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Chemical reactivity of pristine and defected supported graphene

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Abstract:

Due to its exceptional properties graphene (G) is considered as one of the most promising materials for the future. It possible use includes gas sensoring [1], but the underlying chemistry is still unclear since "clean" G was reported to be nearly unreactive for ammonia [2]. The sensitivity towards CO was thereby even lower than for ammonia. We reported non-dissociative chemisorption at cold, pristine G on Ni(111). The adlayer remains thereby stable up to 125 K, allowing to estimate an adsorption energy of 0.58 eV/molecule at low coverage, much higher than for unsupported G films (0.014 eV/molecule) [1]. Among the different adsorption configurations of G on Ni(111), the top-fcc one resulted to be the most reactive [5]. No adsorption occurs, on the other hand, at G supported on the less interacting polycrystalline Cu substrate. More recently we investigated experimentally the effect of doping with nitrogen atoms and find further increases the reactivity of the G/Ni(111) system towards CO. The doped layer is obtained by sputtering pristine G/Ni(111) with N_2^+ ions [6]. For an ~11% dopant concentration, an additional electron energy loss at 238 meV appears in the HREEL spectra besides the loss around 256 meV present also on pristine G/Ni(111). The new feature corresponds to a CO species with a higher desorption temperature and, consequently, a higher adsorption energy than the one forming on pristine G/Ni(111). At low coverage, the adsorption energy is estimated to be ~0.85 eV/molecule.

Keywords: Graphene, chemical reactivity, vibrational spectroscopy, surface chemistry

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