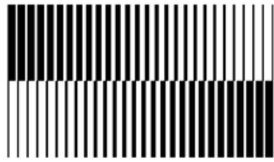

SISC 2017

48th IEEE Semiconductor Interface Specialists Conference

December 6-9, 2017
Bahia Resort Hotel, San Diego, CA
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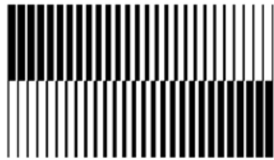

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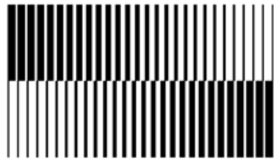

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SISC Ed Nicollian Award for Best Student Paper

In 1995, the SISC began presenting an award for the best student presentation, in honor of Professor E.H. Nicollian, University of North Carolina at Charlotte. Professor Nicollian was a pioneer in the exploration of the metal-oxide-semiconductor system, particularly in the area of electrical measurements. His efforts were fundamental in establishing the SISC in its early years, and he served as its technical program chair in 1982. With John Brews, he wrote the definitive book, "MOS Physics and Technology," published by Wiley Interscience.

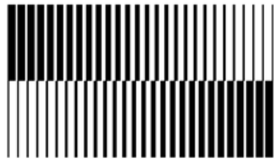
The *SISC Ed Nicollian Award for Best Student Paper* is presented to the lead student author for either an oral or a poster presentation. The winner is chosen by members of the technical program committee at the end of the SISC. The award consists of a plaque, an honorarium, and a permanent mention on the conference web site.

Winner of the 2016 SISC Ed Nicollian Award for Best Student Paper:

Chris M. Smyth

UT Dallas

"Contacts on WSe_2: Interface Chemistry and Band Alignment"
with R. Addou, S. McDonnell, J. Kim, C. L. Hinkle, and R. M. Wallace



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Wednesday Evening Tutorial

Wednesday, December 6, 2017, 8:00 PM

First introduced at SISC 2008, the Wednesday evening Tutorial aims to provide a good foundation in a topic frequently covered at the conference, particularly benefiting students and newcomers to the field. The Tutorial is free to all registered SISC attendees.

L. Samuelson, *Lund U.*

Semiconductor nanowires and their interface properties enabling photovoltaics and lighting applications

The quest for large scale implementation of advanced III-V and III-Nitride semiconductor materials and devices is often hindered by either fundamental materials issues, like lattice mismatch or surfaces and interface states, or simply by cost issues. The use of nanowires (NWs) could possibly offer solutions to several of these challenges. The NWs that I will talk about are single-crystalline semiconductors shaped as one-dimensional rods, in most cases with the implementation of axial and radial heterostructures and interfaces for their functionality.

In this tutorial I will first introduce and motivate why NWs are studied and considered for applications such as for electronics, lighting and photovoltaics. Special emphasis will be put on the way NWs offer remedies to the issues mentioned above and offer smart design and functionality of opto-electronic devices based on heterostructures and interface control.

After this general motivation I will briefly review the semiconductor materials growth of NWs, typically formed either by a vapor-liquid-solid (VLS) mechanism or via selective area growth. I will here give examples of hetero-interface control in such NWs including atomically abrupt interfaces between different materials as well as between different crystalline structures. As a special case I will describe a novel growth mechanism in which perfect NWs as device structures are formed in an aerosol phase, a method given the name Aerotaxy.

Extending from the growth mechanisms and their issues I will then turn to how this field of semiconductor materials research was converted into, what can be called, “a technology”. Starting from the spontaneous formation of nano-sized gold particles from a very thin gold film,

as originally demonstrated by Dr. Kenji Hiruma, perfectly controlled dimensions and locations of NWs was achieved via the development of top-down controlled self-assembly of designed perfect arrays of NWs.

In the later part of this lecture I will turn to examples of application areas where NWs appear to offer significantly novel opportunities to change the respective fields. Among these I will primarily talk about the way NWs enable the realization of inexpensive and efficient solar cells, for which interface control and surface passivation is absolutely critical. These NWs may either be used as a very thin NW-array film or be operating in a tandem configuration with state-of-the-art silicon solar cells, where the Aerotaxy method of fabrication appears as a solution to the very tough cost issues for terrestrial solar cell implementation.

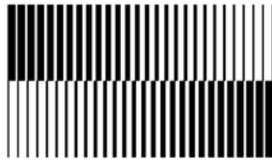
Related to the quest for high-performance III-Nitride emitters for displays and lighting I will give examples of how III-Nitride NWs have enabled the development of NW-LEDs in which an array of such single NW LEDs can operate as RGB-emitting micro-LEDs, highly suitable for display applications. Finally I will present very recent research where we have learned how the control of ideal nucleation of GaN NWs offers a means of forming threading-dislocation-free and relaxed c-planar $In_XGa_{1-X}N$ with X in the range $0 \leq X \leq 0.2$ as a generic platform for demanding device applications, such as direct-emitting green, yellow and red LEDs for full color temperature control as required for Human Centric Lighting systems.

Lars Samuelson obtained his Ph.D. in Solid State Physics at Lund University in 1977 followed by a Post-doc at IBM Research Laboratories in San José, CA. In 1986 he became Professor at Chalmers/Göteborg University and returned in 1988 to a Professorship in the Physics Department in Lund. At that time he switched field to Nanoscience and started the Nanometer Structure Consortium, which quickly developed into the primary center for Nanoscience in Sweden. He has since been engaged in the leadership of Nanoscience research, today as Deputy Director of the NanoLund centre.

He is recognized for his research on low-dimensional structures and the physics and applications thus made possible. In recent years, approximately from the year 2000, his research has been focused on the formation of one-dimensional nanowires, studies of their physical properties, as well as applications of semiconductor nanowires in fields like photovoltaics, light-emitting diodes as well as nanoelectronics. He has given at least 300 invited talks at international conferences and meetings and has published well over 600 papers in refereed journals (h-index≈80; m-index≈2).

He is Fellow of the Inst. of Physics (UK) and of the American Physical Society (Materials Physics) and is a Member of the Royal Swedish Academy of Sciences, KVA (Physics) and of the Royal Swedish Academy of Engineering Sciences, IVA. In 2008 he was awarded as "Einstein Professor" by the Chinese Academy of Sciences, in 2011 the Ideon Prize for Innovation, and in 2013 the IUVSTA Prize for Science of the Triennium 2010 – 2013, and in 2014 he was awarded the "Fred Kavli Distinguished Lectureship in Nanoscience".

