Nitrogen-doped graphene: chemical and morphological properties

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Abstract

Nitrogen-doped graphene has attracted major attention due to its ability to change electronic properties of the graphene and enhance biocompability of the devices. Nitrogen is able to create three main bonding configurations within graphene sheets: graphitic-like, pyridine-like and pyrrolic-like. However, it has been pointed out that only the graphitic-like configuration causes the position of the Dirac point relative to the Fermi level to change and enhances n-type carrier concentration in the graphene.

In our work we studied nitrogen-doped graphene prepared by CVD method on Si face 4H SiC. Properties of the nitrogen-doped graphene were examined by LEED, Raman, XPS and ARPES. Local electronic properties of the graphene were studied using STM/STS techniques. Nitrogen dopants have been observed as a bright spots on STM topography. Dark spots are mainly structural defects in the graphene lattice associated with nitrogen incorporation. Presence of different bonding configurations of the nitrogen atoms in our sample has been confirmed by XPS measurements. We show that the presence of nitrogen causes defect creation within graphene sheets which can significantly reduce conductance of the graphene layers. However, we were able to create graphene sheets with different combinations of nitrogen-carbon bonds configurations and density of created structural defects by tuning the parameters during the graphene synthesis.

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