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Homogeneous and Stable P-Type Doping of Graphene by MeV Electron Beam-Stimulated Hybridization with ZnO Thin Films

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A prerequisite for the development of graphene-based field effect transistors (FETs) is reliable control of the type and concentration of carriers in graphene. These parameters can be manipulated via the deposition of atoms, molecules, and polymers onto graphene as a result of charge transfer that takes place between the graphene and adsorbates. In this work, we demonstrate a unique and facile methodology for the homogenous and stable p-type doping of graphene by hybridization with ZnO thin films fabricated by MeV electron beam irradiation (MEBI) under ambient conditions. The formation of the ZnO/graphene hybrid nanostructure was attributed to MEBI-stimulated dissociation of zinc acetate dihydrate and a subsequent oxidation process. A ZnO thin film with an ultra-flat surface and uniform thickness was formed on graphene. We found that homogeneous and stable p-type doping was achieved by charge transfer from the graphene to the ZnO film.

Keywords: graphene, doping, ZnO thin film

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Site-Specific Growth of Width-Tailored Graphene Nanoribbons on Insulating Substrates

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The band-gap opening in graphene is a key factor in developing graphene-based field effect transistors. Although graphene is a gapless semimetal, a band-gap opens when graphene is formed into a graphene nanoribbon (GNR). Moreover, the band-gap energy can be manipulated by the width of the GNR. In this study, we propose a site-specific synthesis of a width-tailored GNR directly onto an insulating substrate. Predeposition of a diamond-like carbon nanotemplate onto a SiO2/Si wafer via focused ion beam-assisted chemical vapor deposition is first utilized for growth of the GNR. These results may present a feasible route for growing a width-tailored GNR onto a specific region of an insulating substrate.

Keywords: graphene nanoribbon