Beside his role as academic researcher and teacher, he has engaged himself in the creation of spin-out companies and is the primary founder and Chief Scientist for the companies QuMat AB[i)], QuNano AB[ii)], GLO AB[iii)], Sol Voltaics AB[iv)], and Hexagem AB[v)], engaged in fields like: [i)]: Materials; [ii)]: Electronics; [iii)]: LEDs/displays; [iv)]: Solar cells; [v)]: Power/RF.



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Conference Agenda Overview

Wednesday, December 6, 2017

Registration .... 6:00 PM – 8:00 PM
Evening Tutorial .... 8:00 PM – 9:30 PM
Hospitality Room .... 9:30 PM – Midnight

Thursday, December 7, 2017

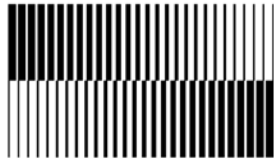
Registration .... 8:00 AM – 5:00 PM
Session 1 – 2D Materials and Interfaces I .... 8:00 AM – 10:05 AM
Session 2 – Poster Preview Session – 2D Materials and Interfaces .... 10:30 AM – 11:15 AM
Session 3 – Interfaces in Biosensing and Biomedical Applications .... 11:15 AM – 12:30 PM
Session 4 – Interfaces and Ferroelectric Materials .... 2:00 PM – 3:35 PM
Session 5 – Poster Preview Session – SiGe, III-V, Wide Bandgap .... 4:00 PM – 5:02 PM
Session 6 – Poster Preview Session – New Materials and Methods .... 5:02 PM – 5:52 PM
Poster Session .... 7:00 PM – 10:00 PM
Hospitality Room .... 10:00 PM – Midnight

Friday, December 8, 2017

Registration .... 8:00 AM – Noon
Session 7 – New Materials and Methods I .... 8:00 AM – 10:00 AM
Session 8 – Interface Metrology .... 10:25 AM – 11:25 AM
Session 9 – Interfaces and Wide Bandgap Materials .... 11:25 AM – 12:45 PM
Technical Committee / Invited Speaker Luncheon .... 12:45 PM – 2:15 PM
Session 10 – Thin Films and Interfaces for Emerging Memory and Logic .... 2:15 PM – 4:05 PM
Rump Session .... 4:30 PM – 6:00 PM
Conference Banquet and Limerick Contest .... 7:00 PM – 10:00 PM
Hospitality Room .... 10:00 PM – Midnight

Saturday, December 9, 2017

Session 11 – Interfaces in Photovoltaics and Optoelectronics .... 8:00 AM – 9:35 AM
Session 12 – New Materials and Methods II .... 10:00 AM – 11:20 AM
Session 13 – 2D Materials and Interfaces II .... 11:20 AM – 12:55 PM



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Conference Program

Wednesday, December 6, 2017

Tutorial

Session Chair: M. Passlack

8:00 PM – 9:30 PM *Tutorial* - **Semiconductor nanowires and their interface properties enabling photovoltaics and lighting applications,** L. Samuelson, *Lund U., Sweden*

9:30 PM – Midnight Hospitality Room

Thursday, December 7, 2017

8:00 AM Welcome and Opening Remarks

Session 1 – 2D Materials and Interfaces I

Session Chair: C. L. Hinkle

8:10 AM 1.1 *Invited* - **Data Mining for New Two- and One-dimensional Weakly Bonded Solids and Application to Two-dimensional Phase Change Materials,** G. Cheon, D. A. Rehn, Y. Zhou, and E. J. Reed, *Stanford U.*

8:45 AM 1.2 - **Band offset at high-quality monolayer MoS_2 and Al_2O_3 interface by internal photoemission,** Q. Zhang[1,2], S. Zhang[1,2], B. Sperling[2], J. E. Maslar[2], S. Pookpanratana[2], C. A. Hacker[2], D. J. Gundlach[2], and N. V. Nguyen[2], [1]*Theiss Research,* [2]*NIST*

9:05 AM 1.3 - **True Dual-Gate MoS_2 FETs with sub-10 nm Top-Gate High-k Dielectrics,** P. Bolshakov[1], A. Khosravi[1], P. Zhao[1], A. Azcatl[1], G. Mirabelli[2], P. K. Hurley[2], C. L. Hinkle[1], R. M. Wallace[1], and C. D. Young[1], [1]*UT Dallas,* [2]*Tyndall National Institute, Ireland*

9:25 AM 1.4 - **AC characterization of Black Phosphorus with Al_2O_3 Gate dielectrics,** J. Liu, Y. Zhou, and W. Zhu, *UIUC*

9:45 AM 1.5 - **Understanding 2D Semiconductor-Metal Interface for Efficient Carrier Injection,** S. V. Suryavanshi[1,2], B. Sklenard[1], B. Magyari-Kope[2], E. Pop[2], and P. Blaise[1], *[1]CEA-LETI, France, [2]Stanford U.*

10:05 AM Coffee Break

Session 2 - Poster Preview Session – 2D Materials and Interfaces

Session Chair: R. M. Wallace

10:30 AM Opening Remarks

10:32 AM 2.1 - **Understanding metal-black phosphorus contact,** X. Li, T. Li, and Y. Wu, *Huazhong U. Science and Technology, China*

10:34 AM 2.2 - **Gate-Tunable Resonant Tunneling in Black-Phosphorus/hBN Heterostructures,** K. Xu, Y. Chen, J. Lyding, and W. Zhu, *UIUC*

10:36 AM 2.3 - **Border Traps and Interface Traps in High-k / MoS_2 Gate Stacks by C-V Analysis,** P. Zhao[1], A. Azcatl[1], A. Khosravi[1], P. Bolshakov[1], P. K. Hurley[2], R. M. Wallace[1], C. L. Hinkle[1] and C. D. Young[1], *[1]UT Dallas, [2]Tyndall National Institute, Ireland*

