

14th International Conference on

Nanomaterials and Nanotechnology

March 30-31, 2017 | Madrid, Spain

Nanostructured few-layer graphene films with edge reconstruction for electronic applications

Nadezhda Nebogatikova¹, Irina Antonova¹ and Vladimir Skuratov²¹Russian Academy of Sciences, Russia²Joint Institute for Nuclear Research, Russia

Graphene electronics needs new materials with tunable electronic properties due to a set of excellent electronic and structural properties and the zero band-gap in its electronic structure. The traditional pathways to open the bandgap in graphene layers are nanolithography. Unfortunately, there is a dramatic decrease in carrier mobility due to chemically active dangling bonds near the formed edges. The stability of graphene-based nanostructures without edge atoms has been investigated recently. One can create such materials by embedding graphene islands into a stable matrix. Such approach was realized in our previous studies of graphene layers and suspensions fluorination. Another decision is 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. We used high energy ions (26-167 MeV) to create perforated few-layer graphene films. Both scanning electron microscopy and atomic force microscopy both 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. We observed the bandgap and electric active traps appearance, dependently on ions energy. We found the conditions for tuning the film electronic and structural properties. The formation of a continuous graphene surface between two perforated layers is very attractive as well as for nanoelectronic devices because of the band-gap appearance in its electronic band structure, opportunity to save the carrier mobility and capability to transmit high electric currents in contrast to nanostructured graphene and semiconducting graphene nanoribbons. Moreover, such nanostructures are promising for sensors and molecule filters.

Biography

Nadezhda Nebogatikova has her expertise in the area of graphene functionalization, graphene quantum dots, suspensions and inks for 2D-inkjet printing. She has found an approach to create different fluorinated graphene-based materials. Her investigations of graphene fluorination opened new pathways for improving graphene-based devices with a wide range of electronic and structural properties. She has 14 publications and worked at Rzhanov Institute of Semiconductor Physics SB RAS in Novosibirsk since 2010.

nadonebo@gmail.com

Notes: