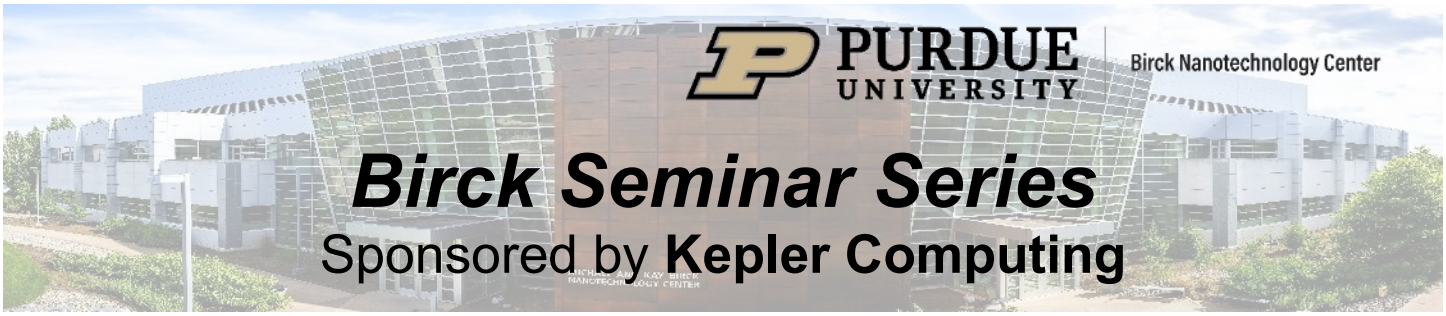

Atomic-Scale Characterization of Heterogeneous Interfaces: Quantifying Structure & Chemistry for Next-Gen Electronic Devices

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Wednesday, February 26th @ 2:00 pm in BRK 1001
Coffee and snacks served before seminar
also on MS Teams

Abstract: **Heterogeneous interfaces** in electronic and quantum devices often undergo structural and chemical transformations when integrating dissimilar materials, leading to various forms of disorder that can impact their stability and performance. This talk will highlight how a**tomic-resolution scanning transmission electron microscopy (STEM)** provides a powerful approach to identify, quantify, and characterize these interfaces at the atomic scale.
We will present electron microscopy studies across different device technologies, including SiC MOSFETs for power electronics, GaAs heterostructures and superconductor-semiconductor systems for quantum computing, and III-Nitride heterostructures for optoelectronic devices. By leveraging high-resolution imaging, spectroscopy, and quantitative analysis, we extract critical interface characteristics such as roughness, bonding states, and chemical inhomogeneities, linking them to fabrication processes and electronic measurements. For example, in SiC MOSFETs fabricated under different oxidation processes, we analyze how interface chemistry evolves based on processing conditions. In Al/semiconductor interfaces, we assess the bonding states of Al to determine the presence of metallic or oxidized species, providing insights into oxidation behavior and material stability.
Through these investigations, we demonstrate how atomic-resolution electron microscopy supports a metric-drive approach to studying disorder at heterogeneous interfaces, offering useful insights into interface quality. This information can help optimize material growth and fine-tune fabrication processes, ultimately contributing to the advancement of next-generation device technologies.

Bio: Dr. Rosa E. Diaz is a Research Professor at the Elmore School of Electrical and Computer Engineering at Purdue University, specializing in electron microscopy and electronic device metrology. She earned her Ph.D. in Materials Science and Engineering from Arizona State University. She has held research positions at Brookhaven National Laboratory, the Okinawa Institute of Science and Technology, where she has worked on developing in-situ electron microscopy techniques for studying materials under near operando conditions.
Dr. Diaz has published over 45 research papers in semiconductors, quantum materials, catalysis, nanotechnology collaborating across disciplines. She is an active member of the Microscopy Society of America, the Materials Research Society, and the American Association for the Advancement of Science, contributing to the development of cutting-edge characterization methodologies.
Beyond research, Dr. Diaz is a dedicated advocate for STEM education and research capacity building in Latin America, working to expand access to scientific opportunities and international collaborations. Through her extensive partnerships with academia and industry, she is actively driving innovation in materials characterization techniques for next-generation electronic and quantum devices, ensuring fundamental research translates into technological advancements.

Host: Neil Dilley, Research Manager | Email: ndilley@purdue.edu