10:38 AM 2.4 - **Impact of Water-Based Layer Transfer on MoS_2/SiO_2 Interface Barrier,** V. V. Afanas'ev[1], D. Chiappe[2], A. Leonhardt[1,2], M. Houssa[1], C. Huyghebaert[2], I. Radu[2], and A. Stesmans[1], *[1]U. Leuven, Belgium, [2]imec, Belgium*

10:40 AM 2.5 - **2D MoS_2 film thickness impact on the efficiency of surface-doped devices,** C. J. Lockhart de la Rosa[1,2], G. Arutchelvan[1,2], A. Leonhardt[1,2], C. Huyghebaert[1], I. Radu[1], M. Heyns[1,2], and S. De Gendt[1,2], *[1]imec, Belgium, [2]U. Leuven, Belgium*

10:42 AM 2.6 - **Ternary graphene-ZnO barristor using a chemically doped graphene,** S. Y. Kim, Y. J. Kim, H. J. Hwang, S. K. Lee, and B. H. Lee, *GIST, Korea*

10:44 AM 2.7 - **Optimizing the MOS capacitor design to study large area 2D-oxide interface,** A. Gaur[1,2], D. H. C. Lin[1], D. Chiappe[1], C. Adelmann[1], J. Van Houdt[1,2], D. Mocuta[1], M. Heyns[1,2], and I. Radu[1], *[1]imec, Belgium, [2]U. Leuven, Belgium*

10:46 AM 2.8 - **Low temperature integrated complementary graphene barristor to overcome the thermal budget in monolithic 3D integration,** S. Heo, Y. J. Kim, K. J. Han, K. Y. Kim, H. I. Lee, S. M. Kim, S. K. Lee, K. E. Chang, J. H. Kim, M. H. Yoon, and B. H. Lee, *GIST, Korea*

10:48 AM 2.9 - **Study of interface defects in top-gated MoS_2 FETs: experiments and physics based simulations,** G. Mirabelli[1], P. Zhao[2], P. Bolshakov[2], C. McGeough[3], F. Gity[1], S. Monaghan[1], G. Hughes[3], C. L. Hinkle[2], R. M. Wallace[2], C. D. Young[2], P. K. Hurley[1], and R. Duffy[1], *[1]Tyndall National Institute, Ireland, [2]UT Dallas, [3]Dublin City U., Ireland*

10:50 AM 2.10 - **Local Density of State of Monolayer PbSe Quantum dot superlattice by Scanning tunneling microscopy,** I. Kwak[1], A. Abelson[2], C. Y. Qian[2], M. Law[2], and A. C. Kummel[1], *[1]UCSD, [2]UC Irvine*

10:52 AM 2.11 - **Resist free photo-ionic metal deposition on 2D materials,** C. J. Lockhart de la Rosa[1,2], K. Xia[2], W.-Y. Chiang[2], G. Arutchelvan[1], Y. Fujita[2], T. Toyouchi[1], H. Yuan[2], J. Su[2], H. Uji-I[1], J. Hofkens[2], S. De Gendt[1,2], and S. De Feyter[2], *[1]imec, Belgium, [2]U. Leuven, Belgium, [3]Hokkaido U., Japan*

10:54 AM 2.12 - **Plasma-assisted Sulfurization of Thin Molybdenum-Containing Films for MoS_2 Synthesis,** C. J. Perini, M. J. Muller, and E. M. Vogel, *Georgia Institute of Technology*

10:56 AM 2.13 - **Van der Waals Interaction Induced Direct Growth of HfAlO on Graphene by Atomic Layer Deposition,** L. Zheng, Y. Yu, X. Cheng, D. Xu, and L. Shen, *Chinese Academy of Sciences, China*

10:58 AM 2.14 - **Hole-doped induced ferromagnetism in 2D SnO,** M. Houssa[1], K. Iordanidou[1], G. Pourtois[2], V. V. Afanas'ev[1], and A. Stesmans[1], *[1]U. Leuven, Belgium, [2]imec, Belgium*

11:00 AM 2.15 - **Methods of passivating the sulfur vacancy in 2D MoS_2,** H. Lu and J. Robertson, *U. Cambridge, UK*

11:02 AM 2.16 - **Thickness Dependent Dielectric Properties: h-BN, Mono- and Bilayer Transition Metal Dichalcogenides,** A. Laturia, M. L. Van de Put, and W. G. Vandenberghe, *UT Dallas*

11:04 AM 2.17 - **Investigation on fully 2D Materials Esaki diode,** N. Torabi[1], M. Berahman[1], A. Khajeh[2], and M. Fardmanesh[1], *[1]Sharif U. Technology, Iran, [2]UC Irvine*

11:06 AM 2.18 - **Effect of Oxygen Ratio on Contact resistance in a-IGZO Thin-Film Transistor,** N. On and J. K. Jeong, *Hanyang U., Korea*

11:08 AM 2.19 - **Nickel Oxide as Hole-selective Contact Interlayer Material for Silicon Solar Cells,** M. Xue, Y. Chen, R. Islam, C. Lu, Z. Lyu, K. Zang, T. I. Kamins, P. C. McIntyre, K. C. Saraswat, and J. S. Harris, *Stanford U.*

11:10 AM 2.20 - **Frequency dependent capacitance due to the stress polarity dependent defects in Metal/high-dielectric/Metal capacitor,** S. C. Kang, S. K. Lee, J. Noh, S. Heo, S.-M. Kim, S. K. Lim, and B. H. Lee, *GIST, Korea*

11:12 AM 2.21 - **Silicon / HfO_2 interface Engineering with Alpha Particle Irradiation,** S. Maurya, *Integral U., India*

Session 3 – Interfaces in Biosensing and Biomedical Applications

Session Chair: P. Blaise

11:15 AM 3.1 *Invited* - **Electronic Label-Free Biosensing Assays,** M. A. Reed, *Yale U.*

11:50 AM 3.2 - **Surface Controlled Lead Halide Perovskite Nanocrystal Growth,** S, Hou[1], Y. Guo[1,2], and Q. Quan[2], *[1]Harvard U., [2]U. Swansea, UK*

12:10 PM 3.3 - **Improving pH Sensing By Nanoscaling the Width of CMOS Technology Compatible FinFETs,** M. Gupta[1,2], A. Veloso[1], Z. Tao[1], W. Li[1], P. Peumans[1], W. Van Roy[1], K. Martens[1,2], and L. Lagae[1,2], *[1]imec, Belgium, [2]U. Leuven, Belgium*

