Preparation and characterisation of graphene-like carbon layer on h-BN nanomesh

Adam Szitas[1], Arnold P. Farkas[2,3], Viktoria Faur[4], Janos Kiss[1,3], Zoltan Konya[1,3]

[1]Department of Applied and Environmental Chemistry, University of Szeged, H-6720 Rerrich Béla sqr 1, Hungary
[2]Extreme Light Infrastructure-ALPS, ELI-HU Non-profit Ltd., H-6720 Szeged, Dugonics sqr 13, Hungary
[3]MTA-SZTE Reaction Kinetics and Surface Chemistry Research Group, University of Szeged, H-6720 Szeged, Dóm sqr 7, Hungary
[4]Department of Physical Chemistry and Materials Science, University of Szeged, H-6720 Rerrich Béla sqr 1, Hungary
szitas@chem.u-szeged.hu

Using boron nitride in graphene based devices and combination of the properties of the two materials in multilayer structures can enhance the outstanding features of graphene and open new perspectives for example in microelectronics. Graphene (G) and atomic layers of hexagonal boron nitride (h-BN) are complementary two-dimensional materials, structurally very similar but with vastly different electronic properties. Recent studies indicate that h-BN atomic layers would be excellent dielectric layers to complement graphene electronics [1,2]. It is feasible that these can be sequentially grown on metal substrates to create the G/h-BN/metal stacked layers which are certainly useful for applications.

Preparation and investigation of graphene layer on non-metal substrates is one of the exciting areas in surface science nowadays [3]. Moreover, formation of graphene with CVD method on - so called - “white graphene” surface (h-BN) is a great challenge, especially because the substrate boron-nitride layer has “nanomesh” structure [4]. Furthermore, graphene growths on clean Rh(111) resulted also a non-planar 2D carbon layer [5].

In our recent project we investigated the adsorption properties of benzene on the h-BN/Rh(111) surface layer at low and at high temperatures. However, according to the adsorption of benzene on 1000K measurements, we can say that we developed a graphene-like carbon structure on the surface of h-BN/Rh(111) without the removal or destruction of the h-BN film.

Oxidation of the carbon layer resulted CO production in agreement with TPD measurements and the complete recovering of h-BN without defects, analysed by CO titration.

Our results evidenced directly by Auger Electron Spectroscopy (AES) method and indirectly by High Resolution Electron Energy Loss Spectroscopy (HREELS) and Mass Spectrometry (MS). Furthermore, we accomplished experiments to identify the prepared carbon layer with Raman spectroscopy.

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