UDC 54.063:54.051

MECHANOCHEMICAL METHOD FOR THE SYNTHESIS OF GRAPHENE

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***Purpose**:* Today, there is tremendous variety of methods for the synthesis of graphene. Liquid-phase exfoliation methods, chemical vapor deposition provide high-quality graphene, but these methods are very expensive and not very effective. Chemical methods in which the graphene oxide obtained by reduction of grapheme obtained by separation of graphite oxide in water do not have these drawbacks. However, these methods are based on the use of a number of corrosive and toxic reagents, such as strong Oxidizers, strong reducing agents and concentrated acids. Thus, the purpose is to get acquainted with the mechanochemical method of obtaining graphene from graphite directly; demonstrate the benefits of graphene by mechanochemical treatment in the presence of solid graphite chemically inert layering agent and subsequent liquid-phase exfoliation in organic solvents.

Object: Graphene is a two-dimensional allotropic modification of carbon, which is a monoatomic layer of carbon with a hexagonal structure. This material has a promising structural, electrical, optical and other properties.

***Methods and tools for research**:* To establish the structure and properties of substances synthesized by a new technique using X-ray diffraction, AFM, TEM and UV-Vis spectroscopy.

***Scientific novelty and practical significance of the results**:* All synthesis methods that exist today have some significant disadvantages (high cost, toxicity agents). Improved methods devoid of these shortcomings will accelerate the development of electronics based on graphene.

***Research results**:* Synthesis of graphene was carried out by the following method: dry mixture of 50 mg of graphite and 2.0 g NaCl was treated in a planetary ball mill for 1 hour. Then the product thoroughly was washed with water to completely remove salt, and then was dried in a vacuum at a temperature of 100°C. Graphene was obtained by ultrasonic treatment of nanostructured carbon material in an organic solvent , that is absolute ethanol (EtOH). Dispersion of large particles was purified by centrifugation at 4000 rpm for 1 hour.

With x-ray diffraction data shows that cross the particle size of the graphite associated with the number of graphene sheets in them decreases sharply as a result of mechanical treatment in the presence of crystals of NaCl.

The results of AFM, the vast majority of graphene particles obtained by drying the dispersion on the substrate in ethanol, has a height of 0.5-0.7nm, which corresponds to graphene.

The results of TEM shows that partial separation of microparticles original graphite occurs during mechanochemical processing the mixture of graphite and sodium chloride.

In UV-Vis spectrum of graphene dispersion present in EtOH is most characteristic of graphene at a wavelength of 270 nm.

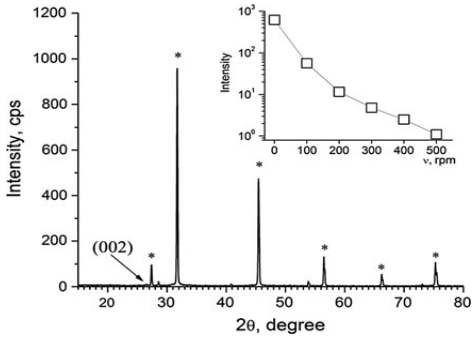

Fig 1 - X-ray diffraction mixture nanostructured graphite and NaCl

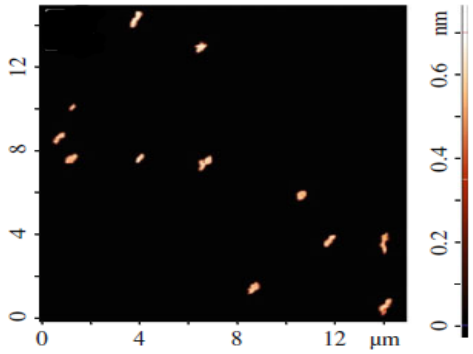

Fig .2 - AFM images of graphene particle dispersion in ethanol

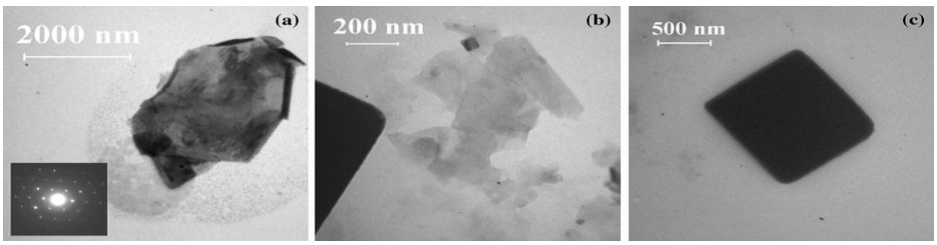

Fig 3. The results of transmission electron microscopy
(A) - the original graphite; (B) - a mixture of graphite and NaCl after mechanochemical treatment; (C) - a separate piece of NaCl after mechanochemical treatment mixture at a rotational speed of 500 rev / min for 1 hour.

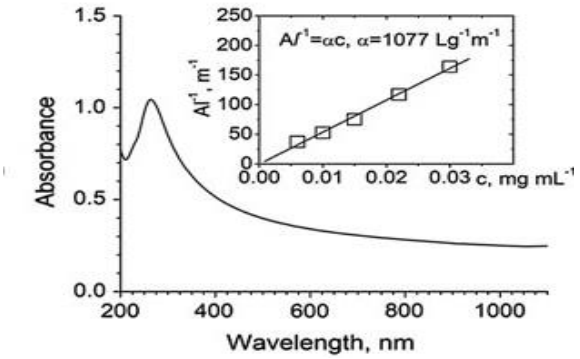

Fig.4 - UV-Vis spectroscopy dispersion in ethanol

Conclusions*:* The ways of getting graphene from graphite are presented in this work.
Keywords*:* graphene, monolayer, mechanochemical synthesis

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