12:30 PM Adjourn for Lunch

Session 4 – Interfaces and Ferroelectric Materials

Session Chair: J. Robertson

2:00 PM 4.1 *Invited* - **Ferroelectric fluorite structured oxides: Materials fundamentals, switching, wake- up, and applications in electronics and energy,** M. H. Park and C. S. Hwang, *Seoul National U., Korea*

2:35 PM 4.2 - **A Study of Endurance Problems in HfO_2-based Ferroelectric Field Effect Transistors: Charge Trapping and Trap Generation,** N. Gong and T. P. Ma, *Yale U.*

2:55 PM 4.3 - **Synthesis of Si-doped HfO_2 Ferroelectric Thin Films using Silicon Ion Implantation,** S. Migita[1], H. Ota[1], H. Yamada[1], K. Shibuya[1], A. Sawa[1], T. Matsukawa[1], and A. Toriumi[2], *[1]AIST, Japan, [2]U. Tokyo, Japan*

3:15 PM 4.4 - **Steep-slope MoS_2 Negative Capacitance Field-effect Transistor without Hysteresis,** M. Si[1], C.-J. Su[2], P. D. Ye[1], *[1]Purdue U., [2]National Nano Device Laboratories, Taiwan*

3:35 PM Coffee Break

Session 5 - Poster Preview Session – SiGe, III-V, Wide Bandgap

Session Chair: T. Oates

4:00 PM 5.1 - **Experimental extraction of Ballistic Efficiency of Germanium Nanowire NMOSFETs,** W. Chung, H. Wu, M. Si, and P. D. Ye, *Purdue U.*

4:02 PM 5.2 - **Dramatic leakage current reduction at n^+/p junctions in Ge,** T. C. Liu, T. Nishimura, and A. Toriumi, *U. Tokyo, Japan*

4:04 PM 5.3 - **Thermal transport properties of NiGe/Ge contact for the heat assessment in Ge MOSFETs,** Y. Nakajima[1,2], N. Uchida[1], W.-H. Chang[1], and T. Maeda[1,2], *[1]AIST, Japan, [2]Tokyo U. Science, Japan*

4:06 PM 5.4 - **Contact Engineering and Schottky Barrier Heights of Ge,** Y. Guo[1,2], H. Li[2], and J. Robertson[2], *[1]U. Swansea, UK, [2]U. Cambridge, UK*

4:08 PM 5.5 - **Doping Effects on Sn Loss in Epi-GeSn on Si by CVD,** F.-L. Lu[1], C.-E. Tsai[1], P.-S. Chen[1], and C. W. Liu[1,2], *[1]National Taiwan U., Taiwan, [2]National Nano Device Laboratories, Taiwan*

4:10 PM 5.6 - **Photoluminescence and electroluminescence of strained GeSn quantum wells,** C.-Y. Lin[1], H.-S. Lan[1], and C. W. Liu[1,2], *[1]National Taiwan U., Taiwan, [2]National Nano Device Laboratories, Taiwan*

4:12 PM 5.7 - **Electrical and Chemical Analysis of the in-situ H_2 Plasma Cleaned InGaSb-Al_2O_3 Interface,** D. A. J. Millar[1], S. Supardan[2], U. Peralagu[1], M. Sousa[3], X. Li[1], V. R. Dhanak[2], Y. C. Fu[1], M. Steer[1], H. Schmid[3], I. Z. Mitrovic[2], and I. G. Thayne[1], *[1]U. Glasgow, UK, [2]U. Liverpool, UK, [3]IBM, Switzerland*

4:14 PM 5.8 - **Crystalline oxide phases on InSb(111)B revealed with scanning tunneling microscopy and spectroscopy,** J. Mäkelä[1], J.-P. Lehtiö[1], Z. J. Rad[1], M. Tuominen[1], J. Dahl[1], M. Yasir[1], M. Kuzmin[1,2], M. P. J. Punkkinen[1], P. Laukkanen[1], and K. Kokko[1], [1]*U. Turku, Finland,* [2]*Ioffe Physical-Technical Institute, Russia*

4:16 PM 5.9 - **Pre-cleaning Effects for Al_2O_3/p-$In_xGa_{1-x}As$ MOS Interfaces,** C. Yokoyama, M. Takenaka, and S. Takagi, *U. Tokyo, Japan*

4:18 PM 5.10 - **Deuterium passivation of TiN/HfO_2/Al_2O_3/InGaAs gate stacks: Pressure and temperature dependence,** M. M. Frank[1], E. A. Cartier[1], T. Ando[1], J. Rozen[1], M. Hopstaken[1], E. Levrau[1], W.-E. Wang[2], and V. Narayanan[1], [1]*IBM,* [2]*Samsung*

4:20 PM 5.11 - **The impact of in-situ hydrogen plasma passivation prior to ALD HfO_2 deposition on the electrical properties of ICP etched p-type InGaAs (110) MOSCAPs,** Y.-C. Fu[1], X. Li[1], U. Peralagu[1], D. Millar[1], M. Steer[1], H. Zhou[1], R. Droopad[2], and I. Thayne[1], [1]*U. Glasgow, UK,* [2]*Texas State U.*

4:22 PM 5.12 - **Temperature-dependent barrier heights measured in high-k/GaAs – elucidating capacitance-voltage frequency dispersion for proper determination of border traps,** K. Y. Lin[1], T. W. Chang[1], H. W. Wan[1], Y. J. Hong[1], L. B. Young[1], J. Kwo[2], and M. Hong[1], [1]*National Taiwan U., Taiwan,* [2]*National Tsing Hua U., Taiwan*

4:24 PM 5.13 - **$Si_{1-x}Ge_x$ thin-layer hole mobility based on thickness-dependent 6x6k.p parameters,** E. Chen, S.-K. Su, and J. Wu, *TSMC, Taiwan*

4:26 PM 5.14 - **Al_2O_3/$Si_{0.7}Ge_{0.3}$(001) & HfO_2/$Si_{0.7}Ge_{0.3}$(001) Interface Trap State Reduction via In-Situ N_2/H_2 RF Downstream Plasma Passivation,** M. Breeden[1], S. Wolf[1], S. Ueda[1], K. Tang[2], and A. C. Kummel[1], [1]*UCSD,* [2]*Stanford U.*

