

# **2018 18th International Workshop on Junction Technology (IWJT 2018)**

**Shanghai, China  
8-9 March 2018**



**IEEE Catalog Number: CFP18796-POD  
ISBN: 978-1-5386-4514-7**

**Copyright © 2018 by the Institute of Electrical and Electronics Engineers, Inc.  
All Rights Reserved**

*Copyright and Reprint Permissions:* Abstracting is permitted with credit to the source. Libraries are permitted to photocopy beyond the limit of U.S. copyright law for private use of patrons those articles in this volume that carry a code at the bottom of the first page, provided the per-copy fee indicated in the code is paid through Copyright Clearance Center, 222 Rosewood Drive, Danvers, MA 01923.

For other copying, reprint or republication permission, write to IEEE Copyrights Manager, IEEE Service Center, 445 Hoes Lane, Piscataway, NJ 08854. All rights reserved.

***\*\*\* This is a print representation of what appears in the IEEE Digital Library. Some format issues inherent in the e-media version may also appear in this print version.***

IEEE Catalog Number:	CFP18796-POD
ISBN (Print-On-Demand):	978-1-5386-4514-7
ISBN (Online):	978-1-5386-4513-0

**Additional Copies of This Publication Are Available From:**

Curran Associates, Inc  
57 Morehouse Lane  
Red Hook, NY 12571 USA  
Phone: (845) 758-0400  
Fax: (845) 758-2633  
E-mail: [curran@proceedings.com](mailto:curran@proceedings.com)  
Web: [www.proceedings.com](http://www.proceedings.com)

CURRAN ASSOCIATES INC.  
**proceedings**  
.com

## Table of Contents

<b>Mar. 8 (Thur.) 08:30-09:00</b>	<b>Opening</b> (Room 102, 1 <sup>st</sup> floor, East Auxiliary Building Affiliated to Guanghua Building)	
<b>Mar. 8 (Thur.) 09:00-10:30</b>	<b>Plenary Session</b> (Room 102, 1 <sup>st</sup> floor, East Auxiliary Building Affiliated to Guanghua Building)	
<b>Co-Chairs:</b>	Bing-Zong Li, Fudan University, China Mizuno Bunzi, Panasonic, Japan	
<b>K1</b>	<b>Advanced Implant Application for 7nm and Beyond</b>	<b>1</b>
<b>9:00</b>	Wei (David) Zou, Kyu-Ha Shim and Todd Henry	
<b>(Keynote)</b>	AMAT, USA	
<b>K2</b>	<b>Impact of the end of CMOS miniaturization on ICT and the world after that</b>	<b>2</b>
<b>9:45</b>	Hiroshi Iwai	
<b>(Keynote)</b>	Tokyo Institute of Technology, Japan	
<b>Coffee Break (10:30-10:45)</b>		
<b>Mar. 8 (Thur.) 10:45-12:00</b>	<b>Characterization for Shallow Junction</b> (Room 102, 1 <sup>st</sup> floor, East Auxiliary Building Affiliated to Guanghua Building)	
<b>Chair:</b>	Kyoichi Suguro, Toshiba, Japan	
<b>S01-01</b>	<b>Analyses of 3D Atomic Arrangements of Impurity Atoms Doped in Silicon by Spectro-Photoelectron Holography Technique</b>	<b>7</b>
<b>10:45</b>	Kazuo Tsutsui <sup>1</sup> , Tomohiro Matsushita <sup>2</sup> , Takayuki Muro <sup>2</sup> , Yoshitada Morikawa <sup>3</sup> , Kotaro Natori <sup>4</sup> , Takuya Hoshii <sup>4</sup> , Kuniyuki Kakushima <sup>4</sup> , Hitoshi Wakabayashi <sup>4</sup> , Kouichi Hayashi <sup>5</sup> , Fumihiko Matsui <sup>6</sup> , and Toyohiko Kinoshita <sup>2</sup>	
<b>(Invited)</b>	<sup>1</sup> Institute of Innovative Research, Tokyo Institute of Technology, Japan; <sup>2</sup> Japan Synchrotron Radiation Research Institute (JASRI), Japan; <sup>3</sup> Osaka University, Japan; <sup>4</sup> School of Engineering, Tokyo Institute of Technology, Japan; <sup>5</sup> Nagoya Institute of Technology, Japan; <sup>6</sup> Nara Institute of Science and Technology, Japan	
<b>S01-02</b>	<b>Junction profiling on hot carrier stressed device by dual lens electron holography and scanning capacitance microscopy</b>	<b>13</b>
<b>11:15</b>	Y.Y. Wang <sup>1</sup> , J. Nxumalo <sup>1</sup> , D. Ioannou <sup>1</sup> , A. Katnani <sup>1</sup> , J. Jeon <sup>1</sup> , K. Bandy <sup>1</sup> , M. McDonald <sup>1</sup> , J. Bruley <sup>2</sup>	
	<sup>1</sup> Globalfoundries Inc., USA; <sup>2</sup> IBM T. J. Watson Research Center, USA	
<b>S01-03</b>	<b>Characterizing Junction Profiles in Ge Photodetectors using Scanning Capacitance Microscopy (SCM) and Electron Holography</b>	<b>17</b>
<b>11:30</b>	J. N. Nxumalo <sup>1</sup> , Y.Y. Wang <sup>2</sup> , M. Iwatake <sup>2</sup> , C. Molella <sup>1</sup> , A. Katnani <sup>2</sup> , J. Orcutt <sup>3</sup> , J. Ayala <sup>2</sup> , K. Nummy <sup>2</sup>	
	<sup>1</sup> GlobalFoundries Inc., USA; <sup>2</sup> GlobalFoundries Inc., USA; <sup>3</sup> IBM Thomas J. Watson Research Center, USA	
<b>S01-04</b>	<b>Effect of Stress on Activation during the Formation of np Junction in Co-Implanted Germanium</b>	<b>21</b>
<b>11:45</b>	Nur Nadhirah Rashid <sup>1</sup> , Umar Abdul Aziz <sup>1</sup> , Siti Rahmah Aid <sup>1</sup> , Suwa Akira <sup>2</sup> , Hiroshi Ikenoue <sup>2</sup> , Fang Xie <sup>3</sup> and Anthony Centeno <sup>4</sup>	

