Developing resonant MOKE measurement system

at SPring-8 BL07LSU

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Magneto-optical effects have been one of the central topics in condensed matter physics. The effects have also been important experimental probes in studying magnetism and spin transport in materials. A considerable number of magneto-optical Kerr effect (MOKE) experiments have been performed using linearly polarized laser light of a single wavelength typically in the visible region. When the probing photon energy is set at an absorption edge of a material (soft X-ray region), it has been observed that the Kerr rotation angle increases dramatically [1,2]. The phenomenon has been known as the resonant MOKE and it has now attracted interests in applying it for time-resolved researches with ultra-short pulse soft X-ray lasers, i.e. X-ray Free Electron Laser. In order to evaluate feasibility of the experimental techniques and the potential as the analytical method, we have developed the resonant MOKE system at SPring-8 BL07LSU.

SPring-8 BL07LSU is a soft X-ray beamline with a long undulator, being composed of figure-8 undulator segments that generate the linearly polarized soft X-ray beam. By adjusting the phase shifts of beams generated at individual segments, polarization of the light is tunable. Such an undulator is so-called the "crossed-type" and it exists only at this beamline over the world. Due to necessity of correct evaluation of the light polarization, the commissioning has still been required and the beamline is equipped with a polarimeter. By combining the polarimeter and an ultrahigh vacuum chamber for a sample with applied magnetic field, we demonstrated the resonant MOKE measurement. Figure 1 shows a photograph of the experimental system.

For the demonstration, we used a crystal of GdFeCo as a sample and applied the magnetic field of 0.5 T. The resonant MOKE measurement was carried out around the L-absorption edge of iron. The Kerr rotation angle at photon energy from $h\nu$=660 to $h\nu$=720 eV was determined by the rotating analyzer ellipsometry method. We succeeded in the measurement and observed that the Kerr rotation angle increased by 2 degree at the L-absorption edge ($h\nu$~720 eV). This large Kerr rotation angle indicates high potential for applying this resonant MOKE method for researches in fast magnetism and spintronics.

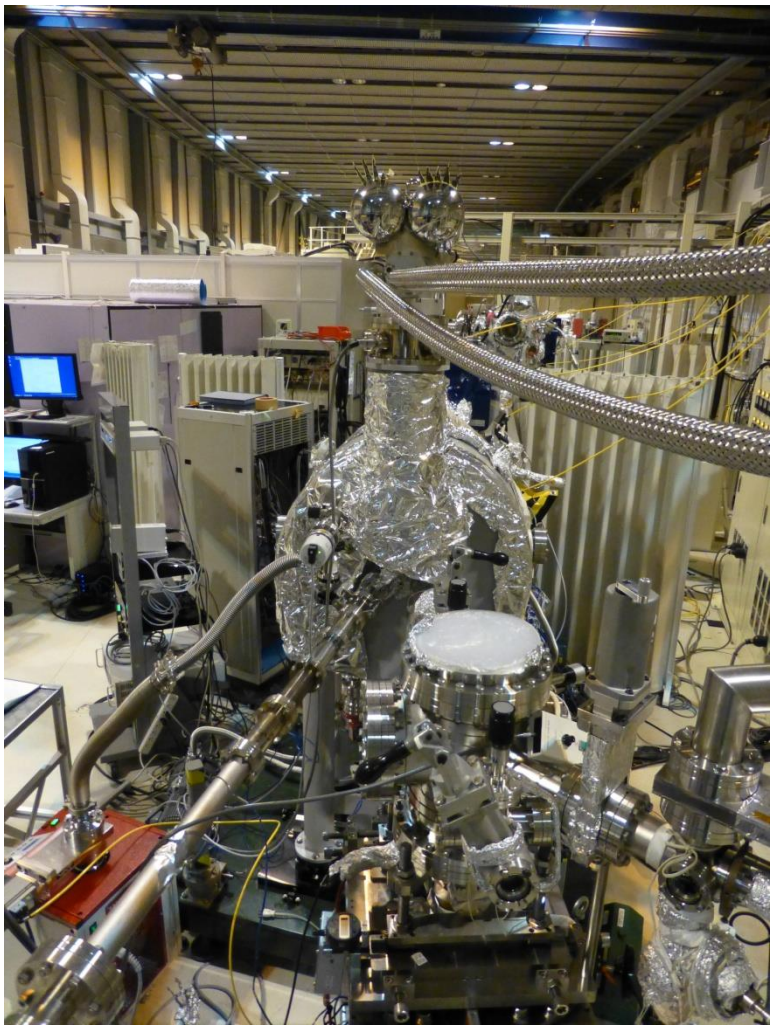

Figure 1 A photograph of experimental system of the resonant MOKE measurement, performed at the free-port station at SPring-8 BL07LSU. It is composed of two ultrahigh vacuum chambers, the magnetic field chamber and the polarimeter.

References

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[2] H.-Ch. Mertins, S. Valencia, D. Abramsohn, A. Gaupp, W. Gudat, P. M. Oppeneer, Phys. Rev. B **69**, 064407 (2004).