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# Trip Report on IEDM 2018

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**Abstract**

Koon Hoo Teo attended the International Electron Device Meeting (IEDM) 2018 in San Francisco from Dec 1 to 5, 2018. The meeting has attracted many attendees, more than 3,000, as this is considered as the gold standard for semiconductor devices research. As expected, this meeting is well attended by both academia and Industries. Areas of interest include Quantum Computing (6 papers), Negative Capacitance and Ferroelectric (17 papers) and GaN (9 Papers) and many others.

*Mitsubishi Electric Research Laboratories*

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Koon Hoo Teo, Version 1.0, January 3, 2019

## Summary

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**Wide Bandgap Devices**– Wide bandgap (WBG) devices offer potential cost saving and technical merits. Converters designed with WBG devices triggers innovation at all levels, which includes system design and circuit architecture. Question discussed include whether SiC or GaN could perform better than what silicon can possibly attained and the challenges to the widespread adoption of these technologies. Barriers to adoption of these technologies include cost, device design and fabrication, reliability and system integration. Presenters include companies such as Infineon, Transphorm and ABB. Development in GaN includes

1. Breakdown fields of 2.8-3.5 MV/cm in GaN on GaN p-n Junction diodes with double side depleted termination
2. Atomically flat AlGaN spacer layers were use to reduce the 2DEG densities and improve carrier mobility while maintaining the low access resistance. This lower electric-field concentration at the edge of gate electrodes enables high voltage operation. Furthermore, a diamond heat spreader decreases the thermal resistance to further improve the output power density.
3. Exposure to hard switching transitions may lead to an increase in dynamic Ron. This effect is ascribed to the presence of hot electrons and verified through electroluminescence measurements.

## Details

The following GaN related presentations were attended (see https://ieee-iedm.org):

GaN HEMTs for 5G Base Station Applications
Shigeru Nakajima
Semiconductor Innovation Business Unit, Sumitomo Electric Industries, Ltd., Yokohama, Japan, email: snakajm@sei.co.jp

Suppressed Hole-Induced Degradation in E-mode GaN MIS-FETs with Crystalline GaOxN1-x Channel
Mengyuan Hua1,Xiangbin Cai2,Song Yang1,Zhaofu Zhang1,Zheyang Zheng1,Jin Wei1,Ning Wang2,and Kevin J. Chen1
1Department of ECE, 2Department of Physics, The Hong Kong University of Science and Technology, Hong Kong, China

email: mhua@connect.ust.hk

Recent advancement of GaN HEMT with
InAlGaN barrier layer and future prospects of AlN-based electron devices

J. Kotani1,2, A. Yamada1,2, T. Ohki1,2, Y. Minoura1,2, S. Ozaki1,2, N. Okamoto1,2, K. Makiyama1,2, and N. Nakamura1,2
1 Fujitsu Ltd., 2Fujitsu Laboratories Ltd., 10-1 Morinosato-Wakamiya, Atsugi-shi, Kanagawa, Japan
email: kotani.junji-01@jp.fujitsu.com

Power GaN HEMT degradation: from time-dependent breakdown to hot-electron effects

M. Meneghini1, A. Barbato1, M. Borga1, C. De Santi1, M. Barbato1, S. Stoffels2, M. Zhao2, N. Posthuma2, S. Decoutere2,
O. Haeberlen3, T. Detzel3, G. Meneghesso1, E. Zanoni1
1Univ. of Padova, Dept. of Information Engineering, via Gradenigo 6/B 35131 Padova (Italy), email: matteo.meneghini@unipd.it 2imec, Kapeldreef 75, 3001 Heverlee (Belgium) 3Infineon, Siemensstraße 2, 9500 Villach, Austria

GaN devices for automotive application and their challenges in adoption

Tetsu Kachi
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Nagoya, 464-8601, Japan, email: kachi@imass.nagoya-u.ac.jp

Barriers to the Adoption of Wide-Bandgap
Semiconductors for Power Electronics

I.C. Kizilyalli1, E.P. Carlson2, and D.W. Cunningham1
1Advanced Research Projects Agency-Energy, U.S. Department of Energy, Washington, DC, email: Isik.Kizilyalli@hq.doe.gov
2Booz Allen Hamilton, Washington, DC