Strong Interaction between Graphene Edge and Metal Revealed by Scanning Tunneling Microscopy

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Abstract

The interaction between a graphene edge and the underlying metal is investigated through the use of scanning tunneling microscopy (STM) and density functional theory (DFT) calculations and found to influence the geometrical structure of the graphene edge and its electronic properties [1]. STM study reveals that graphene nanoislands grow on a Pt(111) surface with the considerable bending of the graphene at the edge arising from the strong graphene-edge–Pt-substrate interactions. Periodic ripples along the graphene edge due to both the strong interaction and the lattice mismatch with the underlying metal were seen. DFT calculations confirm such significant bending and also reproduce the periodic ripples along the graphene edge. The highly distorted edge geometry causes strain-induced pseudo-magnetic fields, which are manifested as Landau levels in the scanning tunneling spectroscopy. The electronic properties of the graphene edge are thus concluded to be strongly influenced by the curvature rather than the localized states along the zigzag edge as was previously predicted.

References

[1] Kim, H. W. *et al.* Carbon, 78 (2014), 190.

Figures

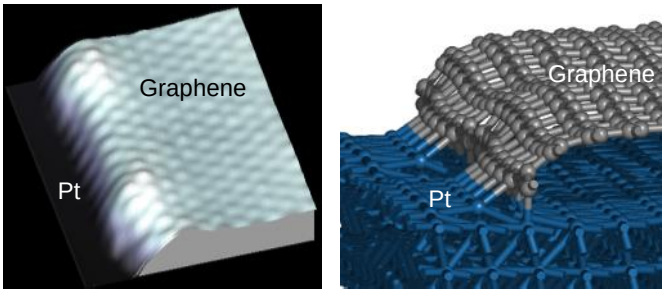

Fig. 1: STM of Graphene grown a Pt (111) substrate and side view of the graphene ribbon on the Pt model system by DFT calculation