

Hard x-ray imaging and nanospectroscopy using photoelectron emission microscope

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We demonstrate sub-50 nm resolution nanoscale imaging and nanospectroscopy using photoelectron emission microscopy (PEEM) with hard x-rays. The advantages of the use of hard x-rays as an excitation source are the large probing depth, clear chemical contrast, nano-XAFS capability, and the visualization of the buried interfaces. The hard x-ray PEEM measurements were performed at the circularly polarized hard x-ray undulator beamline BL39XU of the SPring-8.

We have achieved the spatial resolution of hard x-ray PEEM of below 50 nm at the photon energy of 7 keV. For the magnetic imaging, the magnetic image of ultra high-density recording media CoCrPt are obtained at the Pt L-edge utilizing x-ray magnetic circular dichroism. The written magnetic patterns are clearly observed with a 130 nm spatial resolution.

We have also demonstrated a visualization of the interfacial Au nanostructures buried by a 200 nm Co capping layer. The buried nanostructures are clearly imaged.

The chemical mapping and nano-XAFS of iron meteorite are also shown. Nano-XAFS from a sub-micrometer area is obtained. The significant difference of the nano-XAFS spectra is attributed to the difference of local crystalline structure of the iron meteorite.