

Dr. Pavan Nukala

Operando observation of reversible oxygen migration and phase transitions in ferroelectric Hf_{0.5}Zr_{0.5}O₂ thin films



Abstract

Unconventional ferroelectricity, robust at reduced nanoscale sizes, exhibited by hafnia-based thin-films presents tremendous opportunities in nanoelectronics. Such a scalable ferroelectricity on Si friendly materials is very good news for microelectronics and low-power ferroelectric memory devices. However, the exact nature of polarization switching remains controversial. In this talk, I will discuss our journey towards understanding these systems. This begins with first creating a ferroelectric phase in HfZrO₄ thin films, epitaxially grown using pulsed laser deposition, and discovery of a new rhombohedral phase. It then transitions to studying how these materials switch on such ideal platforms using state-of-the-art characterization techniques such as in situ atomic resolution electron microscopy (while applying bias), and operando nanobeam synchrotron measurements.

Brief biodata of the speaker: Pavan Nukala is an Assistant Professor at the center for Nanoscience and Engineering, IISc Bangalore. He is a materials scientist by training. He did his bachelors and masters from IIT Madras in Metallurgical and Materials Engineering, PhD from the University of Pennsylvania. Later he was a post doc at University Paris Saclay, and a Marie Curie research fellow at the University of Groningen in the Netherlands. His research interests include understanding the physics of thin films and devices of various functional electronic materials including ferroelectric oxides, phase change materials, memristive and neuromorphic materials. His own expertise is on in situ atomic resolution microscopy and operando x-ray diffraction techniques.