Graphene on SiO_2/Si Substrate Prepared by Transfer Process

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Commercially available single-layer graphene is produced on a copper foil by the chemical vapor deposition (CVD) method and then transferred onto a SiO_2/Si substrate. Knowing the surface condition of the graphene is important in the production of graphene oxide. However, polymethyl methacrylate (PMMA) used in the transfer process is known to remain on the graphene surface. Removing PMMA is necessary in the analysis of functional groups of graphene oxide. Since X-ray absorption fine structure (XAFS) measurements are powerful tools, we have investigated the chemical states of graphene surface before and after washing procedure.

XAFS measurements were performed at the BL-8 of SR Center, Ritsumeikan University, equipped with a grazing incidence monochromator with a varied-line-spacing plane grating. In order to investigate the chemical state of surface impurity (PMMA), Oxygen *K*-edge XAFS spectra of the samples were measured in partial electron yield (PEY) by a micro-channel plate detector with retarding grids set to -350 V. The incident angle of SR with respect to the surface normal was varied. The measurements were performed at room temperature under the ultrahigh vacuum of ~5×10^{-8} Pa. Graphene/SiO_2/Si was purchased and washed to remove remaining PMM: the graphene/SiO_2/Si sample was soak in acetone for 1 week, then it was naturally dried in the air.

Figure 1 shows the O *K*-edge spectra. The prominent structure around 538 eV comes from the SiO_2 substrate due to the single-layer thickness of graphene. The peak around 532 eV is assigned to O = C π^* bond [1, 2]. This peak comes from not graphene but remaining PMMA since it does not appear for the CVD graphene on sapphire [3]. The intensity of this peak from PMMA is significant (before the washing procedure). It can be seen that this intensity from PMMA is weakened after the washing procedure. This result suggests that acetone could be used to remove PMMA from graphene surface, although PMMA could not be completely removed.

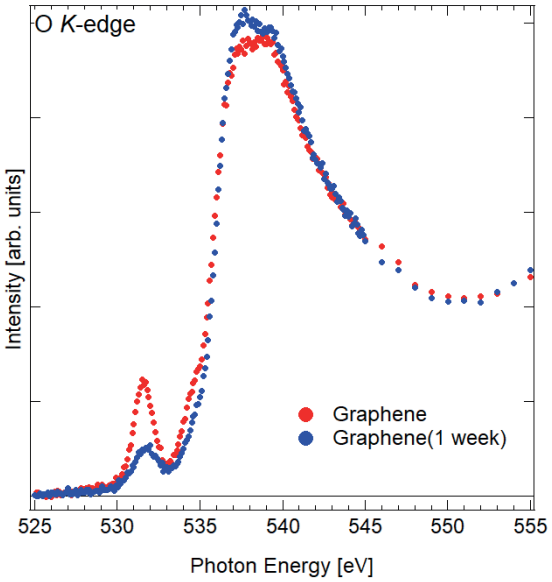

Fig. 1 O *K*-edge XAFS spectra for CVD graphene on SiO_2. Before (red) and after (blue) the washing procedure.

References

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