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MS-2-P-1807 Water-soluble multi-layered graphene nanosheets via high temperature acidic treatment of graphite oxide

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In recent years graphene has attracted wide attention from the scientific community. Its exceptional conductivity, high specific surface area and mechanical strength can be used in the energy storage devices (such as supercapacitors, lithium-ion batteries), composites, sensors, as well as makes it promising as a substrate for the deposition of various particles (metal oxides and sulfides , metal nanoparticles, conductive polymers, etc.)
For some applications, it is necessary to obtain stable solutions (or dispersions) of graphene. From the viewpoint of practical application, aqueous solutions of graphene have great advantages compared with the organic solvents and the possibility of obtaining of these solutions is actively investigated recently.
Previously we have proposed the method of high-temperature treatment of graphite oxide in concentrated sulfuric acid. It was shown that such treatment leads to the formation of the product which contains a large number of holes in carbon layers and called as a «perforated graphite». It was noted that during the process the color of the liquid phase is changed to brown. Subsequent study of the composition of this phase showed that it is, in fact, a solution of multi-layered graphene nanosheets (MGNS). In this work, we perform the further development of method of water-soluble graphene nanoparticles obtaining in order to increase the yield of MGNS, as well as the comprehensive investigation of these particles. It was shown that treatment of graphite oxide in a concentrated sulfuric acid at a temperature of 200°C leads to the formation of MGNS with in-plane size of ~300 nm and small amount of oxygen in its structure in a form of various functional groups. To improve the yield of MGNS the mixture of concentrated sulfuric/nitric acids was used. It was find that initial graphite oxide almost totally decomposed with the formation of MGNS, but the resultant product has a larger amount of oxygen in its structure.
Thus, the present study demonstrates a simple high temperature acidic treatment of graphite oxide as a method of obtaining of easy water-soluble MGNS as well as data of comprehensive study of these nanosheets.

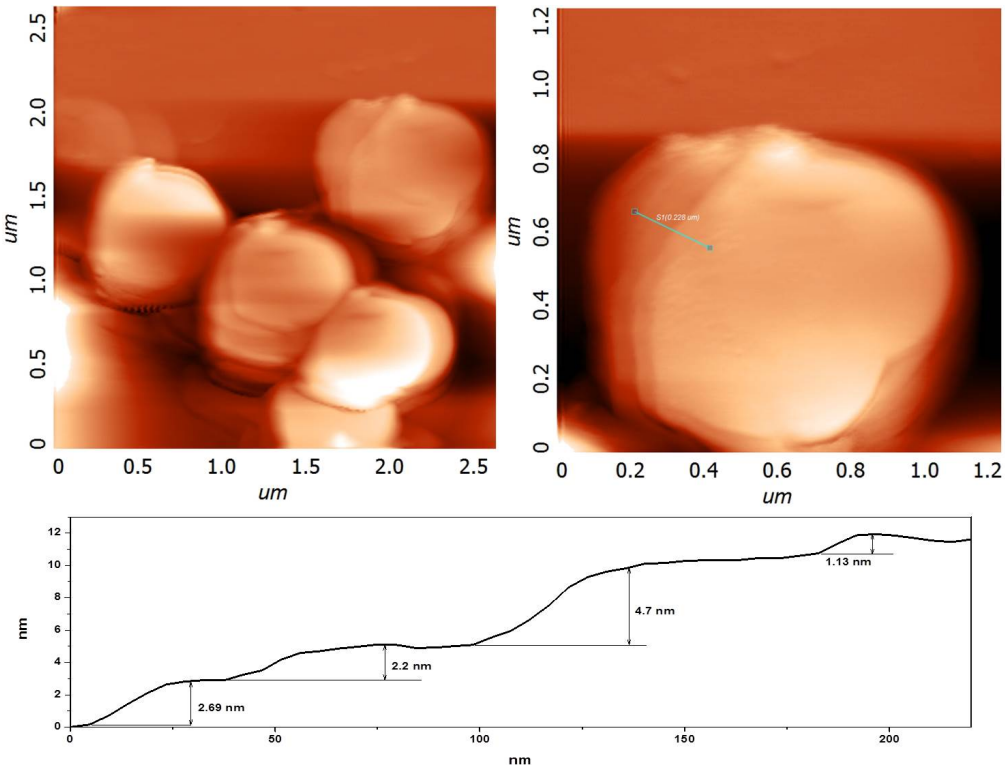

Fig. 1: AFM-images of MGNS on silicon substrate