TIFR Centre for Interdisciplinary Sciences
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Seminar

Materials>< Device Co-Design using a multiscale computational framework

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In the semiconductor Industry, advanced materials such as Transition Metal Oxides (TMO), chalcogenides, 2D semiconductors are integral to a new wave of innovative devices powering future growth areas such as cloud computing, IOT, deep learning and medicine. The traditional 'trial and error' method through extensive experimentation, is cost and time inefficient because of the complex interaction of defects, interfaces and material properties with electrical behavior. In this talk I will discuss a multiscale simulation framework that simulates microscopic material and defects to accurately predict macroscopic electrical device parameters at nanoscale dimensions. I show how macroscopic and microscopic material properties calculated from DFT simulations can be linked to the more technological important task of designing and optimizing new devices. Conversely, the approach allows electrical measurements to extract the film material parameters that can be stored in a database for designing multiple devices. Several case studies from the semiconductor industry illustrate the methodology with the focus on binary oxides including both SiO_2 and TMO, that are used extensively in both logic and memory devices. The talk will progress from predicting leakage in thin film capacitors (DRAM) to reliability of gate oxides and then onto Resistive RAM (RRAM) devices for Non-Volatile Memories (NVM) and neuromorphic devices. Finally challenges for future Material>< Device Co-design using other materials are discussed.

Thursday, Apr 20th 2017

4:00 PM (Tea/Coffee at 3:45 PM)

Seminar Hall, TCIS