

Static and Dynamics Electron Microscopy of Nanostructured Materials

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Abstract:

Electron microscopy has always played important role in materials design and establishing the classical processing-structure-property relation paradigm in materials science and engineering. The past couple decades have witnessed rapid emergence of nanostructured materials and systems as well as designer materials tailored down to molecular and atomic scale. The characterization and analysis of such designer materials require not only higher “figures of merit” such as spatial resolution and analytical sensitivity but these often need to be performed under dynamic or so-called *in-operando* conditions. These stimuli in modern electron microscopes are varied and encompass a gamut; localized heating, in-situ electrical bias and even fluidic-cell, to name a few. This emergence of both, aberration-corrected and *in-situ* S/TEM have greatly advanced our understanding of static and dynamic behavior of nanostructured materials.

The presentation will introduce recently established advanced S/TEMs at the NUANCE Center; JEOL AC S/TEM (ARM200) and *in-situ* S/TEM (ARM300). It will cover examples of use of advanced microscopy in energy materials (Li ion battery electrodes, thermoelectrics), atomically layered 2D structures (chalcogenides, thin films) and others. The presentation will stress the need for fundamental understanding of electron-specimen interactions, which form the basis for the useful techniques. It will also emphasize challenges in acquisition, analysis in the big data world.

Short Biography

Vinayak P. Dravid is Professor of Materials Science and Engineering, in the McCormick School at NU. He is the founding director of the characterization facility, the NUANCE Center, and SHyNE Resource, an NSF-NNCI Center that provides high-tech facilities and expertise. Vinayak received B. Tech. in Metallurgical Engg in 1984 from IIT Bombay, India. He joined Northwestern faculty in 1990 after his PhD in MSE from Lehigh. Vinayak’s scholarly interests are at the intersection of materials and microscopy, spanning electronics, energy, environment and biomedicine. His diverse research portfolio encompasses advanced microscopy, nanotechnology, technology strategy, energy policy and emerging educational paradigms. His Google analytics are: >475 publications, >28,000 citations, H-index >83; dozens of issued/pending patents, and some are licensed to companies related to nanotechnology, sensor and diagnostic systems. His awards include society fellowships (APS, AAAS, MSA, MRS, ACerS). As the founding director of Global McCormick, he helped launch many global initiatives. Vinayak is an avid follower of Chess and follows online tournaments and super GM interactions. One of his passions is to enhance the societal and global appreciation for science and technology, through the beauty, complexity and elegance of microscopy & materials science.

