

# **International Conference on Semiconductor Technology for Ultra-Large Scale Integrated Circuits and Thin Film Transistors VI (ULSIC vs TFT 6)**

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**Editors:**

**Yue Kuo**

**Olivier Bonnaud**

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## **Monday, May 22, 2017**

07:30 - 08:30 Breakfast

08:30 - 08:40 Introductions  
Yue Kuo, Conference Chair  
Norman Li, ECI Liaison

### **IC + TFT Technologies**

**Session Chairs:** Yue Kuo, Texas A&M University, USA  
Olivier Bonnaud, IETR Univ-Rennes 1, France

08:40 - 09:10 **Gravimetric and biological sensors based on SAW and FBAR technologies .....1**  
William Milne, Cambridge University, United Kingdom  
*Girish Rughoobur, Mario de Miguel Ramos, I.Miele, A.J.Flewitt, Cambridge University, United Kingdom; T.Mirea, M.Clement, J.Olivares, B. Diaz-Duran, J.Sangrador, E.Iborra Universidad Politcnica de Madrid, Spain*

09:10 - 09:40 **TFT & ULSIC: Interfacing large-area thin-film sensor arrays with CMOS circuits .....2**  
Sigurd Wagner, Princeton University, USA  
*Yasmin Afsar, Tiffany Moy, Josue Sanz-Robinson, Warren Rieutort-Louis, Yingzhe Hu, Liechao Huang, James C. Sturm, Naveen Verma, Princeton University, USA*

09:40 - 10:10 **Large scale graphene integration for silicon technologies .....3**  
Andreas Mai, IHP, Germany  
*Marco Lisker, Mindaugas Lukosius, Grzegorz Lupina, IHP, Germany*

10:10 - 10:40 **SiGeSn/GeSn hetero- and multiple quantum well structures for optoelectronics on Si .....4**  
Detlev Grützmacher, Forschungszentrum Jülich, Germany  
*Nils von den Driesch, Daniela Stange, Dan Buca, Forschungszentrum Jülich, Germany*

10:40 - 11:10 Coffee Break

### **TFT non-display applications**

**Session Chairs:** Gennadi Bersuker, The Aerospace Corporation, USA  
Sigurd Wagner, Princeton University, USA

11:10 - 11:40 **Neuromorphic application of oxide semiconductors .....5**  
Mutsumi Kimura, Ryukoku University, Japan  
*Tokiyoshi Matsuda, Ryukoku University, Japan; Tomoya Kameda, Yasuhiko Nakashima, Nara Institute of Science and Technology, Japan*

**Monday, May 22, 2017 (continued)**

- 11:40 - 12:10      **Brain-like synapse thin-film transistors using oxide semiconductor channels and solid electrolytic gate insulators .....6**  
Sung-Min Yoon, Kyung Hee University, South Korea  
*Yeo-Myeong Kim, Eom-Ji Kim, Kyung Hee University, South Korea*
- 12:10 - 12:40      **Visible and near-infrared photo-detector combining polysilicon TFT and PbS quantum dots .....7**  
Tayeb Mohammed-Brahim, Rennes 1 University, France  
*Emmanuel Jacques, Rennes 1 University, France; Xiang Liu, Lei Wei, Southeast University, China*
- 12:45 - 14:00      Lunch
- 14:00 - 14:30      **Oxide TFTs for digital holography .....8**  
Chi-Sun Hwang, ETRI, South Korea
- 14:30 - 14:50      **Low-power display system enabled by combining oxide semiconductor and neural network technologies .....9**  
Hitoshi Kunitake, Semiconductor Energy Laboratory Co., Ltd., Japan  
*Shintaro Harada, Fumika Akasawa, Yuki Okamoto, Takashi Nakagawa, Takeshi Aoki, Seiichi Yoneda, Hiroki Inoue, Munehiro Kozuma, Takayuki Ikeda, Yoshiyuki Kurokawa, Shunpei Yamazaki, Semiconductor Energy Laboratory Co., Ltd., Japan*
- 14:50 - 15:10      **Atomic layer deposition: Low temperature process well adapted to ULSI and TFT technologies .....11**  
Ahmad Chaker, University Grenoble Alpes, CNRS, France  
*Pierre Szkutnik, Patrice Gonon, Christophe Vallée, Ahmad Bsiesy, University Grenoble Alpes, CNRS, France*
- 15:10 - 19:00      *ad hoc sessions / Free time*  
  
(Optional) Tour of historic Schloss Hernstein 15:15 – 16:15 (conducted by Peter Glaser)  
Meet at lobby reception at 15:15
- 19:00 - 20:15      Dinner
- 20:15 - 21:45      **Panel Discussion: IC vs, TFT Applications** (followed by social hour)

