Silicene on ultrathin gold layers

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Silicene – a silicon analogous of graphene – is a new, two-dimensional material believed to have significant impact on the semiconductor industry. Like graphene, the Si honeycomb structure hosts massless Dirac fermions [1]. Moreover, the big advantage of silicene is that the band gap could be easily open by removing the symmetry between two hexagonal sublattices what could be achieved e.g. by applying the gate voltage. Nevertheless, the synthesis of silicene is demanding. It must be grown on a supporting material that is most often the monocrystalline Ag(111). It is now on debate if the interaction between silicene and supporting material supresses the existence of Dirac cones in electronic structure [2].

To overcome this limitation several different substrates for silicene growth were proposed. For example: Pb(111) [3], Au(111) [4], and also Si(111) with ($\sqrt{3}\times\sqrt{3}$) Ag reconstruction [5]. Among those the electronic bands with linear dispersion were recently observed on silicene formed on Au(111) [4].

In this contribution we report a new approach for the formation of silicene. Contrary to traditional methods, where silicon is deposited form a Si waver onto a monocrystalline metallic substrate we were able to form Si honeycomb structures on the top of several monolayer thick gold film utilising the surface segregation process of silicon atoms in Au/Si system. In this method we only apply a mild annealing of Au/Si(111) substrate and silicene forms on the top of gold layer. This is accompanied with the appearance of new bands in the electronic structure which reveal linear dispersion.

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