Large-Area Si-Doped Graphene: Controllable Synthesis and Enhanced Molecular Sensing

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Chemical doping of graphene with different heteroatoms (e.g. B, N) is becoming a powerful way to tailor its electrical and chemical properties. Extensive studies have been carried out on N- and B-doped graphene. However, there are few reports on Si-doped graphene (SiG) so far. Here we report the controllable synthesis of large-area SiG sheets for the first time using methoxytrimethylsilane (MTMS) and hexane as precursors in a bubbler-assisted chemical vapor deposition (BA-CVD) setup. As a proof-of-concept, their application in probing different organic molecules (e.g. crystal violet, rhodamine B, methylene blue) was successfully demonstrated. We noted that significant enhanced molecular sensing was achieved when SiG was used as a probing surface in virtue of their enhanced Raman scattering effect. This unique enhancement of SiG was explained using *ab initio* calculations, in which local distortions caused by the presence of Si atoms increase the interaction of the dye molecules with the doped graphene surface, in addition to the presence of an incomplete valence electron caused by the Si atom. Subsequently, the laser electronic excitation generated in SiG is then transferred to the molecule, and give rise to the strong Raman scattering in which both graphene and the molecular vibrations of the dyes are detected [1].

[1] Ruitao Lv *et al.*, Adv. Mater. **26** (2014)7593–7599.