X-ray Magnetic Circular Dichroism Spectroscopy and Magnetic Imaging at SPring-8

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X-ray magnetic circular dichroism (XMCD) spectroscopy is a key technique to study the magnetic materials, offering the element specificity and the high detection sensitivity of magnetic moments. The XMCD technique can be combined with the state-of-the-art X-ray focusing optics such that scanning magnetic microscopy using a circularly-polarized X-ray nanoprobe will become possible. At SPring-8, we have developed XMCD spectroscopy and magnetic microscopy/imaging techniques in the soft and hard X-ray regions [1–4]. In this talk, we describe the current status of the instrumentation developments at the soft X-ray (BL25SU) and hard X-ray (BL39XU) beamlines dedicated to the XMCD study. These beamlines offer the capability of fast helicity switching of the circularly polarized X-ray beam with the high-sensitive lock-in detection of dichroic signals. For magnetic imaging, BL25SU is equipped with a Fresnel zone plate for a scanning soft-XMCD microscopy under strong magnetic fields by a unique combination with an 8-T-superconducting magnet [2, 3]. BL39XU is equipped with a Kirkpatrick-Baez mirror setup for scanning hard-XMCD microscopy with the spatial resolution of 100 nm [4]. We present some recent results including XMCD study of voltage-induced magnetic anisotropy in transition metal/MgO junctions [5, 6], time-resolved XMCD microscopy in a Co/Pt multilayer micro-disk to study the spin precession dynamics in the non-linear regime of ferromagnetic resonance [7], and three-dimensional observation of internal magnetic domains using scanning hard-X-ray magnetic microtomography [8].

References

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