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Elemental Fingerprinting of Materials with Sensitivity at the Atomic Limit[1] MARVIN CUMMINGS, NOZOMI SHIRATO, Argonne Natl Lab, HEATH KERSELL, YANG LI, Ohio U., BENJAMIN STRIPE, DANIEL ROSENMANN, Argonne Natl Lab, SAW-WAI HLA, Ohio U./Argonne Natl Lab, VOLKER ROSE, Argonne Natl Lab — Variants of scanning probe microscopes have proven tremendously valuable for extracting detailed information about the nature of a sample's surface (atomic, electronic, magnetic), however it has proven difficult to yield chemical information utilizing scanning probe techniques alone. At Argonne National Laboratory's Advanced Photon Source, a new in-situ high-resolution microscopy technique, the synchrotron x-ray scanning tunneling microscope (SXSTM), utilizes x-rays as a chemical, electronic and magnetic probe and the nanofabricated tips of a scanning tunneling microscope as the chemical detector to take full advantage of the sub-nm spatial resolutions that STMs provide. Utilizing the new SXSTM technique, chemical fingerprinting of individual nickel clusters on a Cu(111) surface has been demonstrated with a 2 nm lateral resolution and a sensitivity confined to the first atomic surface layer. In addition, the photoionization cross-section from a single nm-scale Ni cluster has been successfully measured. SXSTM could prove to be a powerful new surface characterization technique, enabling exciting areas of opportunity and discovery in the chemical and materials sciences.

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