

## Synchrotron X-ray Measurements

### Facilities

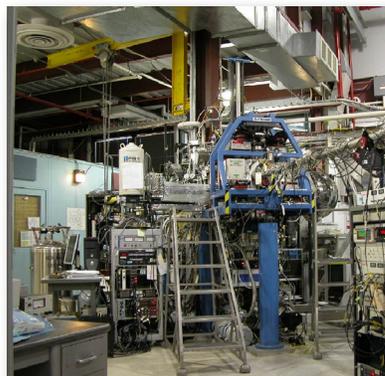
Synchrotron beamlines provide the capability to measure both local and long range electronic and atomic structures of materials and devices at much greater spatial and energy resolution than conventional x-ray methods. The NIST Materials Science and Engineering Laboratory (MSEL) operates a suite of three beamlines at the National Synchrotron Light Source (NSLS) at Brookhaven National Laboratory. These beamlines are part of the Department of Energy User Program at the NSLS, and thus are broadly available to industrial, academic, and other government agency researchers. The combined energy range of the MSEL beamlines allows measurements on every element of the Periodic Table, thereby enabling studies of every material and device structure imaginable.

MSEL researchers have established state-of-the-art measurement facilities at three beamlines: (1) near-edge x-ray absorption fine structure spectroscopy (NEXAFS) at beamline U7A; (2) extended x-ray absorption fine structure spectroscopy (EXAFS) at beam-line X23A2; and (3) x-ray photoelectron spectroscopy (XPS) and NEXAFS at beamline X24A. A fourth measurement capability, imaging XPS, is under development at beamline X24A.

The NEXAFS capability spans the energy range from 0.18 keV to 1.3 keV, and is used to probe the surface chemistry and molecular structure of low atomic weight materials, especially those containing carbon, *e.g.*, self-assembled-monolayers, DNA, proteins, biological materials, organic-molecular electronics, polymer surfaces and interfaces, catalysis, and nanotubes.

The XPS capability, with energy range from 0.7 keV to 5.0 keV, is used as a non-destructive depth selective chemistry probe matched to the length scale of advanced layered materials in the semiconductor industry.

The EXAFS beamline covers the energy range from 4.9 keV to 32 keV and is used to measure higher atomic weight materials, beginning with Ti, on the Periodic Table. X23A2 is used for studies of local atomic and electronic structures on all forms of condensed matter, from monolayer thin films to bulk materials and from crystalline to highly disordered materials.



NEXAFS Beamline U7A



XPS Beamline X24A



EXAFS Beamline X23A2

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