Graphene-like silicene grown on graphite surface

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The challenge of designing groundbreaking systems, to connect with Si-based technology, has inspired the study of novel two-dimensional (2D) nanomaterials. Experimentally, 2D Si layers were first obtained by depositing Si atoms on metal (M) surfaces [1]. However, due to the strong p-d mixing between Si and M atoms, it is still debated if pure 2D-Si has been actually observed [2]. In this study, we have used highly oriented pyrolytic graphite (HOPG) as substrate because if its honeycomb structure and chemical inertness. Based on scanning tunneling microscopy (STM) and Raman spectroscopy we demonstrate the formation of a bi-dimensional silicon arrangement. In particular, the Raman study show a new feature, located at 542.5 cm^{-1}, never reported so far for sp^3 Si modes thus suggesting that we are dealing with a genuine sp^2 mode assigned to silicene in a low buckling configuration. From STM we observed the formation of silicene nanosheets [3], three [4] dimensional clusters, and Si 2D nanosheets intercalated below the first top layer of carbon atoms [5]. Theoretical calculations of the structure and energetic viability of the silicene nanosheets, of the strain distribution on the outermost graphene layer and its influence on the Raman resonances support the reported experimental observations.

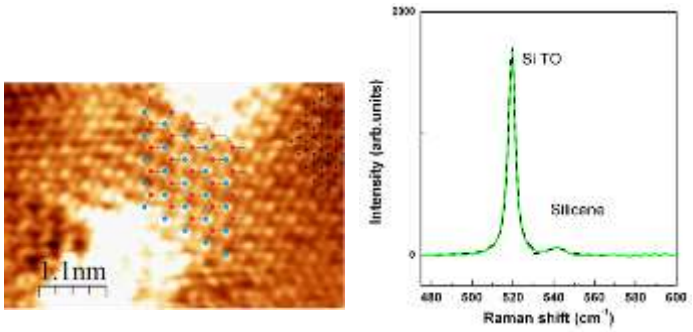

Figure: Left: STM image (10.0 nm x 6.3 nm), of HOPG after 1ML Si deposition at RT. A stick-and-ball model of Si atoms arrangement is superimposed as a reference. Right: Raman spectrum of the sample.

References

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