Non-resonant inelastic X-ray scattering to analyze carbon chemistry in unaltered samples

BHOOPESH MISHRA[1,2]*, EDWARD J. O'LOUGHLIN[2], WILLIAM T. COOPER[3], JULIE JASTROW[2], ROBERT GORDON[4], MAHALINGAM BALASUBRAMANIAN[4] AND KENNETH M KEMNER[2]

[1]Department of Physics, Illinois Institute of Technology, Chicago, IL (Presenting author: bmishra3@iit.edu)
[2]Biosciences Division, Agonne National Laboratory, Lemont, IL
[3]Department of Chemistry & Biochemistry, Florida State University, Tallahassee, FL
[4]Advanced Photon Source, Agonne National Laboratory, Lemont, IL

Advancing mechanistic understandings of carbon biogeochemical cycling is crucial for predicting future climate change. Characterizing chemical speciation of carbon in unaltered samples is critical for assessing the dynamics of carbon cycling in the earth system. Although carbon k-edge x-ray spectro(micro)scopy can provide spatially resolved chemical information about carbon in samples, the thickness and hydration state of environmental samples often precludes the utility of soft x-rays in these studies. Non-resonant inelastic x-ray scattering (NIXS) with a lesser energy resolution inelastic scattering (LERIX) instrument enables measurement of carbon 1s x-ray absorption spectra with higher energy x-rays, thus enabling the measurement of thick and hydrated samples without the need for sample containment in vacuum. We have made NIXS measurements of a variety of carbon-containing material standards, soil constituents, and soil samples. Results indicate measurements can distinguish important C moieties like aromatic-C, amide-C, phenol-C, carbonyl-C, and carboxyl-C. Results obtained from NIXS are complementary to NMR. Details of these results will be presented.