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Nanostructured few-layer graphene and fluorographene films for a wide range of electronic applications

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One of the most important tasks for the graphene-based nanoelectronics development is saving graphene excellent electric properties during its nanostructuring. The most dramatical changes of electric properties are caused by dangling bonds and edge atoms. We created several types of graphene nanostructures without such defects. The first type is partially fluorinated graphene suspensions with nanosized graphene islands embedded into a stable fluorographene matrix. Films created on the base of such suspensions exhibited a row of promising for application properties depending on the suspension fluorination degree. Moreover, we used high energy ions (26 – 167 MeV) to create a continuous graphene surface between two perforated layers. We tried to cut holes in neighboring graphene layers and to bond the chemically active atoms from different layers forming a closed structure of sp²-hybridized carbon atoms. Such approach was suggested by L.A. Chernozatonskii. Both scanning electron microscopy and atomic force microscopy demonstrate nanosized holes (20-40 nm in diameter) formed by ions irradiation. The initial ions energy determines the amount of electronic loss and the value of a sharp local temperature rise in the films. As a consequence, the type of the holes edge may be reconstructed in the range from the dangling bonds to connected edges. The formed nanostructures are very attractive as well as for nanoelectronic devices because of the appearance of the bandgap with a combination of a relatively high carrier mobility.

Biography

Nadezhda Nebogatikova has her expertise in the area of graphene functionalization, graphene quantum dots, suspensions and inks for 2D-inkjet printing. She has 14 publications. She along with her colleagues have found an approach to create different fluorinated graphene-based materials. Her investigations of graphene fluorination open new pathways for improving graphene-based devices with a wide range of electronic and structural properties.

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