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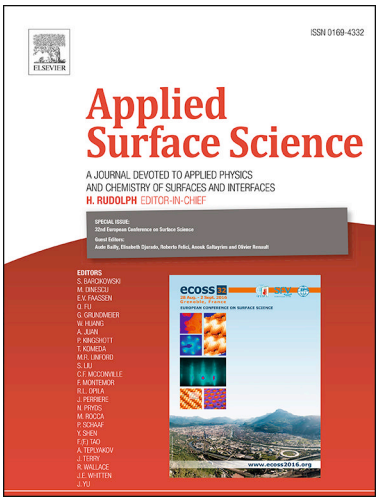

Full Length Article

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Multilayer Graphene Growth on Polar Dielectric Substrates using Chemical Vapour Deposition

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Abstract

High quality of graphene is necessary for its applications at industrial scale production. The most convenient way is its direct growth on dielectrics which avoid the transfer route of graphene from metal to dielectric substrate usually followed by graphene community. The choice of a suitable dielectric for the gate material which can replace silicon dioxide (SiO_2) is in high demand. Various properties like permittivity, thermodynamic stability, film morphology, interface quality, bandgap and band alignment of other dielectrics with graphene needs more exploration. A potential dielectric material is required which could be used to grow graphene with all these qualities. Direct growth of graphene on magnesium oxide (MgO) substrates is an interesting idea and will be a new addition in the library of 2D materials. The present work is about the direct growth of graphene on MgO substrates by an ambient pressure chemical vapour deposition (CVD) method. We address the surface instability issue of the polar oxides which is the most challenging factor in MgO. Atomic force microscopy (AFM) measurements showed the topographical features of the graphene coated on MgO. X-ray photoelectron spectroscopy (XPS) study is carried out to extract information regarding the presence of necessary elements, their bonding with substrates and to confirm the sp-2 hybridization of carbon, which is a characteristic feature of graphene film. The chemical shift is due to the surface reconstruction of MgO in the prepared samples. For graphene-MgO interface, valence band offset (VBO) and conduction band offset (CBO) extracted from valence band spectra reported. Further, we predicted the energy band diagram for single layer and thin film of graphene. By using the room-temperature energy band gap values of MgO and graphene, the CBO is calculated to be 6.85 eV for single layer and 5.66 eV for few layer (1-3) of graphene layers.