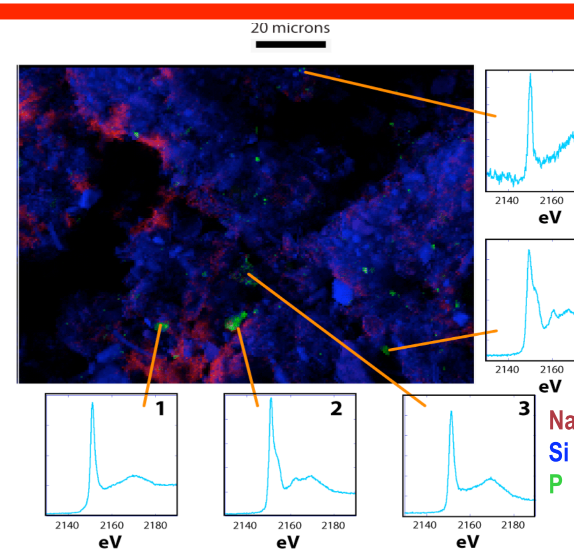
Tender-Energy X-ray Absorption Spectroscopy (TES)

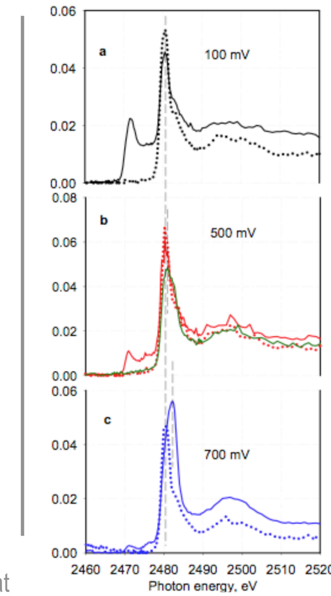
TES at NSLS-II

- Will enable **spatially-resolved** and ***in-situ*** studies of speciation and local structure by x-ray absorption spectroscopy in a *non-vacuum environment*
- Chemical sensitivity to **key lighter elements** Mg through Ti, and advantageous heavier-element L and M edges
- Optimized for the **NSLS-II dipole bend** source -- high brightness over a tunable spatial resolution and energy scanning across 1.2-8 keV will be world-class

Examples of Science Areas & Impact

- **Catalysis**: Materials (zeolites, thin films, nanomaterials), reaction mechanisms and intermediate species, poisoning
- **Energy Materials**: Photovoltaic, fuel cell, battery and superconducting (nano)materials
- **Environmental/Earth Science**: Biogeochemical and redox processes, contaminant behavior and remediation
- **Climate**: Terrestrial and marine C cycling, carbonate (bio) mineralization, geologic record of climate change
- **Sustainability**: Nutrient (P, S, K, Ca, Mg, Fe) cycling, transport and bioavailability, biofuel/biomass productivity





Example applications: Above: natural systems, e.g. P in sediments, exhibit species and distribution heterogeneities at the submicron to mm scale. Diaz et al., *Science*, 320, (2008). At right, combined *in-situ* XAS and electrochemistry examines S speciation during poisoning of fuel-cell catalyst (Baturina et al., unpublished). TES will enable fast-scanning high-quality EXAFS and XANES at tunable spatial resolution to better address these and other real systems.

Beamline Capabilities

Techniques: x-ray fluorescence and spectroscopic imaging, high-performance and *in-situ* EXAFS

Source: dipole bend magnet

Energy Range: 1.2 to 8 keV (optimized for 1.2-5 keV)

Spatial Resolution, Flux: 1x1 mm to 1x1 μm; up to 3×10^{12} ph/sec flux

U.S. DEPARTMENT OF ENERGY

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