UCI Samueli School of Engineering

Department of Materials Science and Engineering UCI

UNIVERSITY OF CALIFORNIA, IRVINE

DEPARTMENT OF MATERIALS SCIENCE AND ENGINEERING

IS PROUD TO HOST A SEMINAR BY

"CONTROLLING AND INVESTIGATING MATERIALS AND THEIR INTERFACES WITH CRYOGENIC AND ENVIRONMENTAL ELECTRON MICROSCOPY"

JOHN D. WATT

SCIENTIST AND ELECTRON MICROSCOPIST
CENTER FOR INTEGRATED NANOTECHNOLOGIES (CINT)
LOS ALAMOS NATIONAL LABORATORY,

Thursday, April 3, 2025

2:00 PM - 3:20 PM

McDonnell Douglas Engineering Auditorium

Abstract: Advances in cryogenic electron microscopy (cryo-EM), primarily driven by the life sciences, have emerged as powerful techniques for the characterization of beam and air sensitive materials. Cryo-EM avoids the drying artifacts introduced when preparing a sample for the high vacuum environment of an electron microscope and significantly reduces e- beam damage. Therefore, materials can be imaged as close to their native hydrated (or solvated) state as possible, while avoiding unwanted transformations (e.g., oxidation). In this talk I discuss how cryo-EM, and in particular focused ion beam (FIB) lift out techniques are being used for the analysis of low-Z metals, biomimetic materials, polymers, nanocomposites, and their liquid-solid interfaces. I will present the workflow and logistics of using the Center for Integrated Nanotechnologies (CINTs) cryo-EM lab, and the unique challenges involved with performing this method at cryogenic temperatures.

I will present work using the environmental transmission electron microscope (ETEM) at CINT and show its effectiveness to investigate and understand the real-time structural dynamics of nanostructured materials under a gaseous environment and elevated temperatures. I will present in-situ TEM experiments that observed the growth and evolution of Pt islands on Ru branched nanoparticles to create CO-resilient single-Pt-atom-on-Ru catalysts. I will then show how by monitoring the evolution of diffraction contrast, we can observe both structural and compositional changes in iron oxide nanoparticles. Specifically, we track the oxidation of a wüstite-magnetite (FeO@Fe3O4) core-shell nanoparticle to single crystalline magnetite and apply deep learning-based denoising methods to enhance structural information.

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Bio: Dr. John Watt is a Scientist and electron microscopist at the Center for Integrated Nanotechnologies (CINT) at Los Alamos National Laboratory. He received his PhD in Chemistry from Victoria University of Wellington, New Zealand and held postdoctoral positions at both VUW and Sandia National Laboratories. His research interests include the synthesis and characterization of soft matter and inorganic materials and investigating their unique interfaces and behaviors using both cryo- and in-situ EM.

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