4:28 PM 5.15 - **Study of a Novel N-type Tunneling FET with a $Si_{1-x}Ge_x$/Si Hetero-pocket,** G. Xu[1,2], Y. F. Chang[1], Y. C. Chen[1], X. Wu[1], R. Ge[1], C. Y. Lin[3], P. Wang[1], G. Tao[2], H. Yin[2], Q. Xu[2], J. Li[2], C. Zhao[2] and J. C. Lee[1], [1]*UT Austin,* [2]*IMECAS, China,* [3]*National Sun Yat-Sen U., Taiwan*

4:30 PM 5.16 - **Effects of W/ZrO_2/Al_2O_3 gate stacks on performance of InGaAs TFETs,** D.-H. Ahn, S.-H. Yoon, M. Takenaka, and S. Takagi, *U. Tokyo, Japan*

4:32 PM 5.17 - **Control of thermal oxidation of 4H-SiC (0001) to enhance MOSFET channel mobility by tuning partial pressures of oxidants (O_2 and H_2O) and oxidation temperature,** H. Hirai, K. Ishinoda, and K. Kita, *U. Tokyo, Japan*

4:34 PM 5.18 - **Relationships between Al_2O_3/GaN Interface Properties near Conduction Band Edge and Post-Deposition Annealing Temperatures,** N. Taoka[1], T. Kobayashi[2], M. Nakamura[2], T. Sagawa[2], N. X. Truyen[1,3], A. Ohta[3], H. Yamada[1], T. Takahashi[1], M. Ikeda[3], K. Makihara[3], T. Kubo[4], T. Yamada[1], T. Egawa[4], S. Miyazaki[3], S. Motoyama[2], and M. Shimizu[1], [1]*AIST, Japan,* [2]*Samco, Japan,* [3]*Nagoya U., Japan,* [4]*Nagoya Institute of Technology, Japan*

4:36 PM 5.19 - **ESR studies of layer thickness and post-deposition annealing effects on ALD-Al_2O_3/AlGaN/GaN MIS-HEMT structures,** T. Kubo and T. Egawa, *Nagoya Institute of Technology, Japan*

4:38 PM 5.20 - **Improved Channel Mobility of 4H-SiC N-MOSFETs by Ultrahigh-Temperature Oxidation with Low-Oxygen Partial-Pressure Cooling Procedure,** M. Sometani[1], Y. Katsu[2], D. Nagai[2], H. Tsuji[2,3], T. Hosoi[2], T. Shimura[2], Y. Yonezawa[1], and H. Watanabe[2], [1]*AIST, Japan,* [2]*Osaka U., Japan,* [3]*Fuji Electric, Japan*

4:40 PM 5.21 - **4H-SiC(0001) N- and P-channel MOSFETs with Pure SiO_2 Gate Dielectrics Formed under Extreme Oxidation Conditions,** T. Hosoi[1], Y. Katsu[1], K. Moges[1], H. Tsuji[1,2], M. Sometani[3], T. Shimura[1], and H. Watanabe[1], *[1]Osaka U., Japan, [2]Fuji Electric, Japan, [3]AIST, Japan*

4:42 PM 5.22 - **Characterization of SiO_2/SiC Interface States Considering Variable-Range Hopping,** H. Yoshioka[1] and K. Hirata[2], *[1]AIST, Japan, [2]NIMS, Japan*

4:44 PM 5.23 - **The correlation between inversion capacitance and field effect mobility 4H-SiC MOSFET at high temperatures,** M. I. Idris[1,2], M. H. Weng[1], N. G. Wright[1], A. B. Horsfall[1], *[1]Newcastle U., UK, [2]UTeM, Malaysia*

4:46 PM 5.24 - **Breakdown Voltage Enhancement in AlGaN/GaN HEMTs Using Double Passivation Layers with a High-k Dielectric,** K. Horio and H. Hanawa, *Shibaura Institute of Technology, Japan*

4:48 PM 5.25 - **Tailoring a High Frequency Independent Technique to Extract an Accurate Interface State Density at SiO_2 / Silicon Carbide Interfaces,** M. H. Weng[1], M. I. Idris[1,2], N. G. Wright[1], and A. B. Horsfall[1], *[1]Newcastle U., UK, [2]UTeM, Malaysia*

4:50 PM 5.26 - **Surface Activated Bonding of SiC/Diamond for Thermal Management of GaN Devices,** Y. Minoura[1,2], N. Okamoto[1,2], M. Sato[2], T. Ohki[1,2], S. Ozaki[1,2], K. Makiyama[1,2], J. Kotani[1,2], A. Yamada[1,2], T. Ishiguro[2], K. Joshin[2], and N. Nakamura[1,2], *[1]Fujitsu Limited, Japan, [2]Fujitsu Laboratories, Japan*

4:52 PM 5.27 - **Surface Plasma Treatment for Breakdown Voltage Enhancement of Vertical GaN-on-GaN Power Devices,** S. Yang, S. Han, and K. Sheng, *Zhejiang U., China*

4:54 PM 5.28 - **Reduction in Oxygen Vacancy Formation Energy Caused by Nitrogen Incorporation in Al_2O_3-based Gate Dielectrics,** E. Kojima, K. Chokawa, H. Shirakawa, M. Araidai, and K. Shiraishi, *Nagoya U., Japan*

4:56 PM 5.29 - **Predicting the induced energy levels of group III acceptor and group V donor impurities in 4H-SiC,** E. Igumbor and W. E. Meyer, *[1]U. Pretoria, South Africa, [2]Samuel Adegboyega U., Nigeria*

4:58 PM 5.30 - **Effect of a thick buffer in the OFF state simulation of AlGaN/GaN HEMT,** A. Gupta[1], H. Dohare[1], C. Sharma[2], D. S. Rawal[2], S. Bhattacharya[3] and V. Natarajan[3], *[1]IIT Madras, India, [2]Solid State Physics Laboratory, India, [3]Research and Innovation Centre, India*

5:00 PM 5.31 - **Study of charge trapping effects in Al_2O_3/ β-Ga_2O_3 MOS structures,** M. A. Bhuiyan[1], H. Zhou[2], P. D. Ye[2], and T. P. Ma[1], *[1]Yale U., [2]Purdue U.*