**Tuesday, May 23, 2017**

07:30 - 08:30 Breakfast

**2D & Novel devices**

**Session Chairs:** William Milne, Cambridge University, United Kingdom  
Chi-Sun Hwang, ETRI, South Korea

08:30 - 09:00 **Gap engineering and reliability study for 2D electronics .....12**  
Kosuke Nagashio, The University of Tokyo, Japan

09:00 - 09:30 **Integration of 2D materials for advanced devices: Challenges and opportunities .....13**  
Robert M. Wallace, University of Texas at Dallas, USA

09:30 - 10:00 **Photoemission study of gate dielectrics on gallium nitride .....14**  
Seiichi Miyazaki, Nagoya University, Japan  
*Nguyen Xuan Truyen, Akio Ohta, Nagoya University, Japan*

10:00 - 10:30 **Multifunctional amorphous metal oxide thin films – Structure transformation for various functions .....15**  
Yue Kuo, Texas A&M University, USA

10:30 - 11:00 Coffee Break

**Flexible and memory TFTs**

**Session Chairs:** Junichi Murota, Tohoku University, Japan  
Andrew Flewitt, Cambridge University, United Kingdom

11:00 - 11:30 **Oxide thin film transistors for flexible devices .....16**  
Yukiharu Uraoka, Nara Institute of Science and Technology, Japan  
*Juan Paolo Bermundo, Mami Fujii, Mutsunori Uenuma, Yasuaki Ishikawa, Nara Institute of Science and Technology, Japan*

11:30 - 12:00 **Low-temperature processed InGaZnO MES-FET for flexible device applications .....17**  
Mamoru Furuta, Kochi University of Technology, Japan  
*Shinsuke Hashimoto, Kenichiro Hamada, Yusaku Magari, Kochi University of Technology, Japan*

12:00 - 12:30 **Oxide semiconductor based charge trap device for vertically integrated NAND flash memory .....18**  
Cheol Seong Hwang, Seoul National University, South Korea

12:30 - 13:00 **Oxide thin films for sustainable, multifunctional and flexible electronics .....19**  
Pedro Barquinha, CEMOP-UNINOVA, Portugal  
*Pydi Bahubalindrani, Okhla Industrial Estate, India*

13:15 - 13:30 Boxed Lunch (pick up in reception lobby)

**Tuesday, May 23, 2017 (continued)**

- 13:30 - 18:30            Excursion to Vienna / *ad hoc* sessions
- 19:00 - 20:00            Dinner
- 20:00 - 20:30            **TFT and ULSI technologies: The parallel evolution of the research and the higher education in France .....20**  
Olivier Bonnaud, University of Rennes 1 & GIP-CNFM, France
- 20:30 - 21:00            **Devices in advanced technology nodes: Application-specific characterization .....42**  
Gennadi Bersuker, The Aerospace Corporation, USA
- 21:00 - 22:30            **Panel Discussion: Challenges in solid state science & technology learning** (followed by social hour)

**Wednesday, May 24, 2017**

07:30 - 08:30 Breakfast

**Fabrication, reliability, materials I**

**Session Chairs:** Olivier Bonnaud, IETR Univ-Rennes 1, France  
Mamoru Furuta, Kochi University of Technology, Japan

08:30 - 09:00 **Atomically controlled processing for dopant segregation in CVD silicon and germanium epitaxial growth .....43**  
Junichi Murota, Tohoku University, Japan  
*Yuji Yamamoto, Ioan Costina, IHP, Germany; Bernd Tillack, IHP and TU Berlin, Germany; Vinh Le Thanh, Aix Marseille University, France; Roger Loo, Matty Caymax, imec, Belgium*

09:00 - 09:30 **Carrier density dependent energy band-gap and phonon frequency in Ge.....44**  
Akira Toriumi, University of Tokyo, Japan

09:30 - 10:00 **Electrically detected magnetic resonance in SiC MOSFETs utilizing multiple techniques .....45**  
Patrick M. Lenahan, Pennsylvania State University, USA  
*Mark A. Anders, Pennsylvania State University, USA*

10:00 - 10:30 **Recent key developments in nanoscale reliability and failure analysis techniques for advanced nanoelectronics devices .....46**  
Kin Leong Pey, Singapore University of Technology and Design, Singapore  
*A. Ranjan, S. Mei, Singapore University of Technology and Design and A\*STAR, Singapore; N. Raghavan, K. Shubhakar, Singapore University of Technology and Design, Singapore; M. Bosman, S.J. O'Shea, A\*STAR, Singapore*

10:30 - 11:00 Coffee Break

**Fabrication, reliability, materials II**

**Session Chairs:** Akira Toriumi, University of Tokyo, Japan  
Patrick M. Lenahan, Pennsylvania State University, USA

11:00 - 11:30 **Model prediction of stochastic effects of plasma-induced damage in advanced electronic devices .....47**  
Koji Eriguchi, Kyoto University, Japan

