Unlocking the Biosensing Potential of Graphene FETs through Chemical Approaches

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Graphene field-effect transistors (GFETs) have emerged as powerful diagnostic tools thanks to their exceptional sensitivity, low detection limits, and compatibility with *in vivo* applications.[1] These capabilities arise from graphene's unique properties (*e.g.*, high carrier mobility, biocompatibility, transparency, and flexibility), enabling the detection of diverse biomolecules such as proteins, DNA, and small molecules.

Realizing GFET potential relies on effective graphene functionalization with biorecognition elements via covalent, non-covalent, or electrostatic strategies.[2] However, adapting these chemistries to transistor fabrication remains a challenge.

Through precise control of surface chemistry and device design, we have developed GFET microarrays capable of detecting small molecules (e.g., neurotransmitters, air pollutants) and viruses with ultra-low detection limits.[2-4] These platforms, based on tailored graphene modifications, offer a powerful foundation for next-generation sensors in health and environmental monitoring, enabling early biomarker and pathogen detection even before isolation, and contributing to pandemic preparedness.

References

[1] Zhao, W., *et al.,* ACS Sens., 6 (2024), 2705–2727.
[2] Wetzl, C., *et al*., Angew. Chem. Int. Ed., 6 (2023), e202212857.
[3] Wetzl, C., *et al*., Nanoscale,15 (2023), 16650-16657.
[4] Silvestri, A., *et al*., Nanoscale,15 (2023), 1076-1085.

Figures

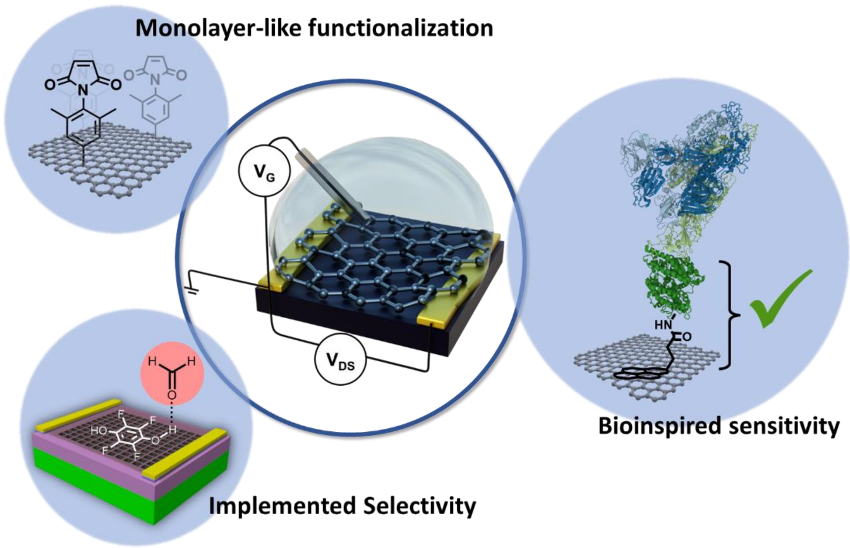

Figure 1: Schematic representation of diverse strategies used in GFET sensors.