Fabrication and atomic-scale investigation of ad-atoms/molecules on free standing graphene

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Graphene, due to its superior mechanical and electrical properties [1] has attracted immense interest. Its carbon atom thick single crystalline structure consisting of carbon atoms renders it highly suitable as transparent sample support for specimens in HRTEM [2]. Moreover, single-layer-graphene (SLG) has also been employed as a template for studying nucleation and growth behavior of nanomaterials, providing useful insight into the mechanism of crystal formation [3]. In the present work, we exploit above mentioned properties of single-layer free-standing graphene coupled with recent advances in low voltage aberration corrected high-resolution transmission electron microscopy (HRTEM) [4] to perform structural and chemical analysis of organic, inorganic and organometallic molecules. Our major objective is to explore different adsorption mechanisms such as chemisorption or physisorption that governs the binding of molecule to the surface of deposition.

This involves careful and systematic interdisciplinary co-operation at various levels of experiment, which includes: **a)** preparation of ultra-clean free-standing SLG [5], **b)** highly controlled and clean deposition of molecules using techniques such as thermal evaporation in vacuum and mass filtered electrospray ion-beam deposition (ES-IBD) [6] and **c)** setting up proper imaging (low-dose) conditions during HRTEM acquisition.

References

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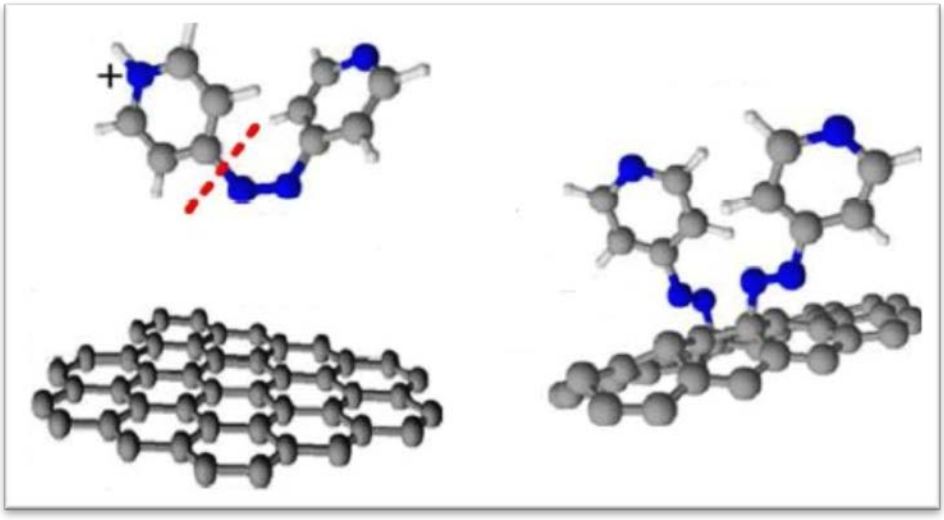

Figure 1: Example of highly controlled and clean deposition process where azopyridinium molecule is deposited on CVD-grown ultra clean SLG via reactive landing [7] mechanism which results in azopyridly-functionalized graphene.