GRAPHENE NANOPOROUS NETWORK: FROM SYNTHESIS TO ELECTRONIC STRUCTURE CALCULATIONS

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Abstract

The family of two-dimensional materials is a rapidly growing one that emerged with graphene synthesis ten years ago. Tailoring the structure of theses materials allows engineering their properties. One example is the change in the topology of graphene band structure as a function of the number of layer and their stacking.[1]

Porous versions of graphene such as antidot lattice [2] (GAL) offer new degrees of freedom for structure-engineering of the properties: gap opening, anisotropic renormalization of Dirac velocity, spin qubit.... Up to now, experimental realization of GAL are mostly based on top-down approach and relied on lithography performed on graphene sheets.[3] We report here a convergent surface polymerization reaction scheme on Au(111), based on a triple aldol condensation, yielding a purely carbon, covalent nanoporous two-dimensional network whose formation and structure are studied with scanning tunneling microscopy. [4]

Ab initio calculations including van der Waals interactions have been performed on the free standing network as well as on the network on Au(111) to analyse the role of the substrate in the convergent reaction. The electronic structure of the free standing network shows Kagome lattice like features: flat band and bands with linear dispersion together with a wide band gap. The possibility to enhance spin-orbit coupling in the system and then to turn it into a topological insulator will be discussed.

References

[1] Ohta, T.; Bostwick, A.; McChesney, J. L.; Seyller, T.; Horn, K.; Rotenberg, E. Phys. Rev. Lett. **98** (2007) 206802
[2] Pedersen, T. G.; Flindt, C.; Pedersen, J.; Mortensen, N. A.; Jauho, A. P.; Pedersen, K. Phys. Rev. Lett. **100** (2008**)** 136804
[3] Bai, J. W.; Zhong, X.; Jiang, S.; Huang, Y.; Duan, X. F. Nat. Nanotechnol. 5 (**2010)** 190.
[4] Landers, J.; Coraux, J; De Santis, Maurizio; Bendiab, N.; Lamare, Simon.; Magaud, L.; Cherioux, F., 2D Materials 1 (2014) 034005

Figures

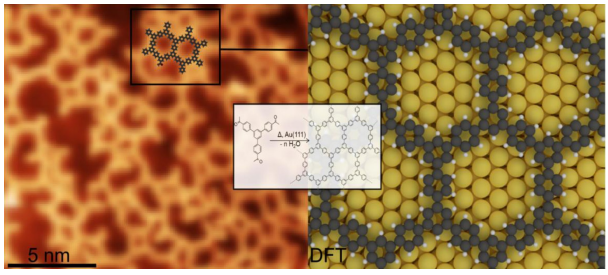

Figure:(Left) Scanning tunnel microscopy (STM) image of a fully conjugated carbon network synthesized on Au(111). (Right) Density functional theory (DFT) calculations showing the stable structure on Au(111). Middle inset shows the reaction based on a novel convergent approach via a triple aldolisation.