

Intimate Understanding for Growth Mode of Graphene on Copper

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Direct synthesis of graphene using a chemical vapor deposition (CVD) has been considered a facile way to produce large-area and uniform graphene film, which is an accessible method from an application standpoint. Hence, their fundamental understanding is highly required. Unfortunately, the CVD growth mechanism of graphene on Cu remains elusive and controversial.

Here, we present the evidences for two different growth modes of graphene on Cu investigated by varying carbon feedstock (C_2H_2 and CH_4) and working pressure. The number of uniform graphene layer grown by C_2H_2 increased with increasing its injection time. A combined secondary ion mass spectrometry (SIMS) and X-ray diffraction (XRD) study revealed a carbon-diffused Cu layer created below surface region of Cu substrate with the expansion of Cu lattice. The graphene on Cu was grown by the diffusion and precipitation mode not by the surface adsorption mode, because similar results were observed in graphene/Ni system. The carbon-diffused Cu layer was also observed after graphene growth under high CH_4 pressure. Based on various previous results and ours, we have successfully found that there are two selective growth modes for graphene on Cu substrate, and a desired mode can be chosen by tuning working pressure corresponding to the kind of carbon feedstock. We believe that this finding will shed light on high quality graphene growth and its multifaceted applications.

Keywords: graphene, growth mechanism