

## Graphene microtransistor array derivatized with modified aptamers as a functionalization alternative for biosensing applications

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Graphene solution-gated field-effect transistors (gSGFETs) (Figure 1) offer a high potential for chemical and biochemical sensing applications to perform label-free, rapid, and highly sensitive analysis coupled with a large ample throughput. These properties, combined with the potential for integration into portable instrumentation makes graphene-based transistors suitable for point-of-care diagnostics. [1] However, practical applications of gSGFETs require reliable and suitable functionalization steps for detection of different types of analytes. In this aspect, the surface modification of graphene has a significant impact on the electronic properties of these devices. Hence, it is crucial to perform robust and reproducible strategies for surface biofunctionalization. [2]

In this work, we report a single-step strategy of functionalization based on derivatized aptamers with fluorenylmethyl and acridine moieties (Figure 2), [3] using multiplexed arrays with 48-gSGFETs (Figure 3), for simultaneous measurements with a custom characterization electronic system [4] which allows the acquisition of significant data on each assay.

Here we demonstrate the potential of this system for biosensing, paying special attention to the robustness and sensitivity, performing the

modification of graphene channel of the transistor by means of different novel strategies for immobilizing aptamers to achieve label-free detection of thrombin as a model. This study is focused on the simplification of the functionalization strategy and a better understanding of the parameters that affects the development of gSGFETs for biosensing.

## References

- [1] R. Forsyth *et al.*, *Diagnostics*, 7 (2017)
- [2] X. Zhang, *et al.*, *Small*, 16, (2020), 1902820
- [3] A. Aviñó *et al.* *Bioorganic & Medicinal Chemistry* 18 (2008) 2306
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## Figures

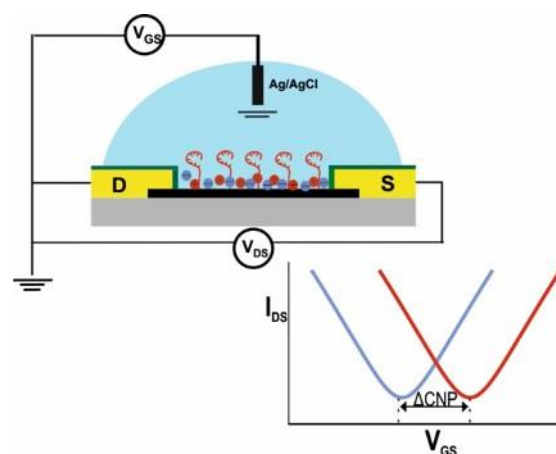


Figure 1. graphene SGFET scheme. Current to voltage curve shift when functionalization is performed

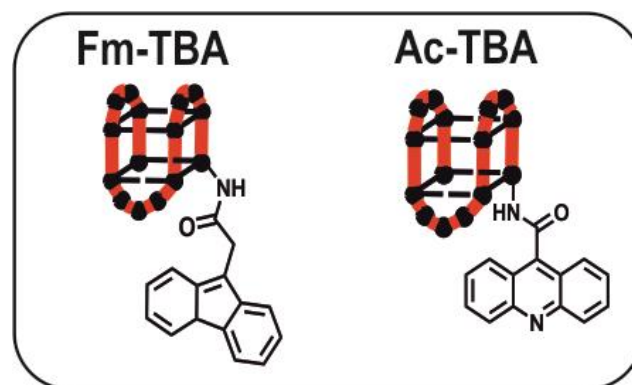
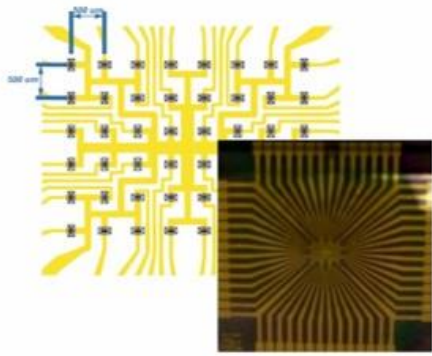


Figure 2. Thrombin Aptamer (TBA) derivatized with Fluorenylmethyl and Acridine molecules



**Figure 3.** Array of 48 transistors of graphene