Improvements of Preparation Chamber for Two-dimensional Photoelectron Spectroscopy

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BL-7 is a VUV beamline dedicated for the electronic structure analysis of surfaces and low dimensional materials [1]. Experimental end station consists of three parts. Sample mounted on a special holder shown in Fig.1 is loaded into the air lock chamber. Then, it is transferred to the preparation chamber. If needed, further sample treatments, such as annealing by resistive heating, sputtering using an ion gun, and deposition of metals from evaporators are possible. Newly build Display-type spherical mirror analyzer (DIANA) is installed in the μ-metal shielded analysis chamber [2, 3].

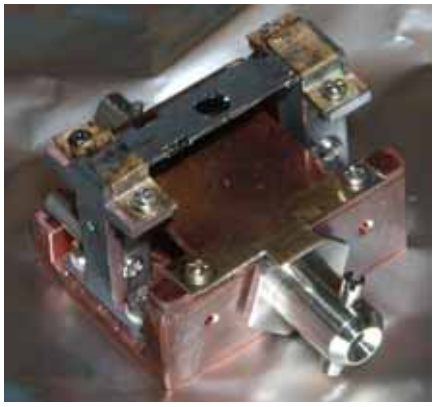

Fig. 1 Sample holder used at BL-7 specially designed for various sample treatments and measurements. Width: 27 mm.

Preparation chamber is equipped with home-made 4-grid LEED / AES optics for sample surface characterization. However, a strong magnetic field from storage ring (SR) magnets obstructed the observation of LEED patterns during SR machine time. In order to solve this problem, we introduced a Helmholtz coil to compensate the magnetic field.

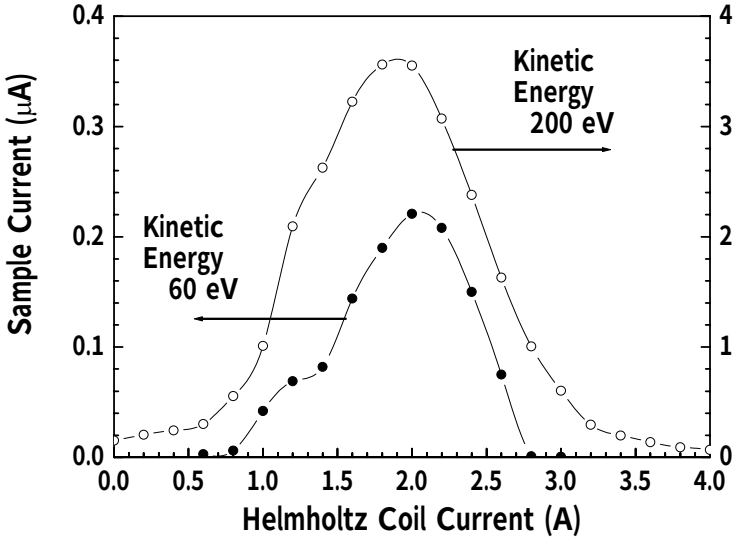

Fig. 2 Sample current vs. Helmholtz coil current. Kinetic energies indicated are those of LEED electron beam.

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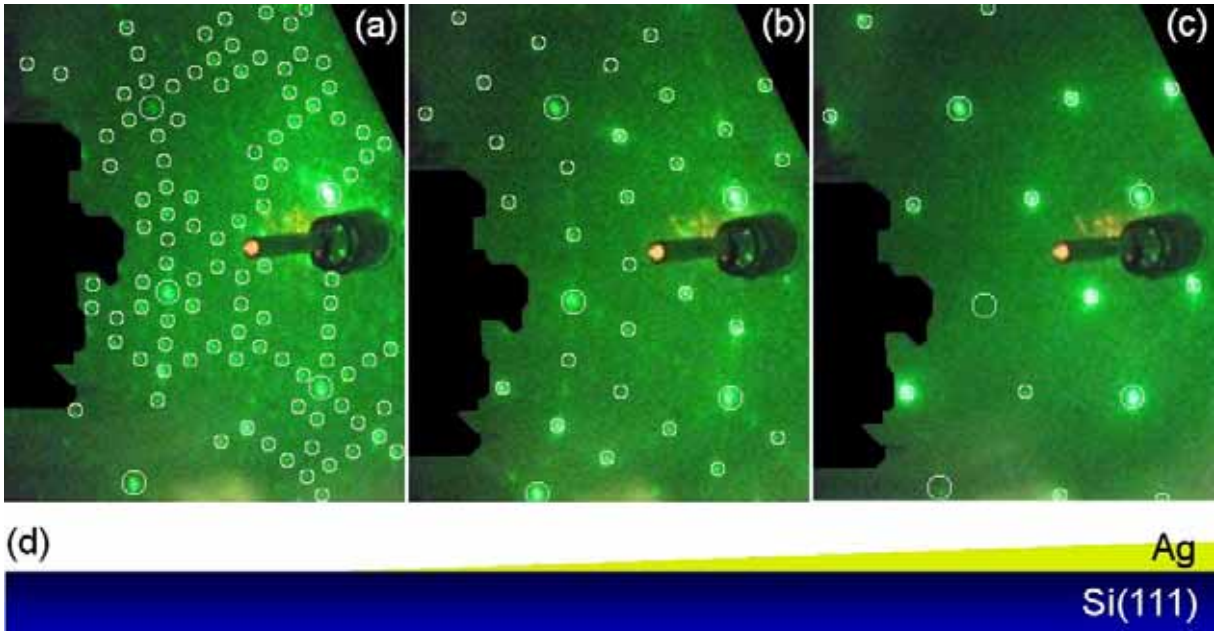

Fig. 3 Low energy electron diffraction (LEED) patterns from (a) Si(111)7×7, (b) Si(111)3×1+√3×√3*R*30º-Ag and (c) Si(111)√3×√3*R*30º-Ag reconstructed surfaces. Large and small circles are fundamental and fractional diffraction spots. Amount of Ag deposition on the Si surface was continuously increased as depicted in (d).

Two coils with 14 turns each were placed over and under the preparation chamber. Radii were 260 mm. Figure 2 shows how the sample current changes by using the Helmholtz coil. Optimum current was 2 A. In this note, we will describe the design and the performance of the beamline.

Here we show examples of LEED patterns acquired while SR was in operation. Ag was deposited onto a Si(111) surface. Amount of Ag deposited was continuously changed on the sample so that one end of the sample was clean while another end was covered with one monolayer of Ag as shown in Fig.3(d). Figure 3(a)-(c) show LEED patterns from various position of the sample surface. As the Ag coverage increased, diffraction pattern corresponding to (a) the Si(111)7×7 clean surface, the Si(111)3×1+√3×√3*R*30º-Ag surface and (c) the Si(111)√3×√3*R*30º-Ag surface appeared sequentially. Composition of surface can be deduced from Auger electron spectroscopy.

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