



Mechanical Engineering Leadership Distinguished Speaker Series

Speaker: Samuel Graham, Eugene C. Gwaltney, Jr. Professor and Chair of the Woodruff School of Mechanical Engineering at the Georgia Institute of Technology

When: Monday, January 28, 2019, 10:30am – 11:30am

Where: 310 Kelly Hall

The Role of Interfaces on the Thermal Performance of Wide Bandgap Semiconductors

Wide bandgap electronics made from Gallium Nitride (GaN), Gallium Oxide (Ga_2O_3), and Hafnium Oxide (HfO_2) are currently under development due to their potential to create some of the most advanced RF, power electronics, and neuromorphic computing devices in the world. However, the performance and reliability of these devices are often controlled by their electrothermal response during device operation. A key feature which limits thermal control of the peak temperature is the thermal resistance that is encountered at material interfaces with these devices. In general, thermal energy is created through joule heating and must be dissipated by transport across interfaces within the devices (e.g., GaN HEMTs) or across contacts to the devices (e.g., in Ga_2O_3 and HfO_2). Thus, an understanding of the interfacial thermal transport and methods to create low thermal resistance interfaces is of key concern in the development of future electronic devices from these materials.

In this talk we will discuss advancements in thermal characterization techniques that have allowed new insights into the impact of interfaces on the thermal response of GaN, Ga_2O_3 , and HfO_2 electronic devices. A key aspect will be the heterogeneous integration with high thermal conductivity substrates such as diamond for advanced heat dissipation. New high speed thermal imaging techniques which allow for the characterization of heat generation and heat flow under pulsed and RF conditions will be shown. Finally, for high heat flux devices such as GaN RF and power devices, the benefits of using of packaging substrates with integrated cooling and low coefficients of thermal expansion will be presented.

Bio:



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 Oak Ridge National Laboratory, and is a 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 Air Force Scientific Advisory Board.