MSE SEMINAR

November 17, 2017
113 McBryde Hall
3:30 – 4:30 PM
Refreshments at 3:00 PM

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"Morphology control in homo-epitaxial growth of GaN vertical p-n diodes"

ABSTRACT

Gallium Nitride (GaN) semiconductors are emerging as the next generation of power electronic devices. Compared to current Silicon-based devices they have higher mobility, better thermal conductivity, and much higher breakdown voltages. Most current commercial GaN devices are grown on non-lattice matched substrates including sapphire, Si and SiC. This puts a limit on performance due to large numbers of dislocations caused by this mismatch. Recently, pseudo-bulk GaN substrates have become available allowing for a reduction in dislocation density of a 100 times or more.

In growth on mismatched substrates the morphology is dominated by the dislocations. On matched substrates there is the potential for very smooth controlled morphology allowing better control of doping and alloying. However, it now becomes susceptible to instabilities including step bunching and meandering that can impact alloying and electrical properties. Currently, the connection between these various instabilities and growth conditions on bulk GaN is limited. This results in difficulties consistently producing devices with properties the underlying materials should be capable of. The goal of this work is to make connections to the theoretical growth models and provide tools for maintaining desired properties across different growth reactors and substrates.

BIOSKETCH

Eric Carlson received a Bachelor's of Science degree in physics from Virginia Tech in 1995. He stayed in the area working for a defense research company located in Radford, VA, HY-Tech Research Corp. He spent about a decade working on x-ray and laser diagnostics for high density plasmas in nuclear weapons effects simulators. With the threat of strategic nuclear war diminished, the work shifted to thin film development, low density process plasma diagnostics, and microwave processing of ceramics. He was responsible for commercializing several products that grew out of this research and holds several patents in these areas. He is currently pursuing a Ph.D. in Dr. Lou Guido's research group working on growth of III-V semiconductor devices.