Surface functionalized graphene for detection of Concanavalin A

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Noncovalent functionalization of graphene by pyrene and its derivatives is a simple and effective way to modify the surface properties of graphene[1]. Here the pyrenyl-maltose is synthesized (shown in Figure 1). Graphene is noncovalently functionalized via π−π interaction between pyrene rings and graphene, while the maltose group performs as the sensing probe for the protein molecules, Concanavalin A (Con A) [2]. This sensing process is shown in the schematic image (figure 1).

By employing the atomic force microscopy (AFM), the morphology of graphene after dipping in the pyrenyl-maltose solution was observed .We find the pyrenyl-maltose molecules aggregate as nanoparticles on the surface of graphene and the coverage increases with the dipping time. The result was also confirmed by the Raman spectroscopy and X-ray photoelectron spectroscopy analysis. We also find the molecules aggregates existed in both solid and solution state and the size of them varies in different solvents. Due to the specific recognition between maltose and Con A, the functionalized graphene exhibits the selective absorption of the protein molecules sensing. And the control experiment of the absorbance of Bovine serum albumin (BSA) further confirmed the selectivity of the functionalized graphene, shown in Figure 2.

References

[1] Xu, Y.; Bai, H.; Lu, G.; Li, C.; Shi, G, Journal of the American Chemical Society, 130 (2008), 5856.
[2] Cummins, B. M.; Garza, J. T.; Coté, G. L, Analytical Chemistry, 85(2013), 5397.

Figures

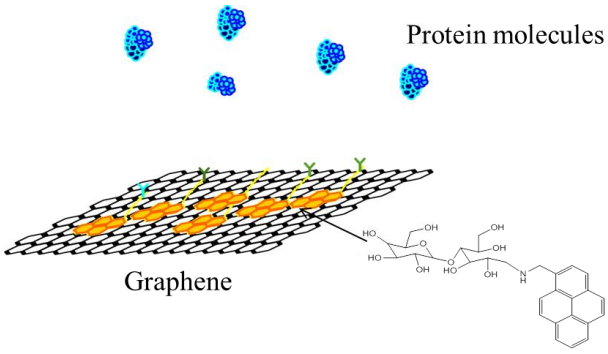

Figure 1: Schematic image of the detecting of protein molecules by pyrenyl-maltose functionalized graphene.

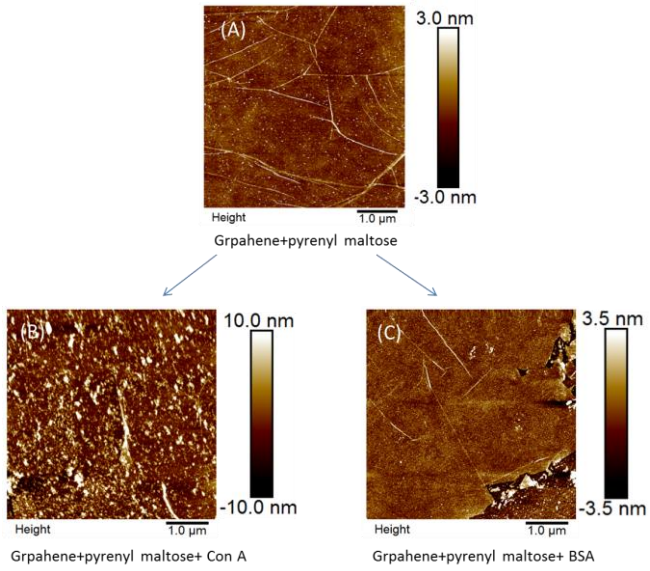

Figure 2: AFM results of the graphene after functionalization (A) and the selective absorbing of ConA (B) and BSA (C).