

WORKSHOP #10

Multimodal Correlative Studies of Functional Nanomaterials

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Environmental transmission electron microscopy (ETEM) probes local atomic structure of nanomaterials under gas pressures. With chemical information available from electron energy loss spectroscopy (EELS), fundamental reaction processes on selective areas of materials can be followed. This atomic scale information must be related to microscopic and bulk material properties to confirm the localized measurements are representative of bulk behavior. X-ray photoelectron spectroscopy (XPS) probes chemical and electronic structures on areas of a few hundred square microns. With differential pumping, XPS can be conducted under near ambient pressures (APXPS). ETEM and APXPS use similar differential pumping schemes to overcome the limitations of electron inelastic scattering by the gas phase. Both techniques have similar pressure limitations, offering several practical opportunities to correlate measurements between the techniques.

This workshop aims to bring together researchers from multiple fields to discuss scientific areas that would benefit from correlating information from the two techniques, specifically monitoring chemical reactions at gas/solid interfaces. Instrumentation developments for probing gas/solid interfaces at the CFN will be presented, and ideas for further developments, including liquid solid interface techniques, will be gathered. We will also examine recent progress in multimodal correlative measurements of nanomaterials that include TEM, APXPS, and other spectroscopies to discuss challenges in correlating measurements among techniques.

Time (EST)	Title	Speaker (Affiliation)
10:00 am	Welcome	
10:10 am	Environmental TEM for Imaging Materials Reactions	Frances Ross* (Massachusetts Institute of Technology)
10:40 am	Exploring the Electronic and Crystal Structures of Alloyed Transition Metal Dichalcogenides through Synchrotron-Based X-Ray Spectroscopy	Ik Seon Kwon (Pohang Light Source)
11:10 am	Correlative Studies of Nanoalloys by XAS and TEM with High Spatial and Elemental Resolutions	Anatoly Frenkel (Stony Brook Univ.)
11:40 am	Correlative Studies of Functional Single Atom and Porous Metal Oxide Catalysts	Steve Suib (Univ. of Connecticut)
12:10 pm	Break	
1:30 pm	Overview of the section	
1:35 pm	Ambient Pressure X-ray Photoelectron Spectroscopy: the past, the present and the future	Slavo Nemsak* (Lawrence Berkeley National Lab.)

2:05 pm	Adapting an Electron Microscopy Microheater for Correlated & Time-resolved Ambient Pressure X-ray Photoelectron Spectroscopy	Burcu Karagoz (Diamond Light Source)
2:35 pm	In situ spectroscopic studies on the dynamic evolution of active site during water-gas-shift catalysis	Gengnan Li (Brookhaven National Lab.)
3:05 pm	Break	
3:25 pm	Overview of the section	
3:30 pm	Graphene-capped micro-reactors: Swiss army knife of modern surface science	Baran Eren (Weizmann Institute of Science)
4:00 pm	Observation of electrochemical reaction using liquid cell in AP-XPS	Kahyun Ham (Max Planck Institute)
4:30 pm	Discussion & Closeout	

* Keynote for TEM or APXPS techniques