Glenn T. Seaborg Center Special Seminar

Beamline on a Benchtop: Laboratory-based XANES and XES for High-Access Studies of Electrical Energy Storage and Other Applications

Gerald T. Seidler

Physics Department, University of Washington

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4:00 pm – 5:00 pm
Bldg. 15, Room 253

Research in electrical energy storage, actinide science, and catalysis that uses x-ray absorption or x-ray emission spectroscopies commonly faces a dilemma: The infrequent access at synchrotron light sources, rather than any inherent technical limitations at those facilities, can be the rate-limiting step in many research programs. Consequently, less-capable x-ray spectroscopy beamlines with around-the-clock availability could have a high impact in energy sciences.

With this in mind, we have recently constructed and commissioned an inexpensive, laboratory-based x-ray absorption near-edge structure (XANES) and nonresonant x-ray emission spectroscopy (XES) spectrometer that makes use of modern, synchrotron-quality x-ray analyzer optics. We find that synchrotron-quality XES can be rapidly performed thanks to recent developments in commercially-available, low-power (10 W) x-ray tubes. Building on the XANES results taken with the same source, we are designing and constructing a higher-powered laboratory-based XANES user facility for the University of Washington's new Clean Energy Institute (CEI). Each of the two fully-independent beamlines of the CEI-XANES instrument will maintain ~1-eV energy resolution from 5 keV to 10 keV with a flux of 10^6-10^7/sec, thus giving 'general-purpose' XANES capability with extremely high access. We believe that this mid-scale facility will play an important role in electrical energy storage research, especially for combinatorial synthesis of electrode materials and for long-baseline studies of the microscopic mechanisms for battery fatigue.

Host: David Shuh (510) 486-6937 DKShuh@lbl.gov Admin. Asst: Catherine Mendez (510) 486-5587
Ernest Orlando Lawrence Berkeley National Laboratory One Cyclotron Road, Berkeley, California 94720