Effect of intercalated metals (Gd, Yb, Fe, Pt) on the physicochemical properties of graphene–SiC

K. Idczak[1], E. Wachowicz[1]

[1] *Institute of Experimental Physics, Faculty of Physics and Astronomy, University of Wrocław, pl. M. Borna 9, 50-204 Wrocław, POLAND*

karolina.idczak@uwr.edu.pl

It is well known, that graphene exhibits unique physical properties that are promising for applications in electronics. One of the possibilities is growth of epitaxial graphene on silicon carbide (SiC) surface [1]. Moreover, by inserting to that system additional elements, especially metals, new materials can be designed with unique properties, which may improve the functionalisation of present devices as well as invention of a new ones [2,3].

Graphitisation process, known as “high temperature thermal decomposition” [1] is based on annealing the SiC crystal in the temperature range 1470-1670 K, which induces desorption of Si atoms, leaving a carbon-rich surface behind. The first C-rich layer, named as a buffer layer is covalently bonded with the Si atoms of the SiC substrate and acts as a template for further formation of graphene [1,4]. Existence of the buffer layer gives the opportunity to modify the graphene–SiC system. One of the strategy is to intercalate metal atoms between graphene and the buffer layer or even under the buffer layer itself. This process allows to convert buffer into new graphene layer (decouple graphene from the substrate) and to create new systems.

In this work, the influence of intercalated various metals atoms (Gd, Yb, Fe and Pt) on the graphene–4H-SiC(0001) surface properties is presented [5,6]. This investigation considered thin films deposition and subsequent system annealing at high temperatures to induce the intercalation process. Analysis of the experimental data obtained using X-ray photoelectron spectroscopy (XPS) and low energy electron diffraction (LEED) techniques was supported by theoretical calculations (DFT). The parameters for the occurrence of the intercalation process, its efficiency and stability were defined. Moreover, a detailed analysis of chemical composition and changes in surface structure were described. The obtained results shed new light on the development of graphene spintronics.

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