TIFR Centre for Interdisciplinary Sciences
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Seminar

In situ stimuli based characterization of materials through Electron Microscopy and Spectroscopy

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The demand for efficient and improved materials drives research teams to produce better materials based on nanostructured phenomena. Generally, these advanced materials are used in special unique environments where performance and reliability are critical. Transmission electron microscopic characterization aids the highest spatial resolution for such characterization, combining real space imaging with local spectroscopic and crystallographic information. *In situ* electron microscopy is the method of observing the materials' behavior in real time at high spatial resolution, not just under static conditions. To study or see dynamic processes including the formation of transient structures *in situ*, observations may be accompanied by simultaneous measurement of dynamic properties to directly establish structure-function relationships. Solutions for *in situ* electron microscopy allow scientists and engineers to observe structure and composition as well as morphology and dynamic property changes real time at micro, nano and even atomic scales, to gain the most complete understanding of how materials can be expected to perform in the real-world applications.

Electron dose rates play a crucial role for any system to be characterized by *in situ* TEM experiments. In some cases, already during sample preparation, the sample will be exposed to electron and ion beams, which has to be taken into account. *In situ T*EM involves repeated high dose rates on the samples. During *in situ* TEM studies, the processes occurring are subtle morphological, crystallographic or compositional changes or variations. Distinguishing between morphological, structural and compositional variations resulting from stimuliapplication and the electron beam induced electrochemistry is crucial in this field of *in situ* TEM. In recent years, there in a huge increase to directly correlate ex situ reactions by *in situ* TEM studies.

Providing an insight into various existing *in situ* TEM techniques ranging from mechanical, thermal, liquid, gas, light, electrical, *in situ* TEM heating studies on nC Pd thin films, nC graphene, *in situ* TEM heating in Lorentz TEM of Fe-Ga alloys, *in situ* TEM biasing studies on all-solid-state Fluoride ion batteries, *in situ* TEM liquid based growth of Ag nanoparticles and understanding the formation of porosity by *in situ* liquid TEM shall be presented.

Thursday, Mar 30th 2017

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

Seminar Hall, TCIS