XAS has long been useful for element-specific characterization of local structure and electronic state in crystalline and non-crystalline materials. Near-edge spectral structure (XANES) is useful in determining oxidation state and coordination species; extended fine structure (EXAFS) provides more detailed structural information within ~8Å. XAS of elements lighter than Ti, however, has been much less applied due to lack of optimized facilities and experimental challenges in the “tender” energy range 1-5 keV. Moreover, classic XAS employs large (mm) spot size and requires uniform samples, posing challenges for heterogeneous systems. Recent improvements in the NSLS Beamline X15B facility have enabled high-quality XAS in the tender energy range, at 0.25-1.0mm spatial resolution, in a non-vacuum sample environment. A newly-funded (NSF Earth Sciences and DOE Geosciences) project is adding microfocusing at X15B, to bring high-performance tender-energy XAS and XRF to the microscale. Microbeam capabilities are expected by early Summer 2013. NSLS-II is a new state-of-the-art synchrotron under construction; the tender-energy microspectroscopy facility developed at X15B will be transferred to NSLS-II to be operational by late 2014.