Layer-controlled single-crystalline graphene film with stacking order via Cu-Si alloy formation

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Multilayer graphene provides both the physically intriguing properties and technologically applications with electronic, optical properties. Several approaches to synthesize the multi layer graphene have been demonstrated but a method of precisely controlling the number of layers with desired stacking sequences is still lacking. Here, we propose an approach for controlling the layer thickness and crystallographic stacking sequence of multilayer graphene films in a wafer-scale via Cu-Si alloy formation using direct chemical vapour deposition (CVD). C atoms are introduced by tuning the ultra-low-limit CH_4 concentration to form a Si-C layer, reaching 1 ~ 4 graphene layers in wafer-scale after Si-sublimation.

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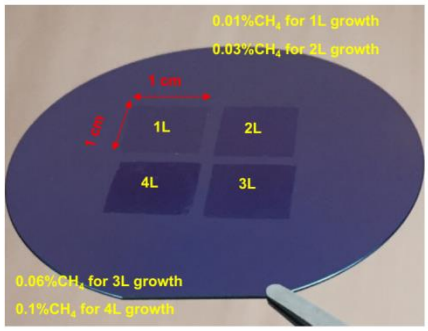

Figure 1: Photograph of centimeter-scale mono-, bi-, tri-, and tetralayer graphene on the SiO_2/Si substrate.

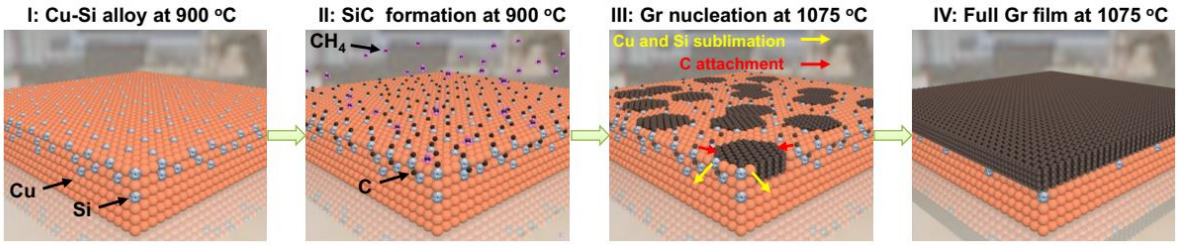

Figure 2: Schematic of growth process. Step I: Si atoms were uniformly distributed in the monocrystalline Cu(111) film; step II: SiC formation at 900 °C in a H_2-rich environment; step III: multilayer graphene islands were grown at 1075 °C; step IV: a full multilayer graphene film was obtained