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Free-Standing Graphene on 3C-SiC Nanostructures

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There is a growing body of literature that recognizes the potential of graphene for use in electronics [1]. However, graphene's lack of bandgap challenges its remarkable range of applications [2]. Theoretical work suggests that a bandgap might be opened in graphene through quantum confinement, for example in graphene nanoribbons. Thermal decomposition of SiC has proven to be an excellent method to grow transfer-free wafer-scale graphene [3]. Growing graphene on SiC thin films on Si is a cheaper alternative to the growth on bulk SiC. In this research we attempt to manipulate the SiC substrate dimension to grow graphene over nanostructures and use hydrogen intercalation to produce free-standing graphene.

SiC mesas have been fabricated by patterning SiC/Si substrates using Focused Ion Beam (FIB) milling [4]. Hydrogen intercalation procedure has been employed at 600 ℃ to fabricate free-standing graphene on the structures [5]. Synchrotron radiation near-edge X-ray absorption fine structure (NEXAFS) with core-level photoelectron spectroscopy (PES), scanning tunnelling microscopy (STM), scanning electron microscopy (SEM), and Raman spectroscopy were used to investigate the process. Our result indicates the possibility of growing free-standing epitaxy graphene over SiC nanostructures. However, more research is needed to better understand the impact of patterning procedure on the graphene growth and decrease the damage caused by milling process.

References

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