A Facility for Spectro-Ptychography of Energy Materials at the Advanced Light Source

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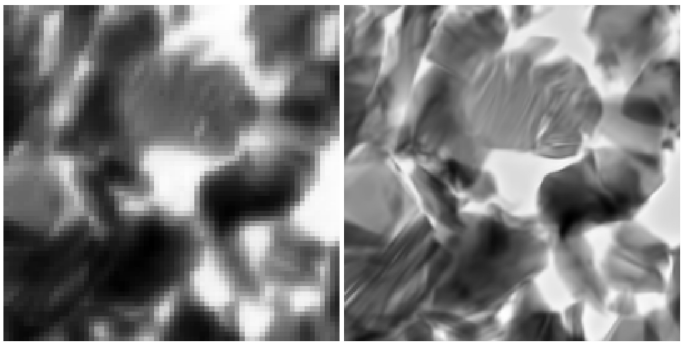
The Advanced Light Source (ALS) has commissioned an imaging facility (called the COSMIC beamline) dedicated to spectro-ptychographic imaging of nano-materials [1]. The x-ray photon energy range available spans the Carbon and Sulfur K-edges (250-2500 eV) and lends itself naturally to the study of chemical phases and nano-morphology of materials related to the energy and environmental sciences. The x-ray beamline design maximizes coherent flux on the sample while providing energy resolution adequate for NEXAFS spectroscopy. The beamline feeds a new scanning microscope with compact design and novel opto-mechanics that can achieve point scan rates in excess of 100 Hz with single nanometer precision and drift rates of only 2 nanometers per minute [2]. The use of an ALS developed fast frame rate CCD makes efficient use of the high coherent x-ray flux and enables rapid ptychographic imaging with diffraction limited spatial resolution now routinely below 10 nm [3]. In this presentation I will provide an overview of the design of the beamline, microscope and data pipeline, which is now serving general scientific users of the ALS. Special attention will be paid to the experimental methods that enable very high spatial resolution and applications in the energy sciences.



Early images from the COSMIC beamline. (Left) Conventional scanning x-ray image of a section of a battery cathode using a 45 nm zone plate at 850 eV x-ray energy, scanned on a 30 nm grid. (Right) Amplitude of the ptychographic reconstruction sampled on a 10 nm grid. Image field is 2 microns.

References

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