Development of synchrotron X-ray nano-beam dynamic force microscope

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Soft X-ray magnetic circular dichroism (XMCD) measurement is one of the most powerful tools for researches on spintronics devices. In recent years, the size of magnetic materials used in spintronics devices has been reduced to several tens of nanometers. To measure the magnetization behavior in such devices, a high spatial resolution measurement technique is required. An XMCD measurements technique with Soft-X ray nano-beam has shown remarkable results for magnetization measurements. However, the spatial resolution of the soft X-ray nano-beam MCD is limited to a few tenths of nanometers. Therefore, a new method for XMCD high spatial resolution is required. A combination of XMCD and scanning probe microscopy (SPM) is one of the promising technique to enhance the spatial resolution of XMCD measurements [1-5]. Here, we developed a soft X-ray nano-beam SPM for high spatial resolution XMCD measurement.

For soft X-ray nano-beam SPM, we developed an original dynamic force microscope (DFM) with UNISOKU Co., Ltd. The soft X-ray nano-beam SPM was installed in Spring-8 BL25SU (Fig. 1). Fig. 2 shows a schematic diagram of our soft X-ray nano-beam SPM. The DFM is fully controlled by the original controller developed with LabVIEW FPGA. The controller can be remotely controlled by python programs. With this system, we can enhance the spatial resolution of the XMCD measurements.

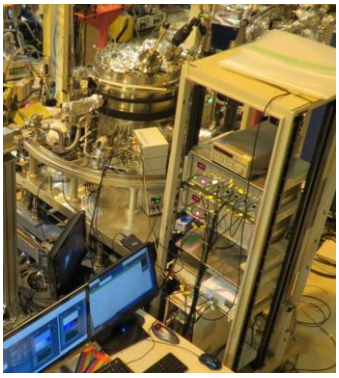

Fig. 1. Photograph of soft X-ray nano-beam SPM.

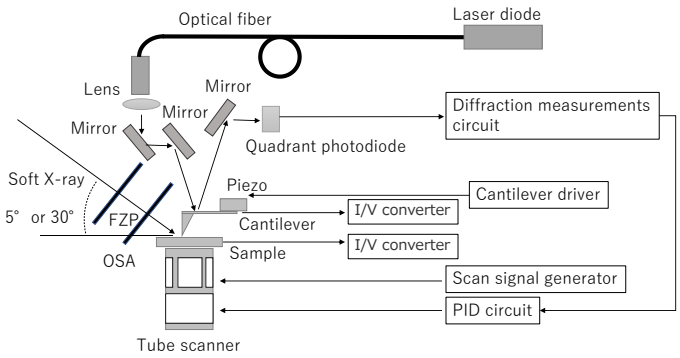

Fig. 2. Schematic diagram of soft X-ray nano-beam dynamic force microscope.

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