

Thursday, April 4, 2024

Refreshments at 3:15pm outside PSF 101
Lecture from 3:30pm - 4:30pm in PSF 101

The Role of Individual Atoms and Molecules in Nanostructured Materials

Dr. Eva Olsson

Chalmers University of Technology



Abstract:

In situ electron microscopy enables the site-specific correlation between atomic structure and properties. Developments of capabilities to manipulate and stimulate by, for example, electric fields, light, mechanical strain and temperature in the electron microscope allow quantitative studies of the active atomic structure using different imaging, spectroscopy and diffraction modes. The spatial resolution of the imaging mode is better than 1 Å and the precision in determining the position of atoms can be better than 1 pm. This enables study of the role of not only material phases but also individual atoms, molecules, defects and interfaces in determining properties. Electron tomography is used to determine the 3-dimensional structure of the materials. The knowledge obtained is used to tune the properties of advanced materials and devices. Catalytic activity of metal nanoparticles and electrical properties of semiconducting nanowires are examples where the strain-induced effects have a strong influence on the properties and performance. Electric fields can change the surface structure of materials and the thermal handling capabilities can be changed by the presence of a single atomic layer surface film. The talk will address crucial aspects to consider when performing *in situ* electron microscopy studies. New aspects of material properties and mechanisms, not obvious from measurements on the macro scale, can be revealed using the high resolution and *in situ* electron microscopy. The knowledge is crucial for not only the understanding of the mechanisms that are involved but also for the design of materials and devices with tailored properties.

Biography:

Eva Olsson obtained her PhD from the Department of Experimental Physics at Chalmers University of Technology, Gothenburg, Sweden, in 1988. She was a postdoc at IBM, T.J. Watson Research Center, Physical Sciences, Yorktown Heights, New York, USA, in 1989-1991. Thereafter she was an Assistant Professor at Chalmers and became Associate Professor in 1996. In 1997 she was appointed Full Professor at The Ångström Laboratory at Uppsala University, Sweden. In 2001 she was appointed Full Professor at Chalmers. She is now the Head of the Research Division Nano and Biophysics. She is also the President Elect of the International Federation of Societies for Microscopy. She became a member of the Royal Swedish Academy of Sciences, Physics Class, in 2011. In 2017 she was a visiting professor at The University of Tokyo supported by the Japan Society for Promotion of Science. Her research is on direct correlation between atomic structure and properties. Interfaces are of particular interest due to their significant influence on the properties and microstructural evolution. The goal is a fundamental understanding of the properties of materials and knowledge of how to design new materials and structures with tailored properties. The main research tool is electron microscopy and *in situ* techniques.

Host: Prof. Dave Smith

View our Spring 2024 Physics Colloquium schedule at <https://physics.asu.edu/colloquia>