Session 6 - Poster Preview Session – New Materials and Methods

Session Chair: R. Clark

5:02 PM 6.1 - **Low-Temperature Thermal ALD TiN_x and TaN_x Films from Anhydrous N_2H_4,** S. Wolf[1], M. Breeden[1], M. Kavrik[1], J. H. Park[1], R. Holmes[2], D. Alvarez[2], J. Spiegelman[2], M. Naik[3], and A. C. Kummel[1], *[1]UCSD, [2]Rasirc, Inc., [3]Applied Materials*

5:04 PM 6.2 - **Comprehensive Analysis of Interfacial Fin Isolation Oxide Charge for Bulk FinFETs,** J.-L. Lai[1], S.-H. Chen[1], M.-Y. Chang[1], M.-H. Chiang[1], W.-C. Hsu[1], G.-L. Luo[2], and K. Wu[2], [1]*National Cheng Kung U., Taiwan,* [2]*National Nano Device Laboratories, Taiwan*

5:06 PM 6.3 - **The Studies of Trap Characteristics induced by NBTI in Nano-sheet FET,** S. Kim[1], Y. Seo[1], D. Son[1], M. Kang[2], and H. Shin[1], [1]*Soul National U., Korea,* [2]*Korea National U. Transportation, Korea*

5:08 PM 6.4 - **Universal pathway of ferroelectric phase evolution in doped HfO_2,** L. Xu[1], S. Migita[2], and A. Toriumi[1], [1]*U. Tokyo, Japan,* [2]*AIST, Japan*

5:10 PM 6.5 - **Surface Free Energy and Interface Strain in HfO_2 and HZO Ferroelectric Formation,** A. C. Kummel[1], E. Chagarov[1], M. Kavrik[1], M. B. Katz[2], N. A. Sanford[2], A. Davydov[2], and M. H. Lee[3], [1]*UCSD,* [2]*NIST,* [3]*National Taiwan Normal U., Taiwan*

5:12 PM 6.6 - **Doping Induced Ferroelectricity in Hafnia: a First-Principles Computational Study,** Y. Guo[1,2] and J. Robertson[2], [1]*U. Swansea, UK,* [2]*U. Cambridge, UK*

5:14 PM 6.7 - **Low Temperature (< 200˚C) Solution Processed MOS Structured Flash Memory,** S. Mondal and V. Venkataraman, *IISc Bangalore, India*

5:16 PM 6.8 - **Experimental Extraction of the Charge Centroid in Metal-Oxide-Nitride-Oxide-Semiconductor Memories,** H. Mino, S. R. A. Ahmed, K. Kato, and K. Kobayashi, *Tokai U., Japan*

5:18 PM 6.9 - **Quantitative Analysis of Interface States in Bulk and Nanostructured Semiconductors Using Electrochemical Impedance Spectroscopy,** A. C. Meng[1], D. Mikulik[2], M. R. Braun[1], K. Tang[1], R. Berrazouane[2], L. Zhang[1], A. Fontcuberta i Morral[2], P. C. McIntyre[1], [1]*Stanford U.,* [2]*EPFL, Switzerland*

5:20 PM 6.10 - **Quantification of electrostatic potential drift in High K Metal Gate stacks using X-ray Photoelectron spectroscopy,** C. Fontaine, M. Gros-Jean, B. Pelissier, T. Chevolleau, *STMicroelectronics, France*

5:22 PM 6.11 - **Resolving the anomalous, giant piezoresistance controversy in nanoscale silicon objects,** H. Li[1], C. T. K. Lew[2], S. Arscott[3], B. C. Johnson[2], J. C. McCallum[2], and A. C. H. Rowe[1], [1]*U. Paris Saclay, France,* [2]*U. Melbourne, Australia,* [3]*U. Lille, France*

5:24 PM 6.12 - **Epitaxial Silicon on Beryllium Oxide Atomic Layer Deposited on Silicon Substrate,** S. M. Lee[1], J. Oh[1], J. H. Yum[2], E. S. Larsen[2], C. W. Bielawski[2], W. C. Lee[3], S. K. Kim[3], [1]*Yonsei U., Korea,* [2]*UNIST, Korea,* [3]*KIST, Korea*

5:26 PM 6.13 - **Oxidation-induced crystalline $Si/SiO_x/Si$ structure,** J.-P. Lehtiö[1], J. Mäkelä[1], M. Kuzmin[1], M. Yasir[1], J. Dahl[1], M. P. J. Punkkinen[1], P. Laukkanen[1], K. Kokko[1], R. Punkkinen[1], H.-P. Hedman[1], P. Repo[2], H. Savin[2], [1]*U. Turku, Finland,* [2]*Aalto U., Finland*

5:28 PM 6.14 - **Hysteric Transfer Characteristics of p-type Thin Film Transistors with SnO thin films grown by atomic layer deposition (ALD),** Y. Jang[1], J. Kim[1], E. Hwang[1], S. Lee[1], J. H. Han[2], and C. S. Hwang[1], [1]*Seoul National U., Korea,* [2]*KRICT, Korea*

5:30 PM 6.15 - **The Analysis of Gate Leakage Current in Lateral Nanowire-FET,** M. Kim[1], Y. Seo[1], M. Kang[2], and H. Shin[1], [1]*Soul National U., Korea,* [2]*Korea National U. Transportation, Korea*

5:32 PM 6.16 - **Creation of two-dimensional electron gas at atomic layer deposited Al_2O_3/TiO_2 film on $SrTiO_3$ substrate,** H. J. Lee, T. Moon, and C. S. Hwang, *Soul National U., Korea*

5:34 PM 6.17 - **Diode performance of the $Pt/Al_2O_3/SrTiO_3$ hetero-structure with two-dimensional electron gas and its time-dependent resistance evolution,** T. Moon[1], H. J. Jung[2], M. H. Park[1], H. J. Kim[1], K. D. Kim[1], Y. H. Lee[1], S. D. Hyun[1], H. W. Park[1], S. W. Lee[2], and C. S. Hwang[1], [1]*Seoul National U., Korea,* [2]*Ajou U., Korea*

5:36 PM 6.18 - **Long-term mechanisms of modifications in surface layers of III-V semiconductor compounds caused by weak magnetic fields,** G. Milenin, R. Red'ko, V. Milenin, *National Academy of Sciences of Ukraine, Ukraine*

