

Emerging AI EIPBN Talk Abstract

Title: Harnessing Magnetic Material Nanotextures for AI

Nanoscale magnetic materials are powerful building blocks for AI computing systems, for energy storage and conversion as well as for in-memory computing. But, it is a challenge to create functional devices that leverage tuned magnetic material behavior while being back-end-of-the-line compatible. As high-performance computing demands continue to grow, efficient on-chip power conversion becomes increasingly critical. AI workloads face the memory wall, requiring new in-memory computing architectures that can leverage magnetic memory devices. In this presentation, we highlight CoZrO as a promising candidate for next-generation on-chip power applications. Its unique nanostructure combines low coercivity with high saturation flux density, a favorable blend for magnetic core components in on-chip systems. We also present our recent efforts in fabricating nanoscale magnetic material based artificial neurons for neuromorphic computing crossbar arrays. We show that the domain wall-based neurons can operate with high reliability over many cycles, and have spontaneous leaking due to shape anisotropy. Together, these advances showcase the convergence of novel materials and device engineering in shaping the future of AI hardware.