

Specific Drug Detection with Non-Covalently Functionalized Graphene Field-Effect Transistors

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Graphene field-effect transistors (GFETs) have unique advantages for sensing applications such as high sensitivity, small size, chemical robustness and direct electric read out. Thus, functionalisation routes to allow for specific sensing, in particular for chemical and biological applications, are highly sought. In this work, specific biosensors for drug sensing were realized with non-covalently functionalized CVD grown graphene as the sensing platform. Perylene bisimide self-assembled monolayers were formed on clean graphene surfaces prior to the PMMA transfer. [1-4] The samples were then subjected to Functional Layer Transfer (FLaT) onto SiO₂/Si substrate and structured to obtain back-gated field-effect transistor (GFET) arrays.[2,3] This non-covalent functionalization provides an excellent base to immobilize specific molecules on the surface, while simultaneously preserving graphene's exceptional inherent electrical characteristics. [3] Subsequently, the drug antibodies were bound specifically on the perylene bisimides. This functionalisation was optimised using reference antibodies with attached gold nanoparticle (AuNP) markers visible in the SEM, specifically coupling to the drug antibodies. Electrical analysis of GFET arrays verified a specific, concentration dependent response to the drug with no cross-reactivity to paracetamol. This functionalisation methodology represents a significant improvement in the development of graphene-based biosensors.

References

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Figures

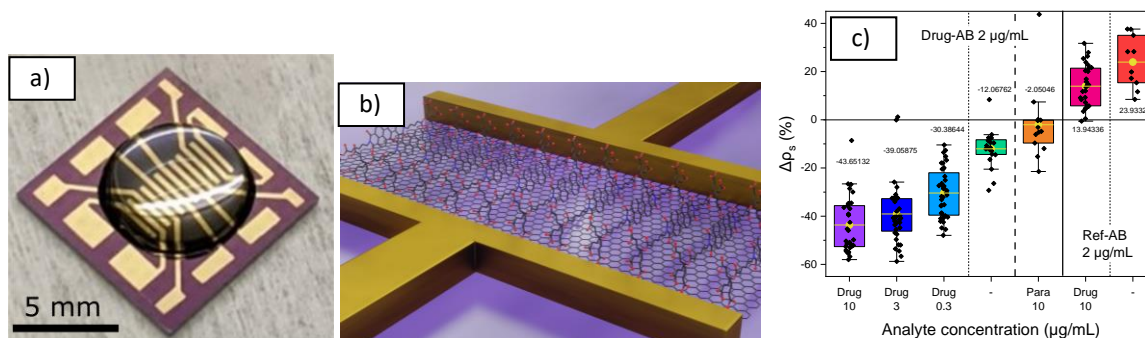


Figure 1: a) Optical image of a GFET with droplet for functionalization, b) schematic view of the self-assembled monolayer of perylene molecules on graphene, c) sheet resistance change of drug biosensors and reference devices.