

“GaN Device Challenges – Reliability, Advanced HEMT Design, and Vertical High Power Switches”

Travis J. Anderson, Ph.D.
U.S. Naval Research Laboratory, Washington, DC

Abstract:

As a wide bandgap semiconductor, the gallium nitride-based materials system is attractive for next-generation power devices, including RF amplifiers, high voltage power switches, and high breakdown voltage diodes. Such devices have a wide range of immediate Naval applications, such as high-power satellite communications and radar, unmanned underwater and aerial vehicles, ship drive components, and hybrid vehicle inverters. GaN devices have been commercially successful, evidenced by the development of light emitting diodes (LEDs) and monolithic microwave integrated circuits (MMICs) based on high electron mobility transistors (HEMTs), however, there are still significant device challenges as the material system is pushed to the fundamental performance limits. This seminar will present an overview of the GaN power device effort at NRL. This research has three primary focus areas – 1) study of failure physics related to radiation-induced degradation in HEMTs as an assessment of performance in extreme environments for space applications, 2) advanced device designs integrating nanocrystalline diamond heat spreading films for improved thermal management and normally-off devices with high-k gate dielectrics, and 3) address unique challenges associated with vertical device design and processing, including evaluation of epitaxial layers used for drift regions and p-type dopant implantation and activation for edge termination in power MOSFET structures.

Biography:

Travis Anderson is a senior chemical engineer in the High Power Electronics Branch at the U.S. Naval Research Laboratory in Washington, DC, where his work focuses on wide bandgap power switches. He has expertise in processing, reliability, failure mechanisms, and radiation effects in GaN, SiC, diamond, and grapheme-based devices. Dr. Anderson received a PhD in Chemical Engineering from the University of Florida in 2008, and a BS in Chemical Engineering from the Georgia Institute of Technology in 2004. He is the author of over 150 publications, 185 presentations (50 invited), and has been awarded 21 patents.