Chemical restoration of few layer exfoliated graphite oxide studied by photoelectron spectroscopy

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Among technological approaches to fabrication of graphene, the exfoliation of thermally expanded graphite oxide (GO) is considered to be one of the most promising [1]. Deoxidation of GO is the most critical stage of the technology since the residual oxygen crucially affects the electronic structure and physical properties of graphene sheet. The aim of the research was to study transformation of chemical bonds and electronic structure of few layer GO films in the course of their deoxidation by annealing in hydrogen. A set of GO films deposited on SiO_2/Si substrate and treated at different temperatures were studied by means of x-ray photoelectron spectroscopy (XPS) using synchrotron radiation and the station of the Russian-German beam-line at BESSY II (Berlin). C1s XPS spectra of few layer GO films represented at Fig.1 show that different carbon oxide groups disappear when the temperature increases. At T=800°C the binding energy E_b of C1s core electron practically coincides with that of highly oriented pyrolytic graphite (HOPG). The residual high energy shoulder in the spectrum measured at T=800°C corresponds to some contribution of C-H bonds. To characterize physical properties, the valence band (VB) spectra of the same samples were studied as well. They show rather wide band gap for GO, which disappear in the film treated at T = 800°C: the VB edge practically merges with the Fermi level indicating occurrence of metallic conductivity. Thus, it has been shown that chemical restoration of thermally expanded graphite oxide in hydrogen is an effective way of fabrication of few layer graphene films.

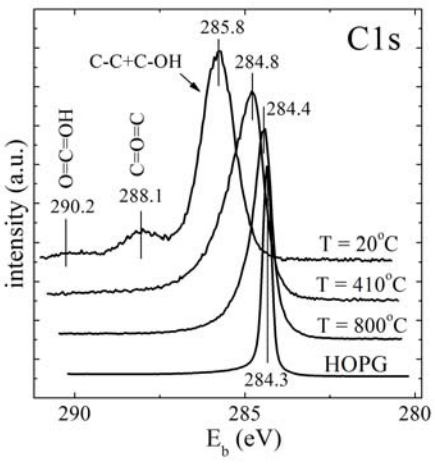

Figure. 1. C1s XPS spectra of few layer GO films and HOPG measured at the photon energy hν =450 eV.

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[1] K.A. Mkhoyan, A.W. Contryman, J.S. Derek at al., *Nanoletters* **9**(3), 1058 (2009).