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Synthesis of Graphene on Hexagonal Boron Nitride by Low Pressure Chemical Vapor Deposition

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Graphene is a perfectly two-dimensional (2D) atomic crystal which consists of sp2 bonded carbon atoms like a honeycomb lattice. With its unique structure, graphene provides outstanding electrical, mechanical, and optical properties, thus enabling wide variety of applications including a strong potential to extend the technology beyond the conventional Si based electronic materials. Currently, the widespread application for electrostatically switchable devices is limited by its characteristic of zero-energy gap and complex process in its synthesis.

Several groups have investigated nanoribbon, strained, or nanomeshed graphenes to induce a band gap. Among various techniques to synthesize graphene, chemical vapor deposition (CVD) is suited to make relatively large scale growth of graphene layers. Direct growth of graphene on hexagonal boron nitride (h-BN) using CVD has gained much attention as the atomically smooth surface, relatively small lattice mismatch (∼1.7%) of h-BN provides good quality graphene with high mobility. In addition, induced band gap of graphene on h-BN has been demonstrated to a meaningful value about ∼0.5 eV.[1]

In this paper, we report the synthesis of grpahene / h-BN bilayer in a chemical vapor deposition (CVD) process by controlling the gas flux ratio and deposition rate with temperature. The h-BN (99.99%) substrate, pure Ar as carrier gas, and CH_4 are used to grow graphene. The number of graphene layer grown on the h-BN tends to be proportional to growth time and CH_4 gas flow rate. Epitaxially grown graphene on h-BN are characterized by scanning electron microscopy, atomic force microscopy, and Raman spectroscopy.

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Reference

[1] Erjun Kan. and Jinlong Yang. Why the Band Gap of Graphene Is Tunable on Hexagonal Boron Nitride. J. Phys. Chem. C 2012, 116, 3142－3146

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