Low Temperature Growth of Highly Nitrogen-Doped Single Crystal Graphene Arrays by Chemical Vapor Deposition

The ability to dope graphene is highly important for modulating electrical properties of graphene. However, the current route for the synthesis of N-doped graphene by chemical vapor deposition (CVD) method mainly involves high growth temperature using ammonia gas or solid reagent melamine as nitrogen sources, leading to graphene with low doping level, polycrystalline nature, high defect density and low carrier mobility. Here, we demonstrate a self-assembly approach that allows the synthesis of single-layer, single crystal and highly nitrogen-doped graphene domain arrays by self-organization of pyridine molecules on Cu surface at temperature as low as 300 °C. These N-doped graphene domains have a dominated geometric structure of tetragonal-shape, reflecting the single crystal nature confirmed by electron diffraction measurements. The electrical measurements of these graphene domains showed their high carrier mobility, high doping level, and reliable N-doped behavior in both air and vacuum.