Fabrication of extended 1D graphene nanoribbons on Cu(111) and Au(111) surfaces investigated by STM under UHV

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On-surface synthesis of graphene nanoribbons (NRG), as prototypical polymers, has emerged contemporary interest in two last decades due to their promising optical, electronic and mechanical properties. The main strategy to obtain these nanoribbons is based on homo-coupling of halogenated molecules induced by thermal activation followed by on-surface assisted cyclo-dehydrogenation. [1] However, this strategy leads only to the formation of non-functionalized NRG because the lateral active sites of precursors are occupied by halogen atoms, while functional NRG can be relevant of interest in many applications (spintronic, optoelectronics etc.). Nevertheless, Sanchez et al. [2] reported that un-halogenated molecules can be used as precursors of graphene nanoribbons but the length of resulting nanoribbons is restricted to 10 nm. Herein, we present 30 nm long NRG fabricated using pristine NRG precursor by optimizing experimental parameters such as coverage and heating's rate and time, investigated by STM under UHV. Moreover, we propose two NRG precursors bearing lateral functional groups (like cyano or pyridyl moieties) as starting points for the formation of 1D and 2D functionalized NRG.
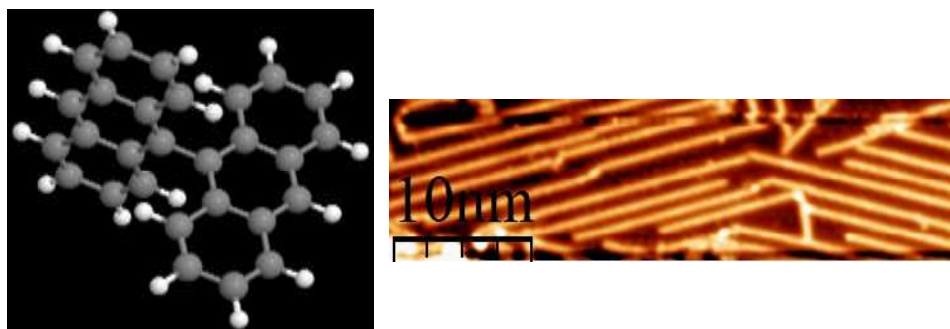

Figure 1 : Left: Model of bias-anthracene molecule used as pristine NRG precursor ; Right: STM UHV image of 30 nm NRG formed by thermal annealing at 400°C from bias-anthracene molecules previously deposited on Cu(111) surface; Image size 40x10nm^2 , U_{bias} = -1.2 V , I = 10 pA.

References

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