED3.13.03
Tuning of Structural and Optical Properties of GeSn and SiGeSn Thin Films Grown by MOCVD Jignesh Vanjaria; Arizona State University, United States.

11:30 AM *ED3.13.04
Black Phosphorus Optoelectronics and Electronics Fengnian Xia; Yale University, United States.