Synthesis and Characterization of Atomic and Electronic Properties of Graphene-based Heterostructure

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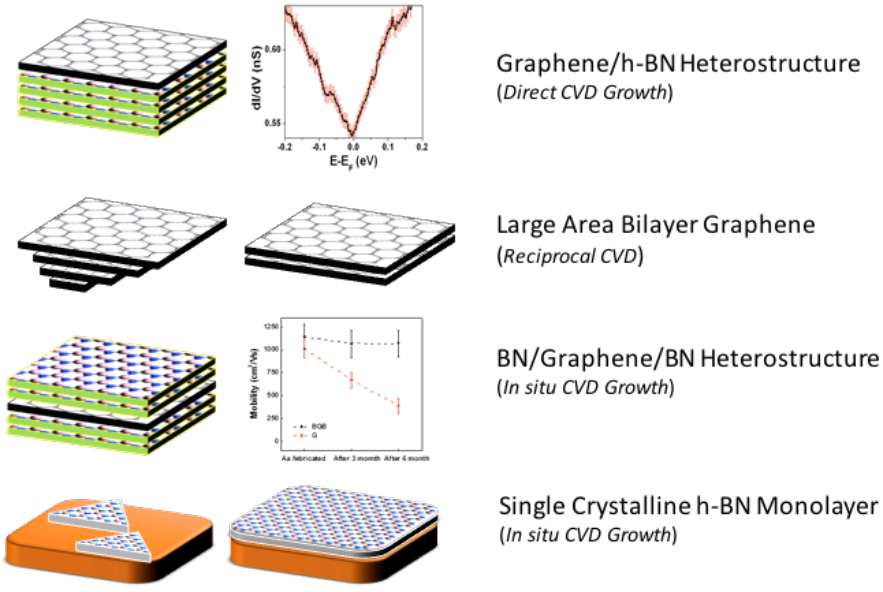
Electronic structure of graphene is affected by number of graphene layers and stacking order.[1,2] Control of layer number as well as scalability has been the main issues for device applications based on graphene. A new and unique CVD method is proposed to synthesize epitaxial multilayer graphene on copper by an iterative process of graphene growth and h-BN etching in chemical vapor deposition (CVD). A h-BN thin film is utilized to provide a gap of well-defined thickness for introducing the precursors and to play the role of the epitaxial growth of multilayer graphene. A thin h-BN film, initially-CVD grown on copper,[3] is locally etched out by hydrogen atoms decomposed from CH4 during the sequential graphene growth, which generates additional growth channels of graphene adlayers again under the first graphene layer. The crystallinity with AB stacking was confirmed by Raman analysis and selected-area electron diffraction measurements as well as statistical studies of optical microscope images. Graphene growth with a h-BN template suggests a potential way for controlling the specific layer number of large-area graphene in CVD for the device applications of graphene.



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