Epitaxial Graphene Growth in UHV on 3C SiC (111) / Si (111)

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Abstract: Compared to other synthesis methods, epitaxial growth of graphene in UHV gives origin to a contaminant free surface. Moreover, the growth on SiC/Si will help to open the band gap of graphene [1] and will provide the basis for electronic applications.

Graphene is a sp^2 hybridized single atomic layer material. Its extraordinary properties make it useful for sensing and nano electronic application. Compare to other synthesis methods, epitaxial graphene growth in UHV from SiC gives origin to a contaminant free surface on top of a semiconductor. This can help to open the band gap of graphene, a crucial ingredient for any electronic applications. It is expected that the Si (111) substrate would be suitable for the growth of graphene, due to its 3 fold symmetry but the large lattice mismatch prevent the growth of continuous and homogeneous layers. Here, we present the study of epitaxial growth of graphene on 3C-SiC (111)/Si (111) substrates, by high temperature annealing in UHV.

The general phenomenon of high temperature annealing of SiC in UHV includes the diffusion and sublimation of Si atoms leading to different surface reconstructions depending on the temperature. We grew graphene by annealing 3C SiC/Si (111) in UHV at 1300 ˚C in UHV with and without Si evaporation step at 900 ˚C [2]. The substrate roughness and surface characterization are performed using UHV AFM and FESEM before annealing. After annealing, in situ (UHV-STM, AFM and XPS) and ex-situ studies (Raman analysis) have performed. Different kind of surface reconstructions is identified through STM atomic images which may open a hidden gap. The number of graphene layers is calculated from the intensity ratio of the XPS graphitic and carbidic peak of 'C' in SiC[3]. A STM image of monolayer graphene is shown in figure -1. Further investigations are in progress.

Figures

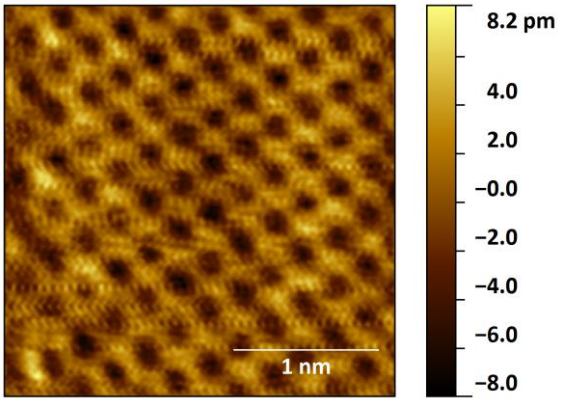

Figure-1: STM topographic image of epitaxial monolayer graphene (hexagonal structure) grown on 3C SiC (111)/Si (111) in UHV (P_{max}: 1.1×10^{-11} mbar).

References

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