



Chemical imaging at 30 nm spatial resolution in 2-d and 3-d with Scanning Transmission X-ray Microscopy

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In the last 20 years, synchrotron based soft X-ray scanning transmission X-ray microscopy (STXM) has emerged as a powerful nano-scale analytical technique with particular strengths in the analysis of soft matter – polymers, biological and environmental samples. This presentation will describe soft X-ray STXM spectro-microscopy and spectro-tomography and illustrate its capabilities with results measured at the Advanced Light Source (Berkeley, CA) and at the Canadian Light Source (Saskatoon, SK). Examples will include: 2d & 3d chemically sensitive imaging of environmental biofilms; speciation and quantitative mapping of metals in natural river biofilms, and orientation mapping of defects in carbon nanotubes. The presentation will also describe use of the fine focused (30 nm) STXM beam to generate chemically specific patterns in multi-component polymeric materials and to probe the relative sensitivities of STXM-NEXAFS versus TEM-EELS (core level electron energy loss spectroscopy in an electron microscope).

Adam Hitchcock is Professor of Chemistry and member of the Brockhouse Institute for Materials Research at McMaster University. Educated at McMaster (BSc in Chemistry, 1974) and the University of British Columbia (PhD in Chemical Physics, 1978), he joined the faculty at McMaster in 1979. Major awards include the 1989 Noranda lecture award (Chemical Institute of Canada) and the senior Canada Research Chair in Materials Research CLS/CCRS (2001-2014). He was appointed a fellow in Academies of the Royal Society of Canada in 2006. His research uses synchrotron based X-ray microscopies and spectroscopies to study a wide variety of materials. In addition he maintains a research program in gas phase inner shell electron energy loss spectroscopy at McMaster. For all of his 30 year academic career he has had active research programs at many different synchrotrons (CHESS, NSLS, ALS, SSRL, Daresbury, LURE (ACO, DCI), HasyLab, BESSY, Elettra, CLS) using both soft and hard X-ray absorption and ionization techniques to investigate gases, liquids, solids, surfaces and photoionization dynamics. His group was deeply involved in developing the current generation of state of the art scanning transmission X-ray microscopes (STXM) which use differential interferometry to take full advantage of the ~25 nm spatial resolution of current generation zone plates. He is the scientific leader of the soft X-ray spectromicroscopy beamline, a state of the art facility for STXM and X-ray photoemission electron microscopy (X-PEEM) microscopy of materials, at the Canadian Light Source (CLS), a 2.9 GeV synchrotron light facility in Saskatoon, Canada. He is the North American editor of the Journal of Electron Spectroscopy and Related Phenomena, appointed in January 1997, after serving on the editorial board since 1986. He has worked with AFCC since 2008 on fuel cell characterization using STXM.