Electrical & Computer Engineering

S E M I N A R

Louisiana State University

Advancing Next-Generation Electronic Devices and Systems Using (Ultra)Wide-Bandgap Nitrides (and Oxides)

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Abstract—The growing demands of artificial intelligence, edge computing, and autonomous systems call for electronic hardware that is energy-efficient, highly integrated, high-speed, and capable of reliable operation in harsh conditions. Conventional silicon technologies are increasingly constrained in meeting these requirements, motivating the exploration of (ultra)wide-bandgap nitride and oxide semiconductors.

In this talk, I will present my work on wide-bandgap electronic devices that bridge materials innovation with new device functionalities, spanning low-power IoT electronics, back-end-of-line (BEOL)-compatible logic-memory integration, and harsh-environment operation using TiO_2, In_2O_3, and ScAlN/GaN material systems. I will place particular emphasis on nitride electronics for harsh environments relevant to next-generation defense, energy, and space applications, and show how ScAlN unlocks new opportunities for GaN electronics. Specifically, I will highlight two advances: (1) ferroelectric ScAlN/AlGaN/GaN HEMTs for high-temperature nonvolatile memory, and (2) lattice-matched ScAlN-barrier GaN HEMTs with suppressed gate leakage for future high-power and high-frequency technologies. Together, these examples illustrate how materials and device innovations can deliver new functionalities in GaN electronics, enabling high-power, high-speed systems and logic-memory integration with strong harsh-environment tolerance. I will conclude by outlining a future research vision spanning oxide-based CMOS logic and in-memory computing, high-speed oxide and nitride electronics for RF and radar systems, and ultra-wide-bandgap and ferroelectric devices for extreme-environment applications.

Bio—Jie Zhang is a Research Fellow in the Department of Electrical Engineering and Computer Science at the University of Michigan, Ann Arbor. His research focuses on wide-bandgap nitride and oxide semiconductor devices for energy-efficient electronics, logic-memory integration, high-frequency and high-power operation, and extreme-environment applications. He received his Ph.D. in Electrical and Computer Engineering from the University of Delaware, where he developed high-performance TiO_2 thin-film transistors for low-power IoT applications. He subsequently conducted postdoctoral research at Purdue University, working on ultrascaled In_2O_3 transistors for back-end-of-line-compatible logic and memory integration with enhanced mobility-stability trade-offs. His current work on ferroelectric ScAlN/GaN devices targets resilient electronics for defense, energy, and space systems. He has authored over 60 publications in leading journals and conferences, including Device, IEEE Electron Device Letters, Applied Physics Letters, IEEE Transactions on Electron Devices, IEDM, and VLSI Symposium.

When: Thursday, **12 February 2026,** 10:00 - 11:00
Where: Room 3316E Patrick F. Taylor Hall
Info: `https://www.lsu.edu/eng/ece/seminar`
Food: ***Refreshments will be served.***