5:38 PM 6.19 - **Passivation layer effects on Ge substrate for the higher-k TiO_2 dielectric material application,** D. G. Kim, H. J. Lee, and C. S. Hwang, *Soul National U., Korea*

5:40 PM 6.20 - **Unipolar CMOS Logic for Beyond-Si CMOS-like Circuits,** Z. Liu[1], X. Sun[1,2], and T. P. Ma[1], [1]*Yale U.,* [2]*IBM*

5:42 PM 6.21 - **Probing the Si/HfO_2 Interface by Deep Level Transient Spectroscopy,** A. Kumar[1], S. Mondal[2, 3], K. S. R. Koteswara Rao[3], [1]*Indira Gandhi National Tribal U., India,* [2]*Achhruram Memorial College, India,* [3]*IISc Bangalore, India*

5:44 PM 6.22 - **Stress relaxation in the Si-SiO_2 system and its influence on the interface properties.,** D. Kropman[1], T. Laas[1], V. Seeman[2], A. Medvids[3], and J. Kliava[4], [1]*Tallinn U., Estonia,* [2]*Tartu U., Estonia,* [3]*Riga Technical U., Latvia,* [4]*U. Bordeaux, France*

5:46 PM 6.23 - **High-Voltage ALD Al_2O_3 / Ta_2O_5 Metal/Insulator/Insulator/Metal (MIIM) Diodes,** D. Z. Austin, M. Jenkins, K. Holden, and J. F. Conley Jr, *Oregon State U.*

5:48 PM 6.24 - **Native point defects in the emerging high electron mobility, semiconducting Bi_2O_2Se,** Y. Zhang[1], H. Li[1], S. Wu[1], J. Robertson[2], and L. P. Shi[1], [1]*Tsinghua U., China,* [2]*U. Cambridge, UK*

5:50 PM 6.25 - **Electro-physical properties of gate-last MOSFETs with low-temperature SiO_xN_y/HfO_x stack after ultra-shallow fluorine implantation from RF plasma,** R. Mroczyński and J. Jasiński, *Warsaw U. Technology, Poland*

5:52 PM Adjourn

Poster Session

Session Chairs: M. Passlack and P. C. McIntyre

7:00 PM – 10:00 PM Poster Session

10:00 PM – Midnight Hospitality Room

Friday, December 8, 2017

8:00 AM Morning Announcement and Opening Remarks

Session 7 – New Materials and Methods I

Session Chair: E. Lind

8:05 AM 7.1 *Invited* - **Enabling Continued Device Scaling: An Equipment Supplier's Perspective,** D. Hemker, *Lam Research*

8:40 AM 7.2 - **Discrimination of pre-existing and generated slow traps under electrical stress in Al_2O_3/GeO_x/n-Ge gate stacks with plasma oxidation process,** M. Ke, M. Takenaka, and S. Takagi, *U. Tokyo, Japan*

9:00 AM 7.3 - **Very High Hole Mobility, Low Gate Leakage Current, and Low EOT in Ge pMOSFET by GeO_x Treated with Plasma and Microwave Annealing,** S.-H. Yi, K.-S. Chang-Liao, C.-W. Hsu, J. Huang, T.-Y. Wu, D.-B. Ruan,J.-S. Li, W.-Y. Hsu, and H.-J. Chen, *National Tsing Hua U., Taiwan*

9:20 AM 7.4 - **Ultra-Low Defect Density sub 0.5 nm HfO_2/SiGe Interface Formation via Al Gettering Gate,** M. S. Kavrik[1], E. Thomson[1], E. Chagarov[1], A. Betts[1], K. Tang[2], P. C. McIntyre[2], Q. Wang[3], M. Kim[3], and A. C. Kummel[1], *[1]UCSD, [2]Stanford U., [3]UT Dallas*

9:40 AM 7.5 - **Selective atomic layer deposition of $MoSi_x$ on Si (001) in preference to Silicon Nitride and Silicon Oxide,** J. Y. Choi[1], C. F. Ahles[1], R. Hung[2], N. Kim[2], S. Nemani[2], A. C. Kummel[1], *[1]UCSD, [2]Applied Materials*

10:00 AM Coffee Break

Session 8 – Interface Metrology

Session Chair: M. M. Frank

10:25 AM 8.1 - **A New Approach To Atomic Scale Characterization Of Solid State Electronics: Incorporating Magnetic Resonance Into A Wafer Probing Station,** D. J. McCrory[1], M. A. Anders[1], R. J. Waskiewicz[1], P. M. Lenahan[1], J. P. Campbell[2], J. T. Ryan[2], and A. J. Lelis[3], *[1]Penn State U., [2]NIST, [3]Army Research Lab*

10:45 AM 8.2 - **ESR identification of the nitrogen acceptor in synthetic 2H-MoS_2: dopant level and activation,** A. Stesmans, B. Schoenaers, M. Houssa, and V. V. Afanas’ev, *U. Leuven, Belgium*

11:05 AM 8.3 - **Quantitative imaging of MOS interface trap using local deep level transient spectroscopy based on scanning nonlinear dielectric microscopy,** N. Chinone, Y. Cho, *Tohoku U., Japan*

Session 9 – Interfaces and Wide Bandgap Materials

Session Chair: J. Conley

11:25 AM 9.1 - **Depletion/Enhancement-Mode β-Ga_2O_3 on Insulator (GOOI) Field-Effect Transistors with Drain Currents Exceeding 1.5/1 A/mm,** H. Zhou[1] and P. D. Ye[2], *Purdue U.*

11:45 AM 9.2 - **Buried Channel Normally-off AlGaN/GaN MIS-HEMT with a p-n junction in GaN Buffer,** R. Soman[1], M. Sharma[1], N. Ramesh[1], D. Nath[1], R Muralidharan[1], K. N. Bhat[1], S. Raghavan[1], and N. Bhat[1], *IISc Bangalore, India*

12:05 PM 9.3 - **AlGaN/GaN MOS-HFET with high-quality and robust N-incorporated aluminum oxide (AlON) gate insulator,** K. Watanabe[1], M. Nozaki[1], T. Yamada[1], S. Nakazawa[2], M. Ishida[2], Y. Anda[2], T. Ueda[2], A. Yoshigoe[3], T. Hosoi[1], T. Shimura[1], and H. Watanabe[1], *[1]Osaka U., Japan, [2]Panasonic, Japan, [3]JAEA, Japan*

