

ME 250 SEMINAR

Materials, Manufacturing, and Metrology: Keys to Developing The Future of Wide Bandgap Power Electronic Devices

Wide bandgap electronics are currently under development due to their potential to create future power electronics. The growth of materials based on gallium nitride and more recently gallium oxide is expected to help create technological advancements that may yield a range of devices that operate with more efficiency, higher operational frequency, and smaller form factors. As these nitride and oxide semiconductors are being developed, there are a number of new materials, manufacturing techniques, and thermal and mechanical metrology methods that must be concurrently created to help ensure the transition from the laboratory to actual applications. Key concerns are scalable methods for growing and packaging the devices, materials and architectures needed to ensure efficient thermal management, and the control of stresses to prevent device failure.

In this talk, we will discuss a range of materials and device architectures that are being developed to enable efficient heat dissipation from both GaN and Ga₂O₃ devices starting at the device level. We will also cover a range of thermal and stress metrology methods that we have developed to enable the measurement of temperature and stresses in the devices both under steady state and transient operation. Finally, an actively cooled power substrate that is being developed for packaging power devices will be presented. At each step, we will show how considerations for materials development, metrology techniques, and methods for scalable manufacturing are necessary to help transition these advancements to applications.

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ZOOM

11:00 AM - 11:50 AM



Samuel Graham
Georgia Tech

Samuel Graham is the Eugene C. Gwaltney, Jr. Professor and Chair of the Woodruff School of Mechanical Engineering at the Georgia Institute of Technology. He leads the Electronics Manufacturing and Reliability Laboratory which is focused on the electrical and thermal characterization, packaging, and reliability of wide bandgap semiconductors, solar cells, and flexible electronics. He also holds a courtesy appointment in the School of Materials Science and Engineering at Georgia Tech, a joint appointment with the National Renewable Energy Laboratory, and is a Distinguished Visiting Professor at Nagoya University in Nagoya, Japan. He is a Fellow of ASME, a member of the Engineering Sciences Research Foundation Advisory Board of Sandia National Laboratories, and a member of the Emerging Technologies Technical Advisory Committee of the US Department of Commerce.