Performance of another type of DIANA

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Two-dimensional photoelectron spectroscopy (2D-PES) is a powerful technique to elucidate not only electronic structures, such as the Fermi surface, but also its atomic-orbital character, even its bonding character [1]. To obtain the two-dimensional photoelectron intensity angular distribution (2D-PIAD) patterns, a display-type spherical mirror analyzer (DIANA) has been developed [2]. Combining DIANA with a linearly-polarized synchrotron radiation (SR), detailed electronic structures have been revealed [3]. However, some distortions have appeared in the 2D-PIAD. Hence, another type of DIANA (Fig. 1) has been installed to the beamline. Here, we report the performance of newly installed DIANA.

Fig. 1 Photograph of two types of DIANA. Left: previous DIANA. Right: new DIANA.

The experiment was performed at the linearly polarized soft x-ray beamline BL-7 of SR center, Ritsumeikan University [4]. A synthetic graphite single crystal was used for the experiment. The sample was oriented so that one of the shortest C–C bonds (Γ–M direction) lies horizontally, which is along the electric vector of the normal incident SR. The measurements were performed at room temperature under ultrahigh vacuum of ~1×10^{-8} Pa. Photon energy was set to 40 eV and the total energy resolution was set to about 0.4 eV. The PIAD of this experiment was collected by energy window of ~0.3 eV.

Typical acquisition time for one PIAD was 30 sec. The angular resolution was about 1°.

Figure 2 shows the 2D-PES results. Angle-integrated spectra [Fig. 2(a)] are consistent with each other. Series of PIADs obtained by the new and previous DIANAs are shown in Fig. 2(b-i). Bright parts correspond to the Fermi surfaces and the constant energy surfaces. Both the Fermi surfaces appear at the hexagonal apexes (the Brilloiun zone corners of *K* points) with the extinction rule, i.e., only at the four left and right *K* points without the top and bottom *K* points, due to the linearly polarized SR excitation of C $2p_z$ atomic orbital character. While the Fermi surfaces obtained by the previous DIANA are slightly distorted around top-right *K* point, those by the new DIANA just locate at *K* points. With decreasing the energy, the PIAD patterns change for both the new and previous DIANAs, reflecting the band dispersion of graphite.

We have successfully installed another type of DIANA. Clearer PIAD patterns can be obtained by using the new DIANA.

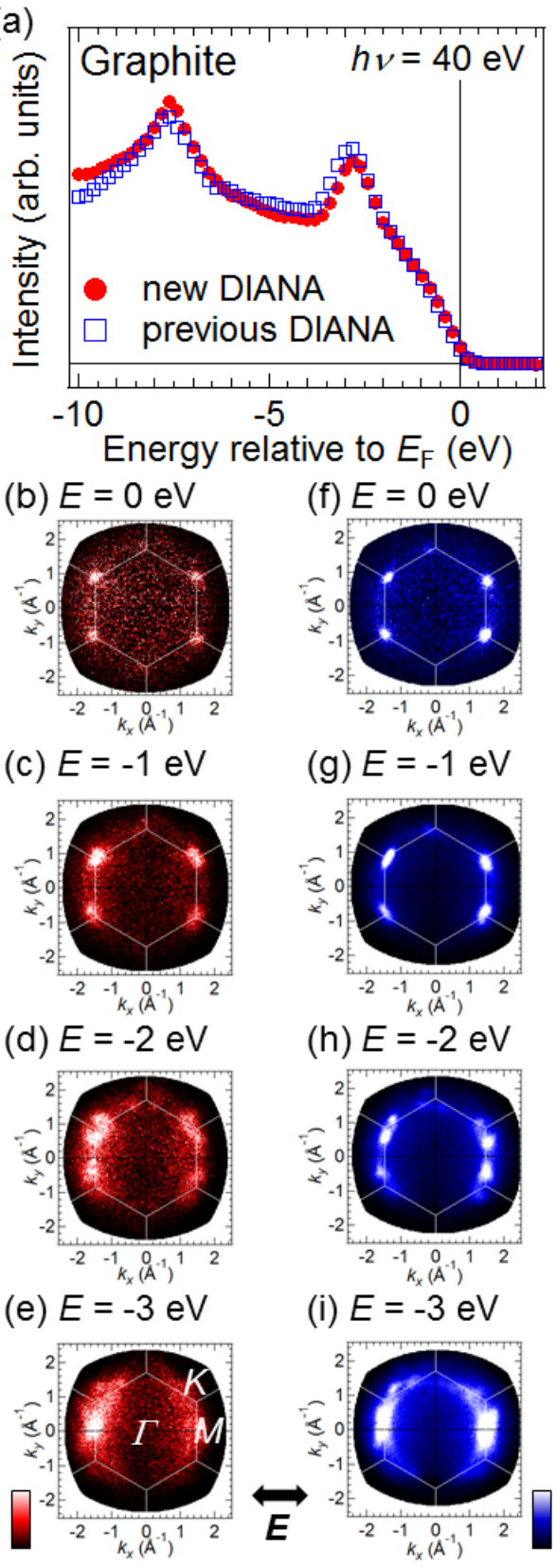

Fig. 2 2D-PES results of graphite. (a) Angle-integrated spectra. (b-e) 2D-PIADs obtained by the new DIANA. (f-i) 2D-PIADs obtained by the previous DIANA.

References

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