Features of graphene layers on SiC (000-1) revealed by transmission electron microscopy

W. Norimatsu, J. Takada, and M. Kusunoki

EcoTopia Science Institute, Nagoya University, Furo-cho, Chikusa-ku, Nagoya-shi, Japan
w_norimatsu@esi.nagoya-.ac.jp

Graphene is a one-atom-thick carbon material, having a hexagonal honeycomb lattice [1]. Graphene can be spontaneously formed by thermal decomposition of SiC [2,3]. Interestingly, structures and electronic properties of graphene formed on Si-terminated and C-terminated faces of the SiC substrate are different from each other. Graphene on C-terminated surface SiC (000-1) behaves like an isolated one, which is thought to be due to the rotational stacking faults. In addition, graphene on SiC (000-1) has higher mobility than that on SiC (0001). Then, it is quite important to fabricate homogeneous and large-area graphene layers on SiC (000-1). For the development of the mass production method, growth mechanism of graphene layers should be clarified in detail. In this study, we investigate the crystallographic features of graphene layers formed on SiC (000-1) mainly using high-resolution transmission electron microscopy (HRTEM), and propose the formation mechanism of them.

Graphene-on-SiC(000-1) samples were prepared by annealing SiC single-crystal in an Ar atmosphere. Specimens for transmission electron microscope (TEM) observation were prepared by an Ar-ion thinning method. Details of the preparation procedure are described in our previous papers [4]. Atomic force microscope observations were also carried out.

As a result of TEM observations, it was revealed that the decomposition of SiC was suppressed by increasing Ar-pressure. As for the growth mechanism, it is suggested that several layers of graphene were nucleated on SiC (000-1) surface, and then grows laterally over the terrace. Details of the crystallographic features of graphene layers on SiC (000-1), compared with those of graphene on SiC (0001) [4], will be discussed in the presentation.

References

[1] K. S. Novoselov, A. K. Geim, S. V. Morozov, D. Jiang, Y. Zhang, S. V. Dubonos, I. V. Grigorieva, and A. A. Firsov, Science, **306** (2004) 666.
[2] C. Berger, Z. Song, X. Li, X. Wu, N. Brown, C. Naud, D. Mayou, T. Li, J. Hass, A. N. Marchenkov, E. H. Conrad, P. N. First, and W. de Heer, Science, **312** (2006) 1191.
[3] M. Kusunoki, T. Suzuki, T. Hirayama, N. Shibata, and K. Kaneko, Appl. Phys. Lett., **77** (2000) 531.
[4] W. Norimatsu, and M. Kusunoki, Chem. Phys. Lett., **468** (2009), 52, Physica E, **42** (2010) 691, Phys. Rev. B, **81** (2010) 161410.