CATALYTIC CVD OF GRAPHENE ON GRAPHITE AND RESIST-FREE METHOD FOR MULTI-ELECTRODES DEVICES

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Graphene is one the most attractive carbon nanostructures due to its exotic electronic properties. Although significant progress has been achieved in investigation of its electronic, magnetic, optical and structural characteristics, however, some aspects present still a number of challenges for the scientific community. Currently, production of graphene can be mostly classified into two categories: 1) top-down approach, such as mechanical and chemical exfoliation of graphene from graphite, and 2) bottom-up methods, such as chemical vapor deposition (CVD) of hydrocarbon gases on metal surfaces and high temperature sublimation of SiC crystals. In the first part of our work, we present the investigation of catalytic chemical vapor deposition of hydrocarbon gases on graphite to produce graphene layers, using a combination of CVD (bottom-up) and graphite (top-down), using methane and Fe catalysts. Scanning tunneling microscopy studies have shown that graphene layers grown on graphite are characterized by diverse morphologies [1,2], such as: (i) curved graphene sheets grow at the edge of topmost bilayer of graphite, (ii) planar graphene layers grow as a continuation of substrate step edges, and (iii) graphene islands grow on terraces of (0001) basal plane of graphite. The growth mechanisms of these graphene structures are discussed. The present synthesis represents a promising approach toward the controlled growth and modification of graphene layers, as well as for engineering the edge properties. In the second part of our work, we further present a simple single-step approach to electrically contact graphene/few-graphene layers (FGL) using a resist- and contamination-free method. Focused ion beam (FIB) patterned Si_3N_4 membranes are used to directly mask the sample deposited on a SiO_2 substrate; the membrane is then aligned onto the sample under an optical microscope in ambient conditions, followed by metal evaporation. Further, we present the characterization of the room- and low-temperatures charge transport properties of different typologies of samples contacted using this technique. This method is of general use, able to reduce contaminants and compatible with current UHV technology.

References

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