<sup>1</sup>Universiti Teknologi, Malaysia; <sup>2</sup>Kyushu University, Japan; <sup>3</sup>Imperial College London, United Kingdom; <sup>4</sup>Xi'an Jiaotong Liverpool University, China

Mar. 8 (Thur.) 13:30-15:15	<b>Annealing Technology</b> (Room 102, 1 <sup>st</sup> floor, East Auxiliary Building Affiliated to Guanghua Building)		
<b>Co-Chairs:</b>	Paul J. Timans, Mattson Thermal Products GmbH, Germany S. Boninelli, IMM-CNR, Italy		
<b>S02-01</b>	<b>Activation of High-temperature-implanted Phosphorus Atoms in 4H-SiC by Atmospheric Pressure Thermal Plasma Jet Annealing</b>	<b>24</b>	
<b>13:30</b>	H. Hanafusa and S. Higashi		
<b>(Invited)</b>	Hiroshima University, Japan		
<b>S02-02</b>	<b>Activation Trends in Millisecond Annealing of Heavy n-Type Doping of Silicon</b>	<b>28</b>	
<b>14:00</b>	Paul J. Timans		
<b>(Invited)</b>	Mattson Thermal Products GmbH, Germany		
<b>S02-03</b>	<b>Damage recovery and strain induced by Phosphorous in Laser Annealed Ge</b>	<b>32</b>	
<b>14:30</b>	S. Boninelli <sup>1</sup> , and F. Cristiano <sup>2</sup>		
<b>(Invited)</b>	<sup>1</sup> IMM-CNR, Italy; <sup>2</sup> LAAS-CNRS, France		
<b>S02-04</b>	<b>High Activation Reaching Supersaturation Achieved by Short-Duration Flash Lamp Annealing</b>	<b>33</b>	
<b>15:00</b>	Hideaki Tanimura, Kenji Inoue, Hikaru Kawarazaki, Takahiro Yamada, Kazuhiko Fuse, Takayuki Aoyama, Shinichi Kato and Ippei Kobayashi SCREEN Semiconductor Solutions Co., Ltd., Japan		
<b>Coffee Break (15:15-15:30)</b>			
Mar. 8 (Thur.) 15:30-17:30	<b>Junction and Contact Technologies for Compound Semiconductors</b> (Room 102, 1 <sup>st</sup> floor, East Auxiliary Building Affiliated to Guanghua Building)		
<b>Co-Chairs:</b>	Hongyu Yu, Southern University of Science and Technology, China Philippe Rodriguez, Univ. Grenoble Alpes, France		
<b>S03-01</b>	<b>Au-based and Au-free Ohmic Contacts to AlGaIn/GaN Structures on Silicon or Sapphire Substrates</b>	<b>37</b>	
<b>15:30</b>	Wenmao Li <sup>1,2</sup> , Jian Zhang <sup>3</sup> , Robert Sokolovskij <sup>1,2,4,5</sup> , Yumeng Zhu <sup>1,2</sup> , Yongle Qi <sup>1,2</sup> , Xinpeng Lin <sup>1,2</sup> , Jingyi Wu <sup>1,2</sup> , Lingli Jiang <sup>1,2</sup> , Hongyu Yu <sup>1,2</sup>		
<b>(Invited)</b>	<sup>1</sup> Southern University of Science and Technology, China; <sup>2</sup> Shenzhen Key Laboratory of the Third Generation Semi-conductor, China; <sup>3</sup> Fudan University, China; <sup>4</sup> Delft University of Technology, the Netherlands; <sup>5</sup> State Key Laboratory of Solid State Lighting, China		
<b>S03-02</b>	<b>CMOS-Compatible Contact Technology for Si Photonics</b>	<b>41</b>	
<b>16:00</b>	Philippe Rodriguez <sup>1</sup> , Elodie Ghegin <sup>2</sup> , and Fabrice Nemouchi <sup>3</sup>		
<b>(Invited)</b>	<sup>1</sup> Univ. Grenoble Alpes, France; <sup>2</sup> CEA-LETI, France; <sup>3</sup> STMicroelectronics, France		
<b>S03-03</b>	<b>Characterization of b-Ga<sub>2</sub>O<sub>3</sub> Schottky Barrier Diodes</b>	<b>47</b>	
<b>16:30</b>	T. Kaneko <sup>1</sup> , I. Muneta <sup>1</sup> , T. Hoshii <sup>1</sup> , H. Wakabayashi <sup>1</sup> , K. Tsutsui <sup>2</sup> , H. Iwai <sup>2</sup> , K. Kakushima <sup>1</sup> <sup>1</sup> School of Engineering, Tokyo Institute of Technology, Japan; <sup>2</sup> Institute of Innovative Research, Tokyo Institute of Technology, Japan		
<b>S03-04</b>	<b>Effect of Deep Level Traps on the I-V and C-V Characteristics of InP/InGaAs Heterojunction</b>	<b>50</b>	
<b>16:45</b>	Man-Li Zhao, Hong-Liang Lu, Yu-Ming Zhang, Yi-Men Zhang, Xiao-Hong Zhao Xidian University, China		

