

Does silicon exists with sp² configuration? the experimentalist's point of view.

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Abstract:

Graphene, a single layer of carbon atoms arranged in a honeycomb lattice, can be considered as the building block of other 3D nano or macro structures. Indeed, stacked it forms 3D graphite, rolled on itself it forms nanotubes, wrapped on itself it forms Bucky balls (fullerene - C₆₀).

Silicene, equivalent of graphene for silicon, if it exists, could be also the building block of the similar nano or macro structures : silicon nanotubes, graphite type silicon, silicon Bucky balls (Si-60). Further more, due to the honeycomb structure, silicene should present the same electronic properties as graphene : the charge carriers should behave as massless relativistic particles.

In this contribution we will try to give a complete review of what it is experimentally observed for silicon today in the frame of the formation of 2D and 3D silicon nanostructures.

We will first recall the different experimental approaches used to get flat silicon monolayer (silicene?) on different substrates and the results obtained. We will see that the methods are very often identical to those used for graphene : segregation process, growth process by PVD, cleavage,...), but surprisingly several methods have not yet been tested (CVD, ...). We will also give a review of the main results obtained on their electronic properties.

We will secondly recall the main results concerning the formation of silicon nano tubes single or multiple walls and their astonishing chemical properties.

Finally, in the light of the different observation/measurement performed very recently on silicon nanostructure, we will try to answer, from an experimental point of view, in comparison with graphene, the initial question given in the title : does silicon exists with sp² configuration ?