A. Resta
CNRS-CINaM, Aix-Marseille University.

Silicene: a novel 2D material.

The two dimensional (2D) honeycomb lattice of silicon known as silicene attract the interests of experimental physicist only recently even if was simulated even before the discovery of graphene (1; 2). Theoretical calculation in fact predict the thermodynamic stability for free standing silicene and germanene in a low buckled configuration (2; 3; 4). Together with the stability were also computed some of the electronic properties for this novel honeycomb lattice (5; 6; 7) which are expected to be similar to graphene, also because of the similar valence electronic configuration of carbon and silicon. The electronic band structure of silicene has linear band dispersion which cross the Fermi level at the high symmetry points **K** and **K'** in the Brilloiun zone, similarly to its cousin graphene. As result of this band structures the electrons near those points behave as mass-less Dirac fermions, which rises captivating phenomena and properties such as anomalous integer quantum Hall effect (7) and very high charge carrier mobility (5).

Most of the silicene synthesis are on silver(111) surfaces. The adsorption of silicon on silver (111) surfaces has a rather complex phase diagram that despite several publications (8; 9; 10; 11; 12) has not produced a unanimous interpretation of the system. Some structures of the phase diagram attracted more interests than others and are better characterized in literature. In particular the Ag(111)4×4 R0° or $Si_{(h)}3\times3$, where with $Si_{(h)}$ is intended hexagonal silicon and the silicene second layer $Si_{(h)}\sqrt{3}\times\sqrt{3}R30°$ attract more interest, see figure 1.

The presentation is focused on those two structures which appear as more promising for future silicene applications. It will also provide some insights on issues that need to be tackled in the near future.

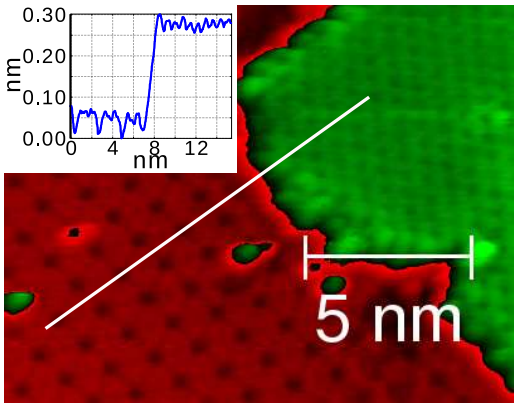

Fig. 1: *Detail of the step between first and second silicene layers on Ag(111), in red the first layer, where it is visible the* $Si_{(h)}3\times3$. *The second layer in green contains the* $Si_{(h)}\sqrt{3}\times\sqrt{3}R30°$.

References

[1] Phys. Rev. B. **50**, 14916, 1994

[2] Phys. rev. B **72**, 075420, 2004

[3] Phys. Rev. Lett. **102**, 236804, 2009

[4] J. Phys. Chem. C **116**, 24639, 2012

[5] App. Phys. Lett. **96**, 082111, 2012

[6] J. Phys. Soc. of Japan **81**, 104713, 2012

[7] Phys. Rev. Lett. **107**, 076802, 2012

[8] Adv. Mat. **24**, 5088, 2012

[9] Surf. Sci. **608**, 297, 2013

[10] App. Phys. Exp. **5**, 045802, 2012

[11] Phys. Rev. Lett. **108**, 155501, 2012

[12] Phys. Rev. Lett. **109**, 056804, 2012