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# Mechanical Engineering Seminar Series

## Thermal Management Strategies to Enable Ultrawide Bandgap Electronics

**Samuel Graham, Jr.**
Dean, A. James Clark School of Engineering
Nariman Farvardin Professor
University of Maryland

Tuesday, April 19, 2022

4:00 p.m.

ME Seminar Zoom link (QR Code below)

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**Abstract**

Ultrawide bandgap semiconductors made from high Al content AlGaN alloys and $Ga_2O_3$ have promise for future rf electronics and power switches. One of the key issues that arises from using these ternary alloys is the intrinsic low thermal conductivity of AlGaN and $Ga_2O_3$ and the low thermal boundary conductance at contacts with these alloys. This requires careful design of the device architecture and layout in order to yield effective heat dissipation pathways for AlGaN systems. In this talk, we will present modeling results which demonstrated specific regimes where cooling from the backside or topside of the ultrawide bandgap devices provide the most efficient pathway for heat dissipation. We will also present modeling and experimental results that demonstrate the effectiveness of the integration of high thermal conductivity dielectrics on the heat dissipation efficiency in these devices. Limitations on the integration of these layers through direct growth or bonding will be discussed. Finally, new opportunities to enhance heat transport in these materials using the concept of digital alloy structural ordering will be presented.

**Bio**

Dr. Samuel Graham, Jr. 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 and the packaging of organic and flexible electronics.

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