Controlled Growth of High-Quality CVD Graphene

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Graphene has garnered widespread interest and confer remarkable potential for next-generation technological applications, which relies on the controllable and mass-production of high-quality graphene films. Chemical vapor deposition (CVD) is considered the most promising method, and great progress has been achieved over the last decade [1]. Currently, this field is being pushed to new heights that pursuit structure control (e.g. orientation, layer, stacking order, contamination, doping, etc.) and low-cost production (e.g. increasing the production capacity and growth rate) [2]. In this talk, I will introduce our recent works on controlled growth of high-quality graphene films via CVD approach. By designing and preparing single-crystal Cu foils, we have opportunities in realizing the epitaxial growth of large-area single-crystal graphene film [3]. We designed and constructed a pilot-scale CVD system suitable for producing A3-size graphene films, which works well and output high-quality graphene films with high capacity. In another hand, we also explore the possibility on controlling the layer number and stacking order, which is motivated by the emerging twistronics. Here I will present our state-of-the-art hetero-site nucleation method for growing twisted bilayer graphene (tBLG) [4]. Gas-flow perturbation and switching of the graphene edge termination play crucial roles in triggering the formation of interlayer twist. The growth mechanism is carefully investigated by using an isotope-labelling technique. The as-obtained tBLGs show high crystalline quality, which is confirmed by the Raman spectra, atomically clear Moiré patterns in TEM image and ultrahigh carrier mobility (over 50,000 $cm^2 V^{-1} s^{-1}$ at room temperature).

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FIGURES

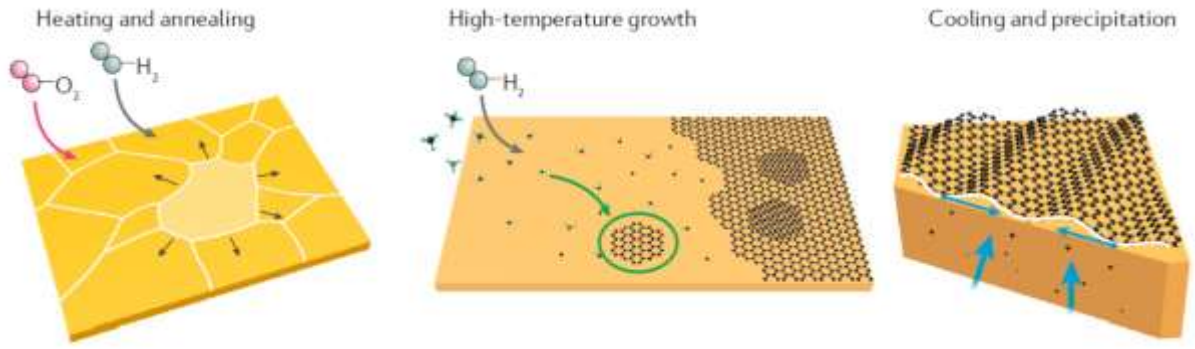

Figure 1: Major steps of growing graphene films on metal substrate.