11:30 - 12:00 **Advances in large PECVD processing technology up to Gen 11 for TFT LCD and OLED .....48**  
Yi Cui, Applied Materials, Inc., USA  
*Beom Soo Park, Gaku Furuta, Jinhyun Cho, Soo Young Choi, Robin Tiner, Allen Lau, Suhail Anwar, Applied Materials, Inc., USA*

**Wednesday, May 24, 2017 (continued)**

- 12:00 - 12:30      **Printed poly-Si TFTs on paper via liquid-Si .....49**  
*Ryoichi Ishihara, Delft University of Technology, Netherlands*  
*Miki Trifunovic, Paolo Sberna, Delft University of Technology, Netherlands;*  
*Tatsuya Shimoda, Japan Advanced Institute of Science and Technology, Japan*
- 12:30 - 14:00      Lunch
- 14:00 - 14:30      **Role of carrier injection in degradation of amorphous oxide films .....50**  
*Alexander Shluger, University College London, United Kingdom*  
*David Gao, Jack Strand, Oliver Dicks, University College London, United*  
*Kingdom; Moloud Kaviani, WPI-Advanced Institute for Materials Research,*  
*Japan*
- 14:30 - 15:00      **Equilibrium mobility in IGZO TFT: Existence of the intermediate  
boolechand phase? .....51**  
*Dieter G. Ast, Cornell University, USA*
- 15:00 - 17:30      Free time for recreation / discussions
- 17:30 - 18:30      **Panel Discussion: Challenges in giga and nano fabrication /Free  
Discussions**
- 19:00 - 21:00      Reception & Banquet



**Thursday, May 25, 2017**

07:30 - 08:30 Breakfast

**IC Memories**

**Session Chairs:** Michael Shur, Rensselaer Polytechnic Institute, USA  
Yukiharu Uraoka, Nara Institute of Science and Technology,  
Japan

08:30 - 09:00 **Single defect characterization at Si/SiO<sub>2</sub> interface .....84**  
Toshiaki Tsuchiya, Shimane University, Japan

09:00 - 09:30 **Trapping mechanism of charge trap capacitor with Al<sub>2</sub>O<sub>3</sub>/High-k/Al<sub>2</sub>O<sub>3</sub> multilayer .....85**  
Toshihide Nabatame, National Institute for Materials Science, Japan

09:30 - 10:00 **Two-terminal vertical thyristor-based capacitorless memory cells using latch-up features .....86**  
Min-Won Kim, Hanyang University, South Korea  
*Seung-Hyun Song, Sang-Dong Yoo, Tae-Hun Shim, Jin Pyo Hong, Jea-Gun Park, Hanyang University, South Korea*

10:00 - 10:30 **Advanced measurement techniques for the characterization of ReRAM devices .....87**  
Albert Crespo-Yepes, Universitat Autònoma de Barcelona, Spain  
*M. Nafria, R. Rodriguez, M. Porti, J. Martin-Martinez, S. Claramunt, X. Aymerich, Universitat Autònoma de Barcelona, Spain*

10:30 - 11:00 Coffee Break

**TFT Devices**

**Session Chairs:** Dieter G. Ast, Cornell University, USA  
Toshihide Nabatame, National Institute for Materials Science,  
Japan

11:00 - 11:30 **Thin film transistor modeling: Frequency dispersion .....88**  
Michael Shur, Rensselaer Polytechnic Institute, USA

11:30 - 12:00 **Instability mechanisms in amorphous oxide semiconductors leading to a threshold voltage shift in thin film transistors .....126**  
Andrew J. Flewitt, Cambridge University, United Kingdom  
*Kham M. Niang, Cambridge University, United Kingdom*

12:00 - 12:30 **Improvement in carrier mobility of metal oxide thin-film transistor by a microstructure modification .....127**  
Jae Kyeong Jeong, Hanyang University, South Korea  
*Yeonwoo Shin, Sang Tae Kim, Hanyang University, South Korea*

**Thursday, May 25, 2017 (continued)**

- 12:30 - 13:00      **Embedded oxide semiconductor memories: A key enabler for low-power ULSI .....128**  
*Takahiko Ishizu, Semiconductor Energy Laboratory Co., Ltd., Japan*  
*Tatsuya Onuki, Shuhei Nagatsuka, Momoyo Yamaguchi, Atsuo Isobe,*  
*Yoshinori Ando, Daisuke Matsubayashi, Kiyoshi Kato, Semiconductor Energy*  
*Laboratory Co., Ltd., Japan; Hai Biao Yao, Chi Chang Shuai, Hung Chan Lin,*  
*United Microelectronics Corporation (UMC), Taiwan*
- 13:00 - 13:10      Conclusions / Next Conference
- 13:15 - 14:30      Lunch and Departures