High-yield, polymer-free, electrolyte-gated graphene FET production as a sensing platform

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Graphene has emerged as an ideal material for field effect sensing thanks to its unique physical and chemical properties, such as high electrical conductivity, electrochemical stability and simple functionalisation [1]. Single layer graphene (SL-Gr) is most often grown by chemical vapor deposition (CVD) on a copper foil and then deposited on a target substrate by wet transfer. This process is known to be labour-intense and not scalable for large volume production of graphene biosensors. Moreover, wet transfer is also detrimental to graphene properties due to inevitable addition of contaminants/dopants to SL-Gr, e.g. polymeric residues [2].

Our proprietary contamination-free process using MOCVD (Metalorganic CVD) is able to produce high-purity 2D graphene at wafer scale with commercially viable yields and consistent performance within specified parameters. Using this novel process, we are able to produce SL-Gr on semiconductor-compatible wafer substrates which in turn enables large scale production of miniaturised sensors. Using our in-house manufacturing facilities, we have developed wafer scale production of electrolyte-gated graphene field effect transistors (FET) for sensing applications. Moreover, through a novel surface engineering method, SL-Gr on our micro-sized graphene FET is free of any polymer residue coming from photoresists that are used during the manufacturing process. We verified cleanliness of our graphene through AFM, Raman spectroscopy and XPS.

Using this process we have launched the first truly scalable product with SL-Gr. Here we present the latest results from our fabrication facility showing the excellent device performance characteristics that are achievable when this fabrication method is reduced to practice. The graphene FET technology developed here has the potential to consistently measure different analytes and deliver rapid results.

References

[1] I. Prattis, et al., Trends in Biotechnology, 2021, 1065-1077
[2] M. Bahri, et al., Materials Today Chemistry, 2021, 100578