Epitaxial graphene growth and characterization of buffer layer on SiC (0001)

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Abstract: Since 2008, epitaxial graphene growth has been developed in terms of homogeneity and scale by using a 1 ATM argon pressure at high temperature (>1650°C) [1, 2]. Until now, it still remains challenging to obtain films with different and controlled characteristics such as the number of graphene layers or the doping by tuning the growth parameters. Here, we optimized the epitaxial growth of monolayer graphene (1LG) on 4H-SiC (0001) under a low argon pressure [3] of 10 mbar. This intermediate pressure allows growing a continued 1LG in a short process time ~1h30.

First, we discuss the initial growth stages from buffer layer (BL) to 1LG as a function of annealing temperature (same heating rate). The combined Raman spectroscopy and AFM analyses show that a BL, fully covering the Si-face of SiC, forms as the first step of growth. Subsequently, 1LG starts to grow at step edges and continue to cover the BL on terraces with a step-flow growth mechanism [4, 5], as demonstrated in Fig.1.

Then, we investigate the structural and electronic properties of the 1LG films. The integrated intensity of G-band in Raman spectra normalized with respect to a HOPG reference, AG/AG-HOPG, of each spectrum in Raman map of our continued graphene film is very close to the experimental value reported for a 1LG [6], demonstrating the good homogeneity. Regarding transport measurement, quantum Hall plateau values observed in our graphene layers confirmed both continuity and thickness of the 1LG film [7].

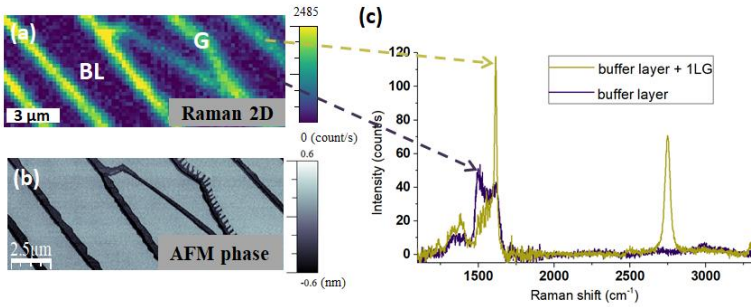

Figure 1 (a and b) Raman 2D map and AFM phase image of one graphene ribbons sample. (c) Representative Raman spectra of buffer layer (BL) and graphene (G).

References:

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