In situ electron microscopy for probing vapor phase growth and phase change induced actuation

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Abstract:

Isn't it seeing in real time make our life easy to find where things are? The same is true for scientific observation of materials through modern electron microscopes. Many of the scientific and technological developments in the area of materials science and nanotechnology are enabled by electron microscopy. Real time observations in transmission electron microscopy (TEM) have enabled direct imaging of growth and mechanical motion in nano and microscale structures, structural phase transitions and interfacial phenomena with atomic scale resolution. In my talk, I will present two examples, namely CNT growth, their self-organization in to dense CNT forest structure and in situ visualization of phase change induced actuation in VO_2 cantilevers. First, I will briefly discuss how *in situ* TEM technique can be used to visualize and quantify actuation in nanostructures that undergo structural transitions by Fresnel contrast imaging of electron transparent cantilevers. Second, I will present aberration corrected environmental TEM observations to answer some of the fundamental questions related to the growth of carbon nanotube forest. The investigated E-TEM method was employed to study CNT growth and provided more details of CNT growth, mechanical interaction between growing CNTs and their dense forest growth. Finally, the recent progress made on the above two aspects will be also presented to correlate the in-situ microscopy findings to practical applications in large scale.

Brief Biography of Speaker:

Dr.Viswanath Balakrishnan is an associate professor at school of engineering, IIT Mandi. He obtained his PhD investigating the atomistic growth mechanism of functional nanostructures using Transmission electron microscopy (TEM) at Indian Institute of Science (IISc), Bangalore in 2008. He was a senior research associate in IISc, Bangalore from 2008-2009 and studied the growth and nanomechanical behavior of bio-minerals. Later, he joined as post-doctoral fellow (2009 - 2013) at Harvard University and carried out in-situ phase transition studies of functional oxide thin films with major components of electrical, mechanical and electron microscopy. Afterwards, he joined Massachusetts Institute of Technology (MIT) as Post-Doctoral Associate (2013-2014) and explored the CVD growth of carbon nanotube (CNT) and Graphene. He was active user at Brookhaven National Laboratory (BNL) and carried out *in situ* TEM probing CNT growth. His research interests revolve around vapor phase growth of 1D and 2D materials, phase transition and nanomechanical behavior of functional materials.