Session 20 - Power Devices and Systems - SiC Power Devices
Tuesday, December 10, 2:15 p.m.
Continental Ballroom 1-3
Co-Chairs: I. Kizilyalli, ARPA-E
D. Hisamoto, Hitachi

2:20 PM **20.1** Suppression of Bipolar Degradation in 4H-SiC Power Devices by Carrier Lifetime Control (Invited)
H. Tsuchida, K. Murata, T. Twara, M. Miyazato, T. Miyazawa, K. Maeda, CRIEPI, AIST, Fuji Electric Company, Ltd.

Bipolar degradation phenomenon, in which the on-state forward voltage increases with the expansion of stacking faults, is a significant issue for practical applications of 4HSiC bipolar devices such as PiN diodes and IGBTs. This paper addresses methods realizing suppression of the degradation phenomenon by adopting carrier lifetime control techniques.

2:45 PM **20.2** Low V_{on} 17kV SiC IGBT Assisted n-MOS Thyristor
Shinichiro Matsunaga, Tomonori Mizushima, Kensuke Takenaka, Yuji Kiuchi, Akihiro Koyama, Yoshiyuki Yonezawa, Hajime Okumura, AIST

The SiC n-MOS thyristor was designed and fabricated. The on-characteristics were improved over IGBTs fabricated under the same wafer conditions and process conditions. The MOS thyristor succeeded in switching operation, and the switching speed of the MOS thyristor was equivalent to that of the IGBT in both turn-on and turn-off.

3:10 PM **20.3** Experimental Investigation and Improvement of Channel Mobility in 4H-SiC Trench MOSFETs
Katsuhiro Kutsuki, Eiji Kagoshima, Toru Onishi, Jun Saito, Narumasa Soejima, Yukihiko Watanabe, Toyota Central R&D Labs Inc., Toyota Motor Corp.

The proposed method is used to evaluate the effect of the surface morphology of trench sidewalls on channel mobility in SiC trench MOSFETs for the first time. When the surface is atomically flat, there is a large increase in channel mobility. This is caused by the suppression of Coulomb scattering.

3:35 PM COFFEE BREAK

4:00 PM **20.4** Improvement in the Channel Performance and NBTI of SiC-MOSFETs by Oxygen Doping
Munetaka Noguchi, Toshiaki Iwamatsu, Hiroyuki Amishiro, Hiroshi Watanabe, Koji Kita, Naruhisa Miura, Mitsubishi Electric Corporation, The University of Tokyo

Si-face 4H-SiC MOSFETs with O-doped channel were demonstrated for the first time. The trade-off between specific on resistance and threshold voltage was improved especially in the high threshold voltage region. Furthermore, O-doping showed better performance for the NBTI characterization, being a promising approach to further improve the gate oxide reliability.

4:25 PM **20.5** Physical Modeling of Bias Temperature Instabilities in SiC MOSFETs
Christian Schleich, Judith Berens, Gerhard Rzepa, Gregor Pobegen, Gerald Rescher, Stanislav Tyaginov, Tibor Grasser, Michael Waltl, TU Vienna, kai, Global TCAD Solution GmbH, Infineon Technologies Austria AG, imec

The performance of SiC MOSFETs can still not be fully exploited due to defects in the atomic structure giving rise to BTI. We investigate BTI in lateral and vertical channel nMOSFETs. By doing physics based device simulations we extract defect bands which finally enables us to provide accurate lifetime extrapolations