OPEN+ Kilovolt Devices Cohort

PROJECT DESCRIPTIONS

GE Global Research – Niskayuna, NY

Advanced Medium Voltage SiC-SJ FETs with Ultra-Low On-Resistance – $3,090,746

GE Global Research will develop a device architecture for the world's first high-voltage silicon carbide (SiC) super junction (SJ) field-effect transistors. These devices will provide highly efficient power conversion (such as from direct to alternating current) in medium voltage applications, including renewables like solar and wind power, as well as transportation. The transistors will scale to high voltage while offering up to 10 times lower losses compared to commercial silicon-based transistors available today.

The Ohio State University – Columbus, OH

GaN MOCVD Growth on Native Substrates for High Voltage (15-20 kV) Vertical Power Devices – $2,211,712

The Ohio State University will develop gallium nitride (GaN) semiconductor materials suitable for high voltage (15-20 kV) power control and conversion. The team will develop a unique method to grow thick GaN films with low background impurity contamination, necessary to allow high voltage operation with high efficiency. The thick GaN layers will be deposited on high-quality bulk GaN base materials with reduced defects, critical to depositing high-quality GaN films on top, and perform high-voltage device design, fabrication, and testing to provide feedback for further GaN material growth and optimization.

Sandia National Laboratories – Albuquerque, NM

20 kV Gallium Nitride pn Diode Electro-Magnetic Pulse Arrestor for Grid Reliability – $5,415,000

Sandia National Laboratories will develop a new device to prevent damage to the power grid caused by electromagnetic pulse (EMP). The EMP arrestor will comprise diodes fabricated from the semiconductor gallium nitride (GaN), capable of responding on the nanosecond timescale required to protect the grid against EMP threats. The arrestor will be capable of blocking 20 kilovolts (kV), enabling a single device to protect distribution-level equipment on the grid. The team will focus on GaN crystal growth and device design to achieve the 20 kV performance target. In addition, the team will create a pilot production line to serve as a model for eventual commercial production.

Virginia Tech – Blacksburg, VA

20-kV GaN Switch Technology Demonstrated in High-Efficiency Medium-Voltage Building Block – $3,000,000

Virginia Tech will accelerate deployment of power electronics into grid-scale energy applications by developing 20 kV gallium nitride devices integrated into a medium-voltage power module. For the GaN power devices, high quality substrates and innovative growth techniques will be used to reduce the background impurity contamination in the thick layers needed to block 20 kV. The power module will be fabricated using three-dimensional (3D) packaging for improved thermal management and high power density at 20 kV. The power module will enable the full potential of high-voltage, high-temperature, and fast-switching GaN devices in medium-voltage power converters for use in renewable energy grid-level applications and transportation.