Work-function engineering of CVD-grown graphene using Cs_2CO_3

Young-Wook Ha, Ick-Joon Park, Hamin Park, Sung-Yool Choi

Department of Electrical Engineering and Graphene Research Center, Korea Advanced Institute of Science and Technology (KAIST), 291 Daehak-ro, Yuseong-gu, Daejeon 305-701, Korea

daliah2000@kaist.ac.kr, sungyool.choi@kaist.ac.kr

Abstract

Graphene has been considered as a candidate for electrodes or carrier transport layers in next generation electronic and optoelectronic devices due to its superior conductivity, transparency, and flexibility. However, chemical vapor deposition (CVD) grown graphene is easily p-doped by the absorbance of dipole molecules such as H_2O [1, 2], so n-doping technology has been desired to utilize graphene as cathode or electron transport layer in devices [3, 4]. Here, we present the n-type doping of graphene using Cs_2CO_3 solution which resulted in the decrease of work-function in graphene. Work-function decreasing of graphene (from 4.8 eV to 4.1eV) was confirmed via UV photoelectron spectroscopy (UPS) analysis. Doping time dependent characteristics of graphene was investigated by observing changes in Dirac voltage of fabricated graphene field effect transistors (GFETs).

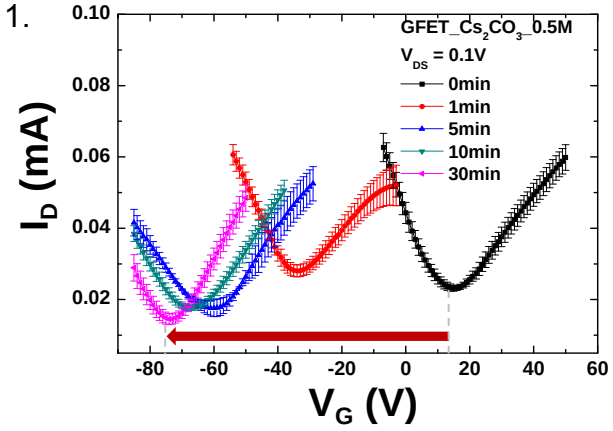
Besides, we confirmed that this doping method does not introduce any damages in graphene from no changes of carbon peak in X-ray photoelectron spectroscopy (XPS) measurement and no D-peak increase in Raman spectra analysis.

References

[1] O. Leenaerts et al., Phys. Rev. B, 77(2008), 125416
[2] T. O. Wehling et al., Chem. Phys. Lett., 476(2009), 125-134
[3] K. C. Kwon et al., *J. Phys. Chem. C*, 116(2012), 26586−26591
[4] J. H. Bong et al., Nanoscale, 6(2014), 8503-8508

Figures

1.



2.

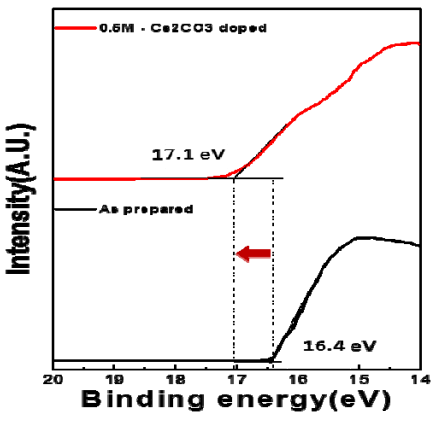


Figure 1. Transfer curves of Cs_2CO_3 doped GFETs depending on the doping time
Figure 2. UPS spectra of graphene before and after doping