LOW DOPED MONOLAYER GRAPHENE ON SIC (0001) VIA SUBLIMATION AT LOW ARGON PRESSURE

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Graphene is a single atomic layer material known for its exceptional properties. In contrast to the other graphene growth techniques (e.g. CVD [1]), thermal decomposition of silicon carbide (SiC) [2, 3] provides transfer free and wafer-scale homogeneous graphene spontaneously forming on a semi-insulating substrate. Since 2008, the growth of monolayer graphene by SiC sublimation at a pressure close to the atmospheric pressure (around 900 mbar) in an argon ambient and at high temperature (>1650°C) is developed [4, 5]. However, it remains challenging to obtain films with different and controlled characteristics (such as the number of graphene layers or the type of doping) by tuning the growth parameters. In this work, we investigated the initial growth stages from buffer layer to monolayer graphene on SiC (0001) as a function of annealing temperature at low argon pressure (10 mbar). All the samples were characterized by Raman spectroscopy and Atomic Force Microscopy. A buffer layer, fully covering the SiC substrate, forms when the substrate is annealed at 1600°C. Graphene formation starts from the SiC step edges at higher temperature (1700°C). A reproducible synthesis of homogeneous monolayer graphene film (at the centimetre scale) could be optimized with an annealing temperature of 1750°C (figure 1 and 2). Transport measurements from room temperature down to 1.7K indicated slightly p-doped samples ($p_{Hall} \simeq 10^{10}$ - $10^{11}cm^{-2}$, @1.7K) and confirmed both continuity and thickness of the monolayer graphene film [6].

References

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[7] Camara et al., PRB, 80 (2009) 125410

Figures

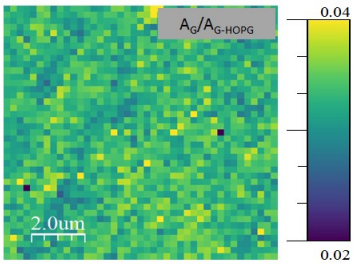

Figure 1: A 10µm x 10 µm Raman map of $A_G/A_{G\text{-}HOPG}$ integrated intensity ratio, showing a value close to experimental one reported for 1LG [7]

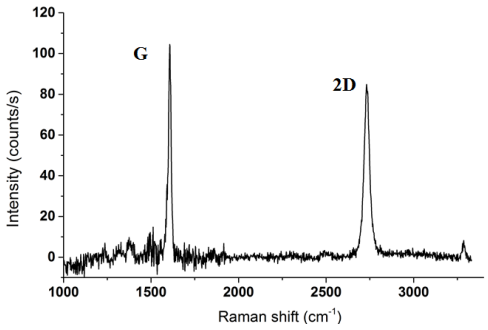

Figure 2: Average Raman spectrum of the mapped zone in figure 1 after subtracting the SiC and buffer layer signal