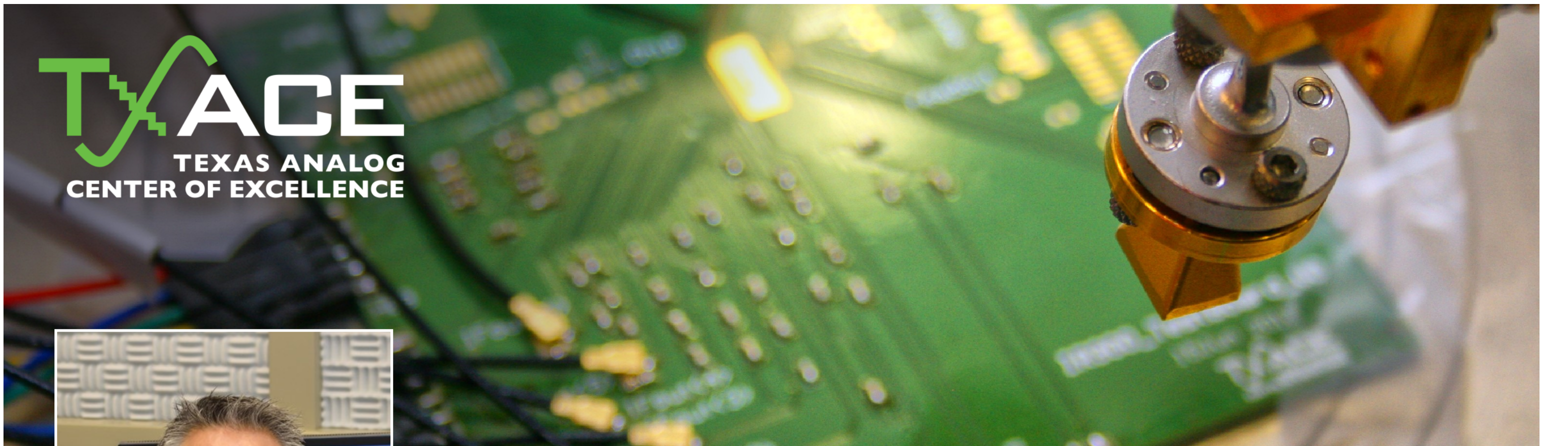

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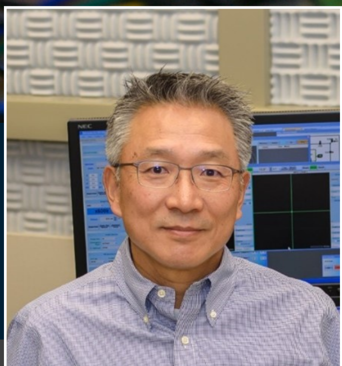

Reliability Study of E-mode GaN HEMT Devices by AC TDDB and HR-TEM/STEM

Moon Kim

Distinguished Professor of Materials Science & Engr
University of Texas at Dallas

BIO

Moon Kim is a Louis Beecherl, Jr., Distinguished Professor of Materials Science and Engineering at the University of Texas at Dallas. He is an elected fellow of Microscopy Society of America and a co-founder of 2Lux Media, Inc. He currently serves as Director of UTD's Nano-Characterization Facility. He earned his B.S., M.S., and Ph.D. in Materials Science from Arizona State University in 1984, 1986, and 1988, respectively. He has published over 450 refereed articles that have received over 13,000 citations with SCI h-index of 58, 2 paper books, 2 iBooks ("Hello, Nano" - available in Apple's iBookstore and Amazon.com), and 1 app-book ("Art & Tech" – available in Apple's iTunes Store. He has also held 2 NanoArt exhibitions. Dr. Kim's current research includes nanoscale fabrication and atomic-scale characterization of various functional nanostructures/devices for applications in nano-electronics, power electronics, energy, electrochemical and bio-devices, and 3D visualization technologies such as virtual reality (VR), Augmented reality (AR), image recognition, and hologram for enhanced education.

ABSTRACT

AlGaN/GaN High Electron Mobility Transistors (HEMTs) have emerged as the most promising candidates for high-voltage power switching applications, particularly in 300-1000V voltage and above 1MHz frequency domain. Among various GaN devices, normally-off E-mode GaN HEMTs with the p-GaN gate are the most attractive due to their high gate bias swing and simpler process implementation. However, although there are some speculations on possible breakdown mechanisms, the exact location, and physical mechanism are not fully understood. Furthermore, the correlation between device electrical degradation and physical degradation in p-GaN gate AlGaN/GaN layered E-mode HEMTs is not well understood. In this project, we have studied the gate reliability of p-GaN gate HEMT devices by DC and AC TDDB experiments and used high-resolution transmission electron microscopy (TEM) for the detailed analysis of the location and nature of the breakdown percolation path, which can be correlated with the electrical TDDB data. In addition, we are also performing a multimode in-situ TEM failure analysis study to monitor the failure event in real-time for a better understanding of the actual failure mechanism. A detailed analysis of the onset of degradation at the p-GaN gate cap will be presented and discussed in this presentation.

Friday, June 25, 2021 at 1:00 – 2:00 p.m.
Virtual

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