S03-05	<b>The effect of ZnO Interface Passivation Layer on Leakage Current Mechanisms and Band Alignment for ZrO<sub>2</sub>/In<sub>0.2</sub>Ga<sub>0.8</sub>As Metal Oxide Semiconductor Capacitor</b>	N/A
17:00	TongYang, Hong-liang Lu, Chen Liu, Wei-jian Yu, Yu-ming Zhang, Yi-men Zhang Xidian University, China	
S03-06	<b>Optimized transport properties of GaN MISHEMTs with thin AlN interlayer</b>	59
17:15	Qianlan Hu, Sichao Li, Tiaoyang Li, Xin Wang, and Yanqing Wu Huazhong University of Science and Technology, China	
Mar. 9 (Fri.) 08:30-10:00	<b>Doping Technology</b> (Room 102, 1 <sup>st</sup> floor, East Auxiliary Building Affiliated to Guanghai Building)	
Chair:	Hiro Ito, AMAT, Japan	
S04-01	<b>H<sub>2</sub> PLAD Hydrogenation Process on 3D NAND Array Poly-Si Access Devices</b>	61
8:30	Shu Qin	
(Invited)	QinTek, Co., USA	
S04-02	<b>Monolayer doping and other strategies in high surface-to-volume ratio silicon devices</b>	65
9:00	Ray Duffy <sup>1</sup> , Noel Kennedy <sup>2</sup> , Gioele Mirabelli <sup>1</sup> , Emmanuele Galluccio <sup>1</sup> , Paul K. Hurley <sup>1,2</sup> , Justin D. Holmes <sup>2,3</sup> , and Brenda Long <sup>2</sup>	
(Invited)	<sup>1</sup> Tyndall National Institute, Ireland; <sup>2</sup> University College Cork, Ireland. <sup>3</sup> Trinity College Dublin, Ireland.	
S04-03	<b>Enhancing Phosphorous Doping Level on Ge by Sb co-Doping with Non-Beamline Implantation Methods</b>	71
9:30	Chuck Paeng, He Zhang, Bodo Kalkofen*, and YS Kim Lam Research Corp., USA; *U. Magdeburg Otto-von-Guericke	
S04-04	<b>Atomic layer deposited solid sources for doping of high aspect ratio semiconductor structures</b>	75
9:45	Bodo Kalkofen <sup>1</sup> , Mindaugas Šilinskas <sup>1</sup> , Marco Lisker <sup>2</sup> , Y. S. Kim <sup>3</sup> , and Edmund P. Burt <sup>1</sup> <sup>1</sup> Otto von Guericke University, Germany; <sup>2</sup> IHP, Germany; <sup>3</sup> Lam Research Corporation, USA	
Coffee Break (10:00-10:15)		
Mar. 9 (Fri.) 10:15-11:45	<b>Metal/Semiconductor Contact Technology for CMOS</b> (Room 102, 1 <sup>st</sup> floor, East Auxiliary Building Affiliated to Guanghai Building)	
Co-Chairs:	Kuniyuki Kakushima, Tokyo Institute of Technology, Japan Hao Yu, IMEC, Belgium	
S05-01	<b>On the manifestation of Ge Pre-amorphization Implantation (PAI) Impact on Both the Formation of Ultrathin TiSix and the Specific Contact Resistivity in TiSix/n-Si Contacts for sub-16/14 nm nodes and beyond</b>	79
10:15	Jun Luo <sup>a,b</sup> , Shujuan Mao <sup>a,b</sup> , Jing Xu <sup>a</sup> , Guilei Wang <sup>a</sup> , Dan Zhang <sup>a,b</sup> , Xue Luo <sup>a,b</sup> , Ningyuan Duan <sup>a,b</sup> , Shi Liu <sup>a</sup> , Wenwu Wang <sup>a,b</sup> , Dapeng Chen <sup>a</sup> , Junfeng Li <sup>a</sup> , Chao Zhao <sup>a,b</sup> , Tianchun Ye <sup>a,b</sup>	
(Invited)	<sup>a</sup> Institute of Microelectronics, Chinese Academy of Sciences, China; <sup>b</sup> University of Chinese Academy of Sciences (UCAS), China	
S05-02	<b>Titanium (Germano-)Silicides Featuring 10<sup>-9</sup> Ω·cm<sup>2</sup> Contact Resistivity and Improved Compatibility to Advanced CMOS Technology</b>	80
10:45	Hao Yu <sup>1,2</sup> , Marc Schaekers <sup>1</sup> , Soon Aik Chew <sup>1</sup> , Jean-Luc Everaert <sup>1</sup> , Naoto Horiguchi <sup>1</sup> , Dan Mocuta <sup>1</sup> , Nadine Collaert <sup>1</sup> , Kristin De Meyer <sup>1,2</sup>	

