

Biological SINS: Broadband synchrotron infrared nano-spectroscopy of biological materials.

Hans Bechtel

By probing intrinsic vibrational and phonon modes, infrared (IR) spectroscopy continues to be a powerful analytical technique for chemical identification, but the spatial resolution of this technique has been traditionally diffraction-limited to several μm 's. Here, we describe synchrotron infrared nano-spectroscopy (SINS), in which spectrally bright and broad IR light from a synchrotron source is coupled to a scattering-type-scanning near-field optical microscope (s-SNOM), enabling sensitive vibrational spectroscopy spanning the entire mid- and far-infrared regions with nanometer spatial resolution. This highly powerful combination provides access to a qualitatively new form of nano-chemometric analysis with the investigation of nanoscale, mesoscale, and surface phenomena that were previously impossible to study with IR techniques. The Beamline 5.4 SINS end-station at the Advanced Light Source (ALS) at Lawrence Berkeley National Laboratory is available to users, such that it can be broadly applied to biological, surface chemistry, materials, or environmental science problems. We demonstrate the performance of SINS on a variety of engineered and natural biological systems, including biominerals, proteins, and peptoid nanosheets.