Reaction of NH_3 annealed graphene studied by near ambient pressure XPS

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Intercalation of atoms or molecules between graphene and its substrate has been widely studied. This is due to the ability to tune physical properties [1], induce decoupling to form quasi-free-standing layers [2] and allow graphene to act as a storage medium enabling chemistry in confinement [3].

Using near-ambient pressure x-ray photoelectron spectroscopy (NAP-XPS) we have investigated the reaction of chemical vapour deposition (CVD) graphene on a Cu substrate annealed in ammonia (NH_3). These studies establish an N 1s peak at 405 eV which persists under ultra-high vacuum (UHV) heating and also when maintained at atmospheric conditions for a prolonged period. This peak has no correlation with the binding energy of the NH_3 vapour peak and is far higher than the three common N doped graphene peaks (i.e. pyridinic, pyrrolic and graphitic). However, previous works on carbon nanotubes (CNT) have assigned peak values of between 404-405 eV to N_2 molecules trapped within the hollow or intercalated between the graphite layers of the CNTs [4].

We believe this peak is a result of N_2 intercalated graphene. Comparisons of Raman data gathered pre- and post-anneal demonstrate the effects of N_2 intercalation on the structure of the graphene. In this talk I aim to outline our understanding of this intercalation, the mechanism of N_2 formation and how it alters graphene's intrinsic properties. I will also explore further opportunities for this research.

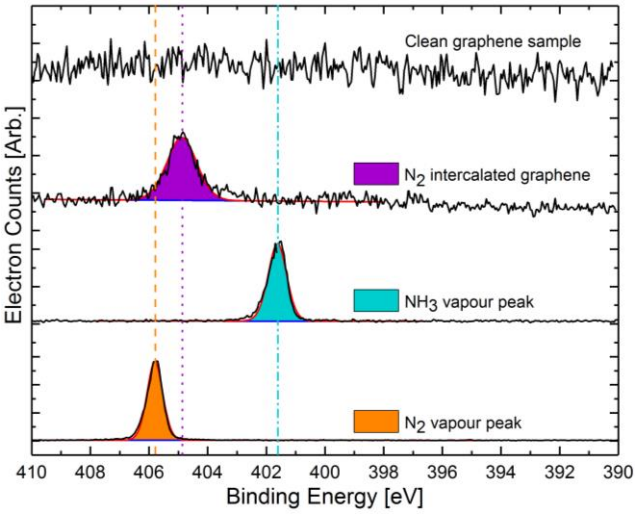

Fig 1. Comparison of N 1s XPS spectrum

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