Label-free direct detection of Thrombin through graphene SGFET with chemically modified aptamers

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Graphene SGFETs offer the potential 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 G-SGFETs' suitable for point-of-care diagnostics. [1]
For all these advantages, last years, the study of gSGFETS for protein biosensing are in increasing demand, but exist some limitations.
The detection between the receptor and the analyte should be produced at the interface graphene-solution within the Debye Length (λ_D). This fact limits the size and the charge of the receptor used, being the aptamers (relatively small and extremely charged) more suitable than the antibodies for immuno-detection with gSGFET. The recent studies are mainly adressed to enlarge the λ_D [2],[3], but there are some other improvements that can be extremely relevant to enhance the sensitivity without modifying the debye lengh. Here we present some of these improvements, in terms of chemical derivatization of the receptors, to better understand the mechanism and the interactions affecting the sensibility of the biosensing system. For this purpose the model of label free, direct detection of Thrombin through chemically modified aptamers [4] has been used.

References

[1] R. Forsyth *et al*., Diagnostics, 7 (2017) 45
[2] Chu *et al*., Scientific Reports, 7 (2017) 5256
[3] *Fu et al.*, Advanced Material, (2016) 1
[4] Aviñó *et al.* Bioorganic & Medicinal Chemistry 18 (2008) 2306

Figures

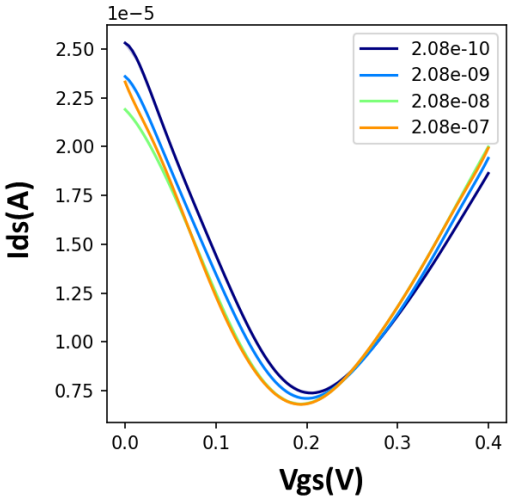

Figure 1: a) Current-voltage measurements of a graphene transi stor (Width: 50 µm, Length: 50µm) with VDS=50mV measured vs a Ag/AgCl reference electrode in PBS 1mM at different Thrombin concentrations (208nM-0.208nM) with an Aptamer chemically modified with a Fluorenylmethyl linker.