(Invited)	<sup>1</sup> Imec, Belgium; <sup>2</sup> K. U. Leuven, Belgium		
S05-03	Improved thermal stability of Al/TiO2/n-Ge ohmic contact by inserting single layer graphene		85
11:15	Yi Zhang, Genquan Han, Jiabo Chen, Yan Liu, Jincheng Zhang, and Yue Hao Xidian University, China.		
S05-04	Effect of platinum interlayer on the thermal stability improvement of nickel stanogermanide		88
11:30	Weijun Wan <sup>1,2</sup> , Wei Ren <sup>1</sup> , Xiaoran Meng <sup>2,3</sup> , Yunxia Ping <sup>3</sup> , Xing Wei <sup>2</sup> , Zhongying Xue <sup>2</sup> , Wenjie Yu <sup>2</sup> , Miao Zhang <sup>2</sup> , Zengfeng Di <sup>2</sup> , Bo Zhang <sup>2</sup> <sup>1</sup> Shanghai University, China; <sup>2</sup> Shanghai Institute of Microsystem and Information Technology, Chinese Academy of Sciences, China; <sup>3</sup> Shanghai University of Engineering Science, China		
Mar. 9 (Fri.)	Contact and Junction Technologies for photon-electron interaction (Room 102, 1 <sup>st</sup> floor, East Auxiliary Building Affiliated to Guanghua Building)		
13:30-15:45			
Co-Chairs:	Kenji Araki, Toyota Technological Institute, Japan Hitoshi Wakabayashi, Tokyo Institute of Technology, Japan		
S06-01	Novel photodetector based on FD-SOI substrate with interface coupling effect		91
13:30	J. Wan <sup>1</sup> , JN. Deng <sup>1</sup> , XY. Cao <sup>1</sup> , H. B. Liu <sup>1</sup> , B. R. Lu <sup>1</sup> , Y. F. Chen <sup>1</sup> , A. Zaslavsky <sup>2</sup> , S. Cristoloveanu <sup>3</sup> and M. Bawedin <sup>3</sup>		
(Invited)	<sup>1</sup> Fudan University, China; <sup>2</sup> Brown University, USA; <sup>3</sup> IMEP-LAHC, France		
S06-02	Opportunities for breaking an energy generation limit of photovoltaic using multijunction and super-multijunction cells		95
14:00	Kenji Araki, Kan-Hua Lee, and Masafumi Yamaguchi,		
(Invited)	Toyota Technological Institute, Japan		
S06-03	Light Plastic Integrated Micro CPV Module: PIC with Three-Junction PV cells		99
14:30	Michihiko Takase, Masaharu Terauchi, Nobuhiko Hayashi, Hikaru Nishitani, Takuji Inohara, Youichirou Aya, Shutetsu Kanayama and Bunji Mizuno		
(Invited)	Panasonic Corporation, Japan		
S06-04	Interfacial passivation by LiF or PbF2 for high efficiency perovskite solar cell		102
15:00	Yiqiang Zhan		
(Invited)	Fudan University, China		
S06-05	Photodetector Based on Silicon-on-Insulator with High Responsivity		103
15:30	X. Y. Cao <sup>1,2</sup> , HB.Liu <sup>1</sup> , JN.Deng <sup>1</sup> , WS.Lin <sup>2</sup> ,and J. Wan <sup>1</sup> <sup>1</sup> Fudan University, China; <sup>2</sup> Shanghai University of Engineering Science, China		
Coffee Break (15:45-16:00)			
Mar. 9 (Fri.)	Modeling and Simulation (Room 102, 1 <sup>st</sup> floor, East Auxiliary Building Affiliated to Guanghua Building)		
16:00-16:45			
Chair:	Dong-Ping Wu, Fudan University, China		
S07-01	Parasitic Resistance Modeling and Optimization for 10nm-node FinFET		107
16:00	Xicheng Duan, Peng Lu, Weicong Li, Jason C.S. Woo University of California, USA		
S07-02	Simulation of Ge/(Si)GeSn Hetero-junction Tunnel FETs with Suppressed Ambipolar Current <sup>6</sup>		111
16:15	Yongwang Zhang, Suyuan Wang, Jun Zheng, Chunlai Xue, Chuanbo Li, Yuhua Zuo, Buwen		

