Fall 2022 Joint Colloquium
Materials Department & Materials Research Laboratory

Robert Kaplar, PhD

Sandia National Labs

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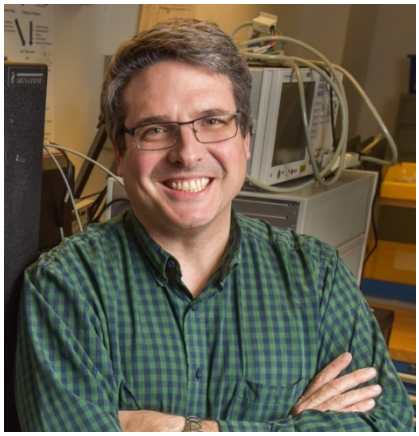
11:00 am | ESB 1001



Development of Medium-Voltage III-Nitride Power Electronic Devices

The AlGaN/GaN HEMT has become a relatively mature power electronic device with various versions being offered commercially, and it has already enabled significant improvements in the efficiency and power density of power conversion systems based upon it. However, it has primarily been limited to breakdown voltages less than 1.2 kV. The III-Nitride semiconductors, however, offer significant promise for medium-voltage (defined here as 1.2-20 kV) devices beyond the traditional GaN-channel HEMT. This talk will describe various efforts at Sandia National Laboratories to develop such devices, including both vertical GaN devices as well as devices based upon ultra-wide-bandgap AlGaN alloys. In addition to device results, the talk will discuss the material properties necessary to advance device performance, processing challenges, reliability, and key application areas including electric vehicles and the electric grid.

Bio

Bob Kaplar received his Ph.D. in Electrical Engineering in 2002 from Ohio State University under the direction of Professor Steve Ringel, where he studied deep-level defects in dilute nitride alloys (InGaAsN). He subsequently joined Sandia National Laboratories, Albuquerque, NM, as a post-doctoral researcher focusing on InGaN/GaN quantum-well LEDs for solid-state lighting. He remained at Sandia as a technical staff member and began working on wide-bandgap power electronic devices, and from 2014-17 led Sandia's Grand Challenge Laboratory-Directed Research and Development program on Ultra-Wide-Bandgap semiconductors, which was an internally-funded effort that focused primarily on the development of AlGaN for power electronics. Since 2017 he has been the manager of the Semiconductor Material and Device Sciences department at Sandia, where he coordinates research programs on WBG and UWBG materials and devices, with a primary focus on the advancement of next-generation III-Nitride-based power electronics.

Hosted by Sriram Krishnamoorthy and Jim Speck.