Startup of the Extreme Ultraviolet Spectroscopy Beamline

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Vacuum ultra violet (VUV) lights that have photon energies from several eV to several ten eV are used to analyze characteristics and electronic states of materials. Fabrication technique with VUV is interesting in photo-induced chemical reaction and lithography because VUV lights exert strong effects to chemical products and biological cells. For using VUV lights, Vacuum condition is needed because the materials constructing atmosphere absorbs the lights. Laboratory light sources for VUV generate fixed energy lights; for example, He light source produces only a few types lights as He I and He II. Synchrotron radiation is powerful light source, covering from infrared to X-rays, including VUV light. The vacuum ultraviolet spectroscopy beamline originally designed and constructed in the Photon Factory was donated in the SR Center of Ritsumeikan University. It was installed at BL-1 with minimum modifications in 2010 [1]. In the fiscal year of 2011, we prepared another experimental port for estimating the beamline performance.

New experimental port (port-B) was constructed up-stream of the beamline of the main experimental port (port-A) that has first focal point. Port-B can be used for any experiment by temporary

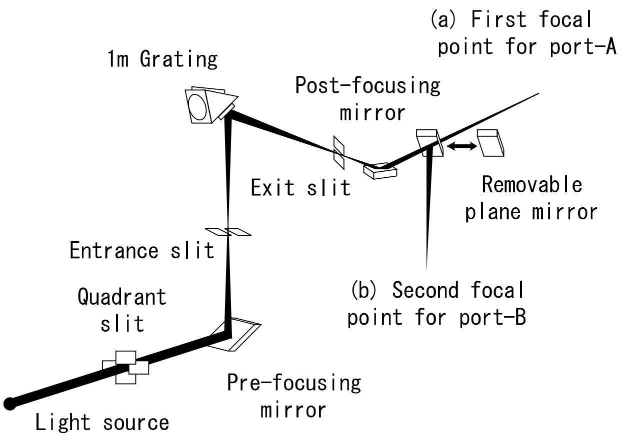
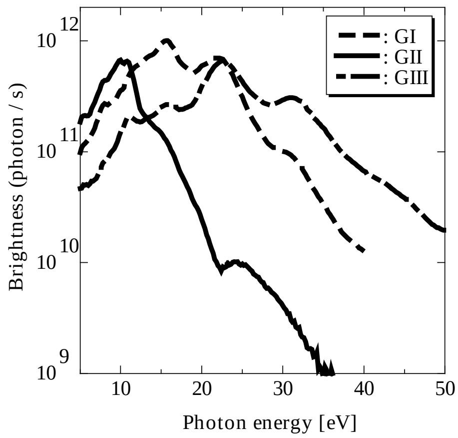
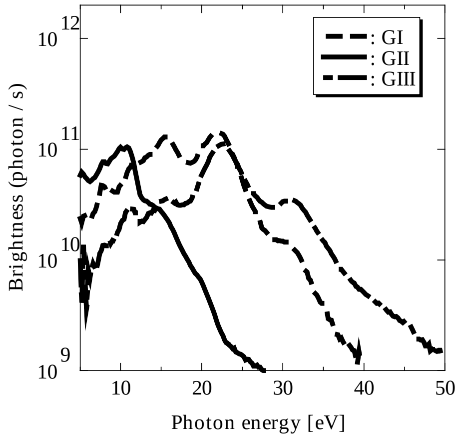


Figure 1. Outline of optical system in beamline 1. The beamline was constructed by Seya-Namioka monochromator including three optical mirrors. The monochromatic light focuses at two focal points for experimental port-A and port-B.

arrangement of the experimental equipments. Figure 1 shows the updated optical system that has the second focal point in port-B. An Au coated plane mirror was inserted between the post-focusing mirror and the first focal point. Monochromatic and focusing light from the monochromator is deflected vertically to the port-B by an inserted mirror. The mirror is retractable without breaking vacuum condition. Photon flux at the second focal point is reduced to 10 % of that at the first focal point due to the reflectivity of the mirror. We examined the beamline specifications about photon flux and energy resolution. Photon fluxes were ~10^{12} photon/s at the first focal point of port-A and ~10^{11} photon/s at the second focal point of port-B when the energy resolution E/ΔE is ~200. The beam size is 4 mm (horizontal) × 2 mm (vertical) at both focal points. Figure 3 shows energy distribution curve of the photon flux of each focal point using three kinds of gratings. Each focal point shows similar distribution. The brightness at the second focal point is one order of magnitude smaller than at the first focal point. Experiments for irradiation and reflectivity measurements were temporarily prepared at the port-B. VUV reflectivity of Au was measured with nearly normal incidence optical layout. The photon intensity was detected by photomultiplier (Hamamatsu Photonics). An MgF_2 filter was inserted into the beamline for cutting secondary photons higher than 11 eV. The result is shown in figure 2, which is similar to the previously reports [2]. Reflectivity measurement in BL-1 can be done at only one fixed angle at present.



(a) at port-A



(b) at port-B

Figure 2. Photon flux intensities (a) at port-A and (b) at port-B using three kinds of gratings.

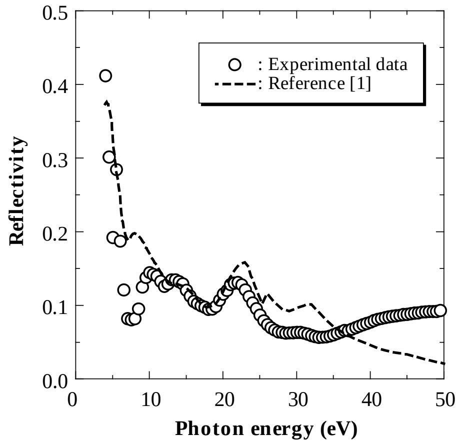


Figure 3. Reflectivity of Au coated mirror. The open circle is experimental data and dash line is reference data [2].

References

[1]M. Yoshimura, S. Imada, K. Terashima, Y. Miyata, H. Eto, T. Ohta, *Memories of The SR Center Ritsumeikan University*, **2011**, 13, 167-169
[2]E. D. Palik ed., “Handbook of Optical Constants of Solids”, *ACADEMIC PRESS*, **1998**