SW-001

Dissociative adsorption structure of guanine on Ge(100)

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Understanding the reaction mechanisms and structures underlying the adsorption of biomolecules on semiconductors is important for functionalizing semiconductor surfaces for various bioapplications. Herein, we describe the characteristic behavior of a primary nucleobase adsorbed on the semiconductor Ge(100). The adsorption configuration of guanine, a primary nucleobase found in DNA and RNA, on the semiconductor Ge(100) at an atomic level was investigated using scanning tunneling microscopy (STM) and density functional theory (DFT) calculations. When adsorbed on Ge(100) at room temperature, guanine appears dark in STM images, indicating that the adsorption of guanine on Ge(100) occurs through N-H dissociation. In addition, DFT calculations revealed that "N(1)-H dissociation through an O dative bonded structure" is the most favorable adsorption configuration of all the possible ones. We anticipate that the characterization of guanine adsorbed on Ge(100) will contribute to the development of semiconductor-based biodevices.

Keywords: guanine, Ge(100), scanning tunneling microscopy, density functional theory

SW-002

Transfer-free growth of graphene by Ni-C co-deposition

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Graphene, as a single layer of sp^2-bonded carbon atoms packed into a 2D honeycomb crystal lattice, has attracted much attention due to its outstanding properties such as high carrier mobility, chemical stability, and optical transparency. In order to synthesize high quality graphene, transition metals, such as nickel and copper, have been widely employed as catalysts, which need transfer to desired substrates for various applications. However, the transfer steps inevitably induce defects, impurities, wrinkles, and cracks of graphene. Here, we report a facile transfer-free graphene synthesis method through nickel and carbon co-deposited layer, which does not require separately deposited catalytic nickel and carbon source layers. The 100 nm NiC layer was deposited on the top of SiO_2/Si substrates by nickel and carbon co-deposition. When the sample was annealed at 1000°C, the carbon atoms diffused through the NiC layer and deposited on both sides of the layer to form graphene upon cooling. The remained NiC layer was removed by using nickel etchant, and graphene was then directly obtained on SiO_2/Si without any transfer process. Raman spectroscopy was carried out to confirm the quality of resulted graphene layer. Raman spectra revealed that the resulted graphene was at high quality with low degree of sp^3-type structural defects. Furthermore, the Raman analysis results also demonstrated that gas flow ratio (Ar : CH_4) during the NiC deposition and annealing temperature significantly influence not only the number of graphene layers but also structural defects. This facile non-transfer process would consequently facilitate the future graphene research and industrial applications.

Keywords: Graphene, Co-deposition, NiC