Program Overview

Room /Time	Jefferson 2-3
TuM	PS1-TuM: Plenary Session I

Plenary Session
Room Jefferson 2-3 - Session PS1-TuM

Plenary Session I
Moderator: Dr. Kelson Chabak, Air Force Research Laboratory

8:45am **PS1-TuM-2 Plenary Lecture: Gallium Oxide Electronics - Device Engineering Toward Ultimate Material Limits***, **Siddharth Rajan**,* The Ohio State University **INVITED**

The unique material properties of Gallium Oxide make it promising for a range of future applications, but innovative materials and device engineering are needed to translate these ultimate material limits to real technology. This presentation will discuss our recent work on epitaxy, heterostructure design, and electrostatics to achieve high-performance $\beta\beta$-Ga2O3 lateral and vertical electronic devices.

Recent work on lateral Gallium Oxide transistors have demonstrated excellent electron transport and device characteristics. We will discuss some advances in materials growth and device design for lateral structures which enabled key transistor demonstrations including the first $\beta\beta$-(Al,Ga)2O3/$\beta\beta$-Ga2O3 modulation-doped structures with excellent transport properties, double-heterostructure modulation-doped structures, scaled delta-doped transistors with cutoff frequency of 27 GHz, and self-aligned lateral field effect transistors with > 900 mA/mm current density.

Significant potential exists for Gallium Oxide devices with 3-dimensional geometries for enhanced field and thermal engineering. We will outline the use of a new damage-free epitaxial etching technique using Ga atomic flux that enables highly precise fabrication of 3-dimensional structures. We will also show some applications of atomic Ga-flux etching to realize excellent field termination in vertical diodes, and lateral FINFETs with enhanced performance.

The high breakdown field of Gallium Oxide makes it critical to manage electric field profiles within the device. Extreme-permittivity dielectrics provide unique opportunities to create devices that can sustain extreme fields without premature breakdown of metal-semiconductor and dielectric-semiconductor interfaces. We will discuss promising results related to this approach, such as BaTiO3/Ga2O3 heterojunctions that enable more than 5.7 MV/cm vertical breakdown field and BaTiO3/Ga2O3 transistors with > 5.5 MV/cm breakdown field, the highest for a field effect transistor in any material system, and with state-of-art power switching figure of merit of 586 MW/cm2.

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