Nick Yun, SUNY Poly PhD Candidate

Title: Design and Demonstration of High Voltage (>6.5kV) 4H-Silicon Carbide (SiC) Power Device

Abstract: The most unique feature for a power device is the ability to withstand high voltages (>600V) with a voltage supporting layer, called the “drift region”. The breakdown voltage of the power device depends on the thickness and doping concentration of the drift region, as most of the voltage is supported by the depletion region formed within the drift layer. The optimization of the drift region must be performed to meet the breakdown voltage requirements based on the application while minimizing the on-state voltage drop to reduce power dissipation. When compared to the silicon counterparts, SiC allows for the design of a thin, heavily doped drift region to support a specified voltage due to its superior material properties. Additionally, leakage currents generated during the off-state mode are also significantly suppressed due to intrinsic carrier density an order of magnitude lower than Si. These merits of SiC become more substantial when building high voltage power devices (>3.3kV) where resistance in the drift region dominates the overall on-resistance of the device. In this talk, the design of the drift layer including the edge termination techniques will be introduced. Also, the fabrication and characterization of high voltage (>6.5kV) SiC devices will be discussed.