Formation and Reduction of Ultrathin Layers of Graphene Oxide on Planar Solids

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Fabricating of extanded graphene-based surface coatings on solids with different surface energy remains a challenging problem. Herein, we report a new facile and scalable approach to form monolayers of 2D carbons on various solids by using self-assembly of graphene oxide at the oil/water interfaces. [1] We showed that interfacial monolayers with controlled packing density of graphene oxide can be deposited on the hydrophilic surfaces such as silicon wafers and quartz glass as well as on the hydrophobic surface of Teflon. Graphene oxide attained flat arrangements in the monolayers on hydrophilic surfaces (Fig.1a) and yielded the films of partially scrolled particles on the surface of Teflon (Fig.1b). The as-formed graphene oxide surface coatings underwent rapid reduction under microwave irradiation at 1000 W. The efficiency of reduction was dependent on the ability of the supporting material to absorb microwaves: silicon wafer>quartz glass>Teflon. The single layers of graphene oxide reduced on the surface of silicon wafers showed extraordinary low sheet resistance 1.2 kΩ•sq^{-1}. Our strategy is useful as a quick-and-cheap method for modifying surface hydrophilicity (Fig. 2) or electrical properties by the deposition of carbon-based films and for creating the GO templates suitable for further bottom-up assembly of various surface architectures.

References

[1] A. I. Zvyagina, A. A. Shiryaev, A. E. Baranchikov, V. V. Chernyshev, Y. Yu. Enakieva, O. A. Raitman, A. A. Ezhov, I. N. Meshkov, D. A. Grishanov, O. S. Ivanova, Yu. G. Gorbunova, V. V. Arslanov, M.A. Kalinina, NewJ.Chem., 41 (2017) 948

Figures

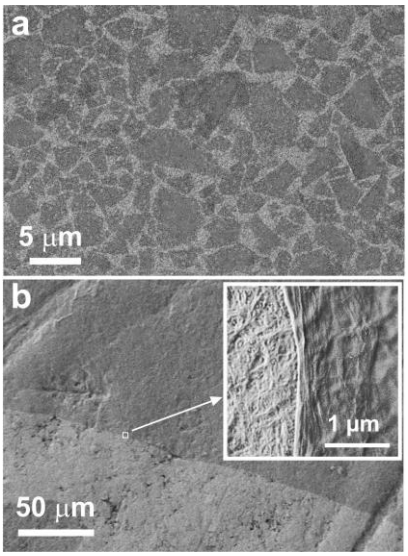

Figure 1: SEM images of graphene oxide monolayer transferred from oil/water interface onto a) silicon support, b) Teflon.

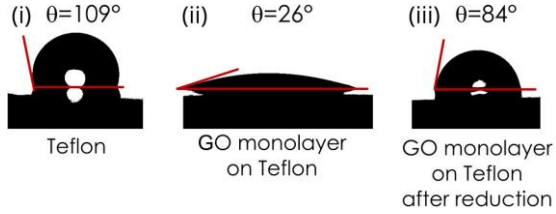

Figure 2: Measurement of static contact angle of water droplet on the surface of Teflon: (i) clean support, (ii) with deposited GO and (iii) reduced GO after microwave irradiation.