

Hawkins Memorial Lecture in Heat Transfer:

Sam Graham

**Dean of Engineering
University of Maryland**

Seminar: Friday, October 7th - 10:30 AM, ME 2054



Engineering Interfaces To Improve Thermal Performance of Wide Bandgap Semiconductors

Abstract:

Wide bandgap electronics 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 Ga₂O₃ and HfO₂). Moreover, the recent creation of digital alloys has opened new doors for bandgap engineering, but at the expense of introducing additional interfaces that impact heat flow. 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, Ga₂O₃, and HfO₂ electronic devices. A key aspect will be the linkage between materials science, growth processes, modeling, and thermal characterization to yield insights into improved device architectures. New highspeed thermal imaging techniques which allow for the characterization of heat generation and heat flow under pulsed and RF conditions will be discussed. Finally, future technologies involving Digital Alloys and their impact on heat flow will be presented.

Biography:

Dr. Samuel Graham is the Nariman Farvardin Professor and Dean of Engineering at the University of Maryland. Prior to joining the University of Maryland, he was a professor and chair of the Woodruff School of Mechanical Engineering at the Georgia Institute of Technology. He holds a joint appointment with the National Renewable Energy Laboratory, serves on the Emerging Technologies Technical Advisory Committee for the U.S. Department of Commerce, and the Engineering Science Research Foundation of Sandia National Laboratories. His research expertise is in the thermal characterization and reliability of wide bandgap semiconductor technologies for power electronics and advanced rf communications. In addition, his group works on strategies for energy thermal energy storage using phase change materials for build energy systems.

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