WORKSHOP # 2 – Tuesday, April 21, 2026

Microelectronics beyond Si: metrology challenges and advanced characterization methods

Organizers: Hanfei Yan (NSLS-II), Larry Carr (NSLS-II), Yong Chu (NSLS-II), Aswin Anbalagan (NSLS-II), Lu Ma (NSLS_II), Wen Hu (NSLS-II), Yuan Gao (NSLS-II), Conan Weiland (NIST), Vesna Stanic (IBM), Jean Jordan-Sweet (IBM), Christian Lavoie (IBM), Judith Yang (CFN), Chang-Yong Nam (CFN), Prashansa Mukim (Instrumentation)

The exponential growth of AI computing is driving unprecedented demand for microelectronics that deliver higher performance with dramatically improved energy efficiency. As device dimensions continue to shrink to pack more transistors onto each chip, conventional planar scaling has reached its fundamental physical limit, with device performance increasingly constrained by power consumption and the separation of the CPU and main memory. Under these constraints, silicon-based technologies alone will eventually be unable to sustain the requirements of exascale AI computing.

To address this challenge, industry and academia are exploring next-generation platforms, including two-dimensional materials beyond silicon and neuromorphic devices that enable compute-in-memory. Despite rapid progress, fundamental materials questions and major technical hurdles remain—particularly in metrology and process integration—hindering scalable, high-yield fabrication.

The goal of this workshop is to identify the most pressing metrology challenges, define the required capabilities and tools, and demonstrate what current state-of-the-art characterization techniques (including AI-enabled methods) can achieve today. We aim to create a forum where materials scientists, device engineers, and characterization experts can build synergistic collaborations, leveraging the world-leading user facilities at BNL.

We will focus on 2D materials, topological conductors, neuromorphic materials and devices, advanced optical, x-ray and electron characterization techniques, and AI-enabled methods.

Start Time (ET)	Title	Speaker (Affiliation)
8:25	Open remark	Hanfei Yan (NSLS-II)
8:30	Lab to Fab – Process development, screening and integration of neuromorphic materials with advanced microelectronics	Nathaniel C. Cady (SUNY POLY)
9:00	3D Integration of 2D Materials for Advanced Logic, Memory, and Bio-inspired Computing	Saptarshi Das (Pennsylvania State University)
9:30	Oxide semiconductor transistors for an active silicon BEOL	Martin Frank (IBM)
10:00	*Break*	
10:30	Reconfigurable 2D Devices for Machine Learning Applications	Ji Ung Lee (SUNY POLY)
11:00	Novel Conductors for Post-Cu Interconnects	Ching-Tzu Chen (IBM)

11:30	TBD	Chang-Yong Nam (CFN)
12:00 – 2:00 pm	*Lunch Break (travel to/from SUSC to Berkner Hall)*	
2:00	Evaluation of 2D Material Quality toward Device Reliability	Elisabeth Mansfield (NIST)
2:30	Electron Ptychography of Advanced Microelectronics Devices	Shake Karapetian (Cornell University)
3:00	III-Nitride Ferroelectrics for Low-Power AI Hardware	Deep Jariwala (University of Pennsylvania)
3:30	*Break*	
4:00	*AI-Enabled Materials Characterization and Experimental Automation*	Mathew Joseph Cherukara (Argonne National Laboratory)
4:30	Advances in Imaging of Functional Material Systems	Xiaojing Huang (NSLS-II, BNL)
5:00	Multimodal characterization of correlated oxide thin films across metal–insulator transitions	Fernando Camino (CFN, BNL)
5:30	Adjourn	