Nanocomposites and nanomaterials

Mechanochemical preparation of 2D nanomaterials: graphene, transition metal disulfides, carbon and boron nitrides, germanane

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Graphene is the first two-dimensional (2D) nanomaterial, which is promising for use in energy storage and energy conversion devices, electronics, sensorics and other fields due to its unique properties. Discovery of graphene has led to an appearance of the wide range of other 2D materials, including metals, semiconductors, and dielectrics. This report presents the results concerning the mechanochemical preparation of such 2D materials like graphene, transition metal disulfides (MoS_2, WS_2), boron (BN) and carbon (C_3N_4) nitrides, germanane (GeH).

Currently, there are a number of known methods for producing graphene and its inorganic analogues: micromechanical cleavage, liquid exfoliation and others. However, the existing methods have significant drawbacks. The developed mechanochemical approach, which is characterized by high efficiency, high output of monolayer particles, improved environmental friendliness, etc. allows avoiding some of them. The approach is based on the primary dry mechanochemical delamination of the initial bulk layered crystals in the absence of any solvent, using chemically inert water-soluble inorganic salts as the delaminating agent, and subsequent ultrasonic liquid exfoliation of the obtained nanostructured materials into the graphene-like state. The resulting 2D materials are studied using various complementary experimental methods [1–3].

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3. Posudievsky O. Yu., Kozarenko O. A., Khazieieva O. A. Et al. Ultrasound-free preparation of graphene oxide from mechanochemically oxidized graphite // J. Mater. Chem. A-2013.-**1**.-P. 6658–6663.