	Cheng, Qiming Wang Institute of Semiconductors, Chinese Academy of Sciences and University of Chinese Academy of Sciences	
<b>S07-03</b>	<b>Thermal Failure and Voltage Overshoot Models for Diode Behavior under Electrostatic Discharge Stresses</b>	<b>115</b>
<b>16:30</b>	Hang Li <sup>1</sup> , Yuanzhong Zhou <sup>2</sup> , Meng Miao <sup>1</sup> , Javier A. Salcedo <sup>2</sup> , Jean-Jacques Hajjar <sup>2</sup> , and Kalpathy B. Sundaram <sup>1</sup> <sup>1</sup> University of Central Florida, USA; <sup>2</sup> Analog Devices, Inc., USA	
<b>Mar. 9 (Fri.) 16:45-18:00</b>	<b>Junction and Process Technology for Novel MOS Device Structures (Room 102, 1<sup>st</sup> floor, East Auxiliary Building Affiliated to Guanghua Building)</b>	
<b>Chair:</b>	Jing Wan, Fudan University, China	
<b>S08-01</b>	<b>Gate stack and Ni(SiGeSn) metal contacts formation on low bandgap strained (Si)Ge(Sn) semiconductors</b>	<b>119</b>
<b>16:45</b>	D. Buca <sup>1</sup> , C. Schulte-Braucks <sup>1</sup> , N. von den Driesch <sup>1</sup> , A. T. Tiedemann <sup>1</sup> , U. Breuer <sup>2</sup> , J.M. Hartmann <sup>3</sup> , P. Zaumseil <sup>4</sup> , S. Mantl <sup>1</sup> and Q.T. Zhao <sup>1</sup>	
<b>(Invited)</b>	<sup>1</sup> Peter Grünberg Institute (PGI 9) and JARA-FIT, Forschungszentrum, Germany; <sup>2</sup> Central Division of Analytical Chemistry (ZCH), Forschungszentrum, Germany; <sup>3</sup> CEA-LETI, France; <sup>4</sup> IHP, Germany	
<b>S08-02</b>	<b>High-performance heterojunctions based on 2D semiconductors</b>	<b>120</b>
<b>17:15</b>	Mingqiang Huang, Xiong Xiong and Yanqing Wu	
<b>(Invited)</b>	Huazhong University of Science and Technology, China	
<b>S08-03</b>	<b>Highly Selective Etch of Silicon Dioxide with Tungsten Hard Mask Deposited by PVD Process</b>	<b>122</b>
<b>17:45</b>	Yuanhui Fang, Jian Zhang, and Yu-Long Jiang Fudan University, China	
<b>Author Index</b>		<b>125</b>