CVD growth of graphene on SiC(0001) in hydrogen-argon atmosphere

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Graphene grown on SiC using propane-CVD (Chemical vapor deposition) in hydrogen-argon atmosphere appears appealing for the realization of graphene-based quantum Hall resistance standards (QHRS). Recently, QHRS made of such graphene have surpassed their GaAs counterparts in terms of cryomagnetic conditions and have established a new state-of-the-art [1]. Yet, detailed studies of this hybrid graphene growth method are still lacking. Our contribution will investigate the propane-CVD growth of graphene on SiC under hydrogen-argon atmosphere, focusing mainly on the control of the number of graphene layers which is critical for metrology.

Graphene films were grown on SiC(0001) substrates at 1450°C using propane as the carbon source and hydrogen/argon mixtures as the carrier gas at a pressure of 800 mbar. Fig 1 presents a typical AFM view (a) and a XPS spectrum (b) of a graphene sample. In an attempt to control the number of graphene layer and to understand growth mechanisms, we have studied the effects of the propane flow and of the growth duration. Fig. 1(c) presents the intensity of the graphene peaks in XPS spectra, which are linked to the number of graphene layers, as a function of the propane flow. The curves are representative of the strong effect of the hydrogen ratio in the carrier gas. Our contribution will discuss the effects of the different growth parameters on the control of the number of graphene layers and on their uniformity, and compare them to previous works on graphene CVD on SiC [2].

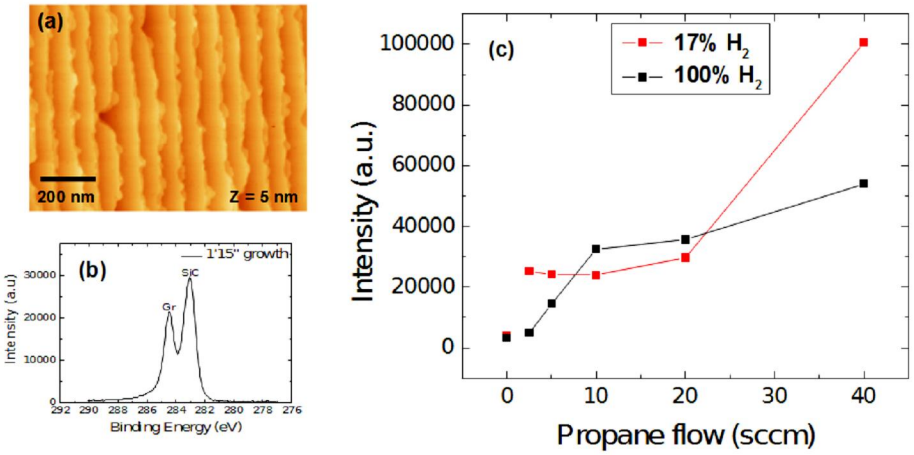

Figure 1. (a,b): AFM view and XPS spectrum of a typical graphene film. (c): XPS graphene peak intensity *vs.* propane flow using hydrogen or hydrogen/argon mixture as the carrier gas.

[1] F. Lafont, et al., Nature Commun. 6, 6806 (2015).
[2] A. Michon *et al.*, *J. of Applied Physics,* 20, 203501, (2013).