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Wide field imaging energy dispersive X-ray absorption spectroscopy

Based on spectral K-edge subtraction imaging (developed at CLS-BMIT), a new energy dispersive X-ray absorption spectroscopy method is developed at BMIT-BM beamline for simultaneous wide-field imaging and transmission X-ray Absorption Spectroscopy (XAS). Sufficient energy and spatial resolution are demonstrated for both full field imaging and computed tomography in quantifying selenium chemical species.

This technique has significant potential in rapid screening of heterogeneous biomedical or environmental systems to correlate metal speciation with function. Unlike the classic XAS approach which relies on mechanically scanning over the energies for every spectrum, a single projection image with the presented technique collects about 1000 spectra simultaneously in less than a second. The covered energy range is about 250 eV with the current system setting.

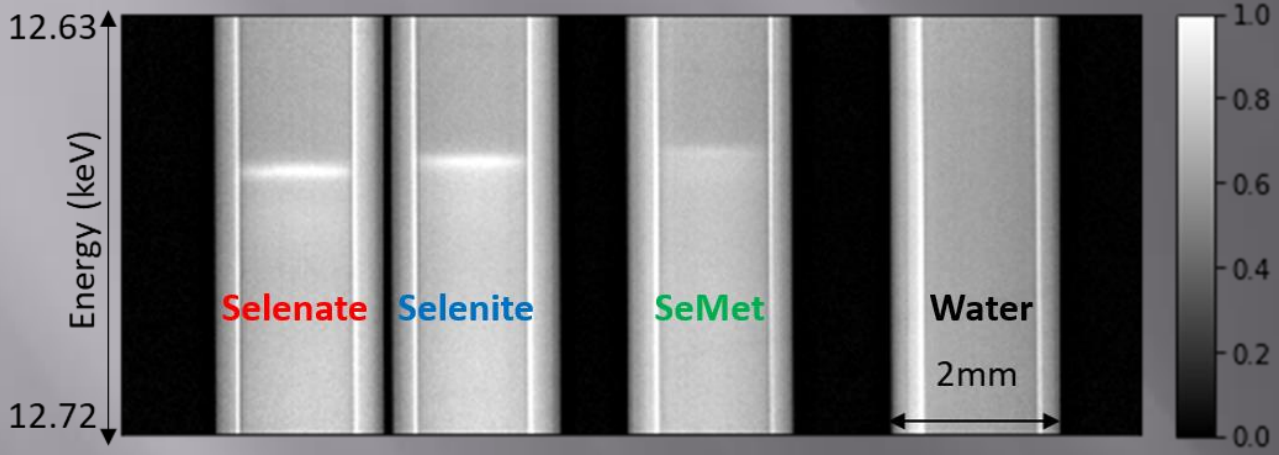

Figure 1. A projection image of Na2SeO4 (Selenate), Na2SeO3 (Selenite), selenomethionine (SeMet) solutions and water in separate tubes (from left to right) with 100 ms exposure time. The 'white lines' are the absorption peaks of Se k-edge in the local environments.

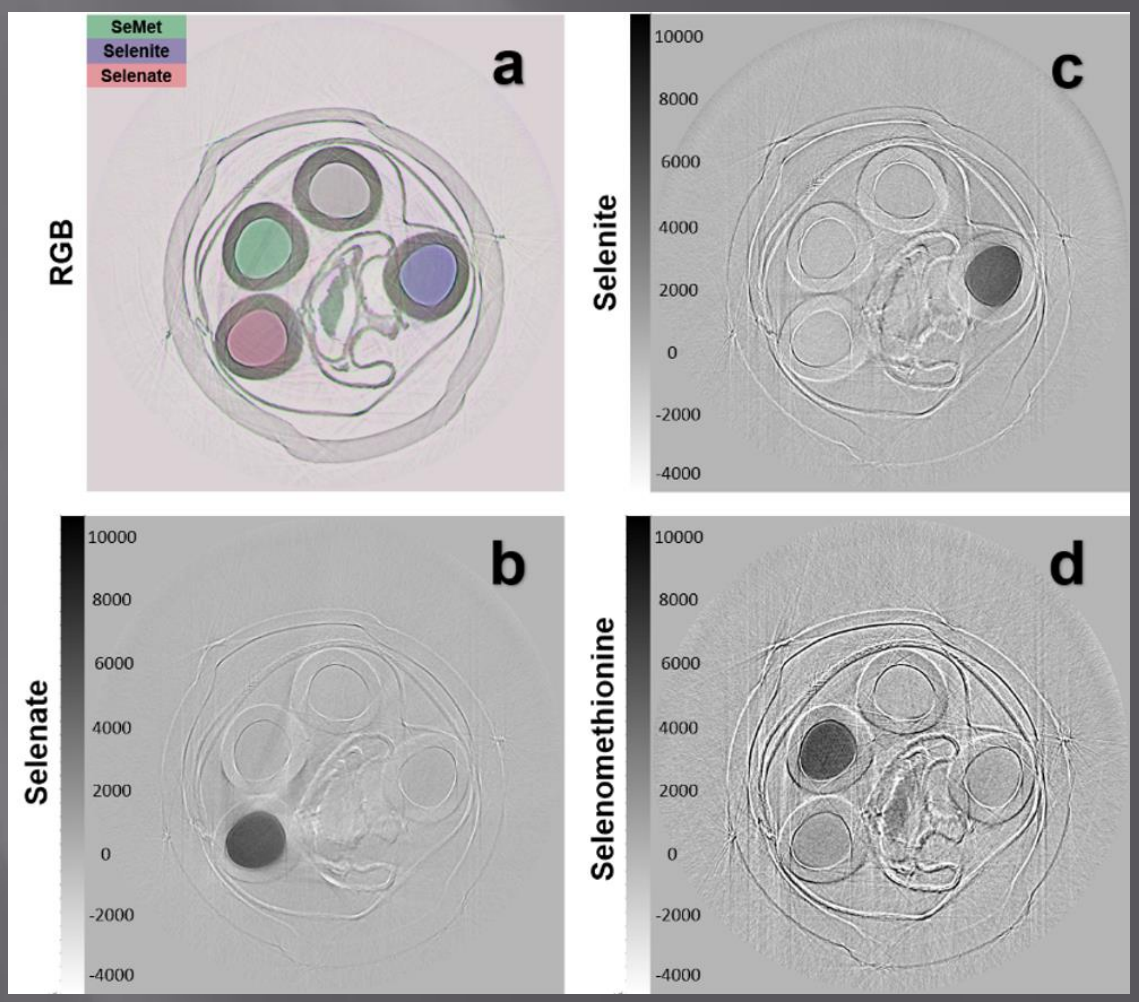

Figure 2. CT reconstruction of Se compound solutions. (a) A composite image of the reconstructed data with the water equivalent concentration shown as gray, SeMet concentration as green, selenite as blue and selenate as red. The individual reconstructed selenium compound concentrations are shown in (b) selenate, (c) selenite and (d) selenomethionine.