BL17SU
(RIKEN Coherent Soft X-ray Spectroscopy)

In the past few years, BL17SU has been restructured from a soft X-ray (SX) spectroscopy beamline to a microspectroscopy beamline. BL17SU was originally constructed to advance spectroscopic studies mainly for solid-state physics and materials science by means of conventional photoabsorption, photoemission, and SX emission spectroscopies. In the early phase of BL17SU, we began operating the spectroscopic photoemission low energy electron microscope (SPELEEM) [1] for public use. Since then, it has provided opportunities to investigate local electronic structures as well as magnetic domains of advanced materials with a spatial resolution of about 22 nm.

To extend the capability of BL17SU for microspectroscopic studies of various materials, we installed a versatile photoemission electron microscope (PEEM; FOCUS GmbH) into the b-branch carry-in station of BL17SU at the end of FY2016 (Fig. 1). After its commissioning in FY2018, FOCUS-PEEM has been open to public users. We have also developed a time-resolved PEEM measurement system using a FOCUS-PEEM combined with a femtosecond laser system and a SX chopper [2]. Research using this system investigates transient changes in the electronic and magnetic structure.

Toward the end of FY2016, we began developing a scanning SX spectromicroscope with a modest spatial resolution (*e.g.,* ~500 nm). The goal is to study local electronic structures on surfaces and interfaces of advanced materials under conditions ranging from a low-vacuum to a helium atmosphere, taking advantage of a photon-in photon-out

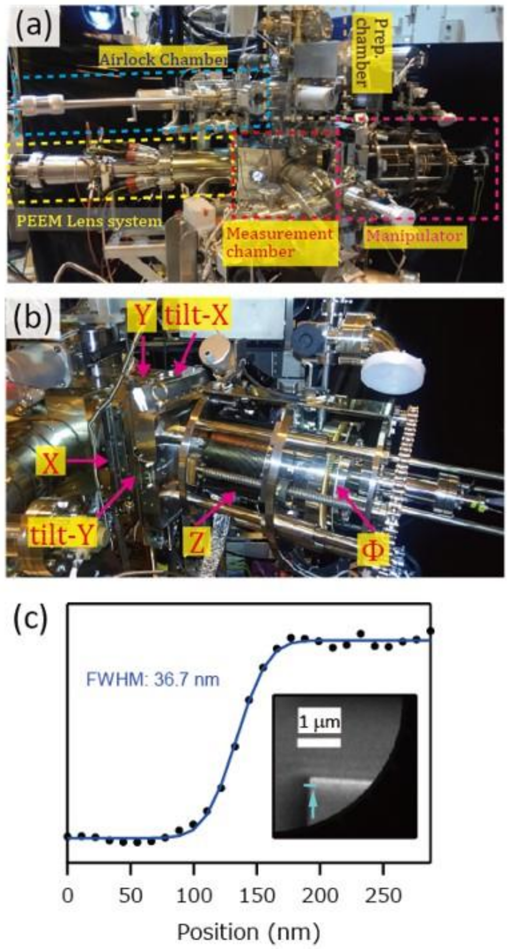

Fig. 1. (a) Photograph of overall view of the PEEM apparatus. (b) Photograph of the six-axis sample manipulator, specially designed to flexibly adapt to various experiments. (c) Line profile of the step edge of a silver film with a lithographed pattern (black dots). Corresponding position is indicated in the inset PEEM image with a blue line and an arrow. Fitting result is overlaid with a blue line. Achieved spatial resolution is ~36.7 nm when a UV lamp is used (~100 nm when SR is used).

measurement scheme [3]. Figure 2 shows a schematic and photographs of the apparatus installed at the b-branch carry-in station, (*i.e.*, the endstation is shared with the FOCUS-PEEM). In this carry-in station, the two machines can be easily switched since they are built on slide-rails.

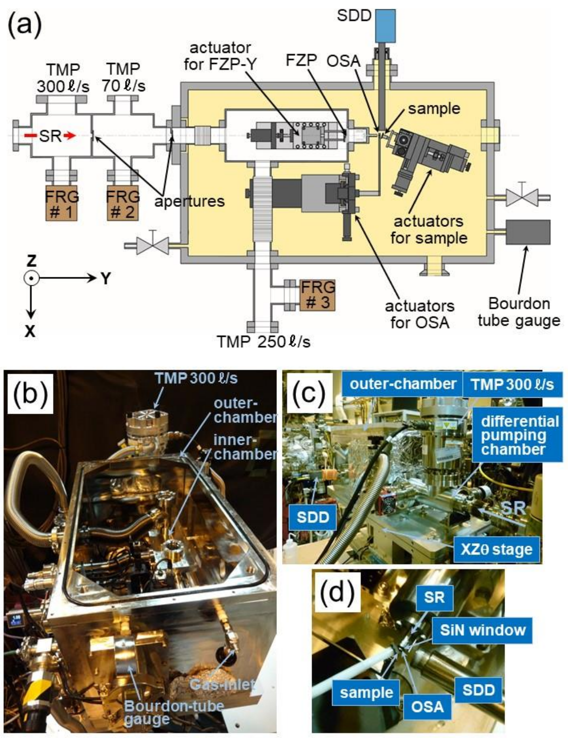

Fig. 2. (a) Top schematic view of the scanning SX spectromicroscope, where TMP is a turbo-molecular pump, FZP is the Fresnel zone plate, OSA is the order-sorting aperture, and SDD is the silicon drift detector. (b-d) Photographs of the present apparatus. (b) View from downstream, (c) view from upstream, and (d) area around the sample.

During the commissioning of the scanning SX spectromicroscope in FY2018, we simultaneously began microspectroscopic studies on various advanced materials. Additionally, we are developing another scanning spectromicroscope whose designed spatial resolution is smaller than 30 nm. Its commissioning is scheduled for FY2020. Currently, more than 50% of the total user time of BL17SU is devoted to microspectroscopic experiments.

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References:

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[3] M. Oura et al., submitted (under reviewing).