Empowering detection in graphene field effect transistors: the key role of chemistry

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Graphene field-effect transistors (GFETs) have emerged as powerful diagnostic tools due to their exceptional sensitivity, selectivity, low detection limits, and compatibility with *in vivo* applications.[1] These advantages stem from graphene's unique properties, including high carrier mobility, biocompatibility, transparency, and flexibility. As a result, GFETs can detect various biomolecules, such as proteins, DNA, and small molecules, with outstanding specificity and sensitivity across diverse environments.

Functionalizing graphene with biorecognition elements is critical to exploit its potential, achieved through approaches like covalent binding, non-covalent interactions, and electrostatic adsorption.[2] However, identifying optimal immobilization strategies remains challenging, as many graphene chemistry methods are not directly translatable to transistor fabrication.

By precisely optimizing graphene functionalization and device design, we have developed GFET microarrays capable of detecting small molecules (*e.g.*, neurotransmitters, air pollutants)[2-3] and viruses with ultra-low detection limits.[4] These advancements lay the groundwork for a new generation of analytical platforms, leveraging precisely engineered graphene modifications. Such platforms promise significant contributions to health and environmental monitoring, enabling early pathogen and biomarker detection even before isolation, offering critical tools in the fight against future pandemics.

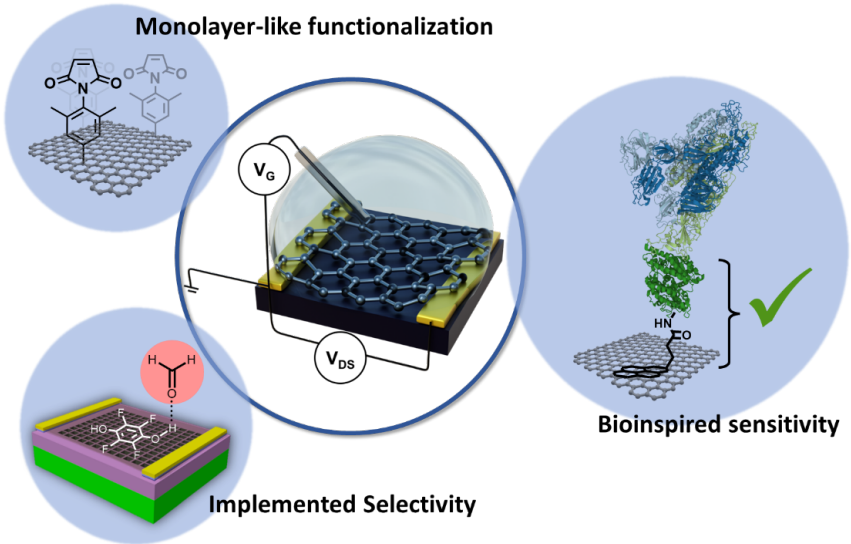

Figure 1. Schematic representation of diverse strategies used in GFET sensors.

References

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