12:25 PM 9.4 - **Surface transfer doping of diamond/MoO_3 with an Al_2O_3 interface layer,** Y. Yang[1], F. A. Koeck[1], X. Wang[1], H. Surdi[2], S. Chowdhury[2], and R. J. Nemanich[1], *[1]ASU, [2]UC Davis*

12:45 PM Adjourn for Lunch

12:45 PM – 2:15 PM Committee / Invited Speaker Luncheon

Session 10 – Thin Films and Interfaces for Emerging Memory and Logic

Session Chair: M. Passlack

2:15 PM 10.1 *Invited* - **Emerging memories: High density integration challenges,** N. Ramaswamy, *Micron Technology*

2:50 PM 10.2 - **Distinguishing Oxygen Vacancy Electromigration and Conductive Filament Formation in TiO_2 Resistance Switching Using Liquid Electrolyte Contacts,** K. Tang[1], A. C. Meng[1], F. Hui[2], Y. Shi[2], T. A. Petach[1], D. Goldhaber-Gordon[1], M. Lanza[1], and P. C. McIntyre[1], *[1]Stanford U., [2]Soochow U., China*

3:10 PM 10.3 - **Antiparallel and negative voltage dependent multi-level resistive switching characteristics by using Al interfacial layer in Cu/Al/a-CO_x/TiN structure,** S. Ginnaram[1], S. Chakrabarti[1], and S. Maikap[1,2], *[1]Chang Gung U., Taiwan, [2]Chang Gung Memorial Hospital, Taiwan*

3:30 PM 10.4 *Invited* - **Oxide Electronics Harnessing Electronic Phase Transitions,** S. Datta[1], N. Shukla[1], M. Jerry[1], A. Parihar[2], and A. Raychowdhury[2], *[1]U. Notre Dame, [2]Georgia Institute of Technology*

4:05 PM Coffee Break

4:30 PM – 6:00 PM Rump Session - **Interfaces and thin films in modern semiconductor technology**

7:00 PM – 10:00 PM Conference Banquet and Limerick Contest

10:00 PM – Midnight Hospitality Room

Saturday, December 9, 2017

Session 11 – Interfaces in Photovoltaics and Optoelectronics

Session Chair: P. C. McIntyre

8:00 AM 11.1 *Invited* - **Interfaces and contacts in next generation silicon photovoltaics,** P. Stradins, W. Nemeth, and S. Harvey, *NREL*

8:35 AM 11.2 - **Atomic Layer Deposited TiO_2-IrO_x Alloys Generate High Photovoltage for Silicon Photoanodes,** O. L. Hendricks, C. E. D. Chidsey, and P. C. McIntyre, *Stanford U.*

8:55 AM 11.3 - **Indium Oxide-based Photo Field-Effect Transistor with Polymeric Photosensitive Gate,** R. M. Imenabadi, M. L. Van de Put, T. B. Daunis, L. Xu, L. N. S. Murthy, J. W. P. Hsu, and W. G. Vandenberghe, *UT Dallas*

9:15 AM 11.4 - **Surface texturing of GaAs with anisotropic chemical etching and interfacial metal catalysts,** K. Kim and J. Oh, *Yonsei U., Korea*

9:35 AM Coffee Break

Session 12 – New Materials and Methods II

Session Chair: A. C. Kummel

10:00 AM 12.1 - **Demonstration of a large V_{fb} shift induced by selectively formed multiple dipole layers in Al_2O_3/SiO_2 laminated dielectric stacks,** H. Kamata and K. Kita, *U. Tokyo, Japan*

10:20 AM 12.2 - **Analysis of Interface Trap States Generated by the Self-Heating Effect in Highly Flexible Single-Crystalline Si Nanomembrane Transistors,** J. H. Bong[1], S. Y. Kim[1], C. B. Jeong[2], K. S. Chang[2], W. S. Hwang[3], and B. J. Cho[1], *[1]KIST, Korea, [2]Korea Basic Science Institute, Korea, [3]Korea Aerospace U., Korea*

10:40 AM 12.3 - **Effect and Measurement of Band Edge Sharpness for InGaAsSb/InAs Tunnel FETs,** E. Lind, E. Memisevic, M. Hellenbrand, and L.-E. Wernersson, *Lund U., Sweden*

11:00 AM 12.4 - **Relationship between interface state generation and substrate hole current in InGaAs n-channel MOSFETs,** S.-H. Yoon[1], D.-H. Ahn[1], M. Takenaka[1], and S. Takagi[1], *U. Tokyo, Japan*

Session 13 – 2D Materials and Interfaces II

Session Chair: I. Radu

11:20 AM 13.1 *Invited* - **Band-to-band tunneling devices from two-dimensional materials,** A. Prakash, P. Wu, and J. Appenzeller, *Purdue U.*

11:55 AM 13.2 - **High Hole Mobility, Back-End-of-Line Compatible WSe_2 FETs Grown by MBE on ALD Oxides,** R. Yue[1], P. Paletti[2], Y. Nie[1], L. A. Walsh[1], L. Liu[2], M. A. Heidarlou[2], R. Addou[1], C. Smyth[1], A. T. Barton[1], J. Kim[1], L. Colombo[3], and R. M. Wallace[1], K. Cho[1], A. Seabaugh[2], and C. L. Hinkle[1], *[1]UT Dallas, [2]U. Notre Dame, [3]Texas Instruments*

12:15 PM 13.3 - **Synthesis and Electrical Characterization of Monolayer Tungsten Diselenide,** Z. Yao, J. Liu, K. Xu, E. Chow, and W. Zhu, *UIUC*

11:35 PM 13.4 - **Effects of Growth and Processing Conditions on Contacts to $MoSe_2$ and $MoTe_2$,** C. M. Smyth[1], R. Addou[1], S. McDonnell[2], M. J. Mleczko[3], E. Pop[3], C. L. Hinkle[1], and R. M. Wallace[1], *[1]UT Dallas, [2]U. Virginia, [3]Stanford U.*

12:55 PM Closing Remarks and Adjourn

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