Investigation of metal oxides deposition on electrical properties of CVD Graphene

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Abstract

During the last decade, graphene has gained increasing attention and research interest due to its outstanding properties that make it an excellent candidate for advanced applications in future electronics and photonics [1]. In particular, the potential of graphene for optoelectronic applications is currently being explored extensively because of its high carrier mobility and absorption from the far infrared to the ultraviolet [2]. Nevertheless the fabrication of graphene-based devices is still challenging: the impact of the fabrication process on device performance is now well accepted, but is yet to be fully detailed.

Here we report on the evaluation of growth of metal oxides (Al_2O_3 and HfO_2) on electrical properties of graphene-based structures. Complementary techniques have been used to characterize graphene before and after metal oxide growth: MicroRaman spectroscopy to characterize the graphene quality and doping, Atomic Force Microscopy to determine the uniformity of the dielectric grown on CVD graphene.
For this study; we address more specifically the influence of the metal oxide layer deposited as a protecting layer and/or as a passivation layer. The following samples have been fabricated:

- with/without a protecting metal oxide layer, deposited by evaporation after graphene transfer.
- with/ without a passivation layer, deposited by evaporation or atomic layer deposition[3,4] at the end of the process

Comparisons of the electrical properties carried out on each sample highlight the benefits of a protective layer as well as a passivation layer. Metal oxide layers deposited by atomic layer deposition have shown interesting results in term of stable and reproducible Dirac point close to 0V (Figure 1).

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References

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Figures

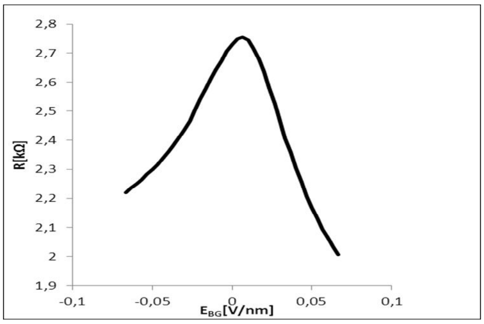

Figure 1. Transfer of a passivated graphene field effect transistor measured under ambient conditions after 4 weeks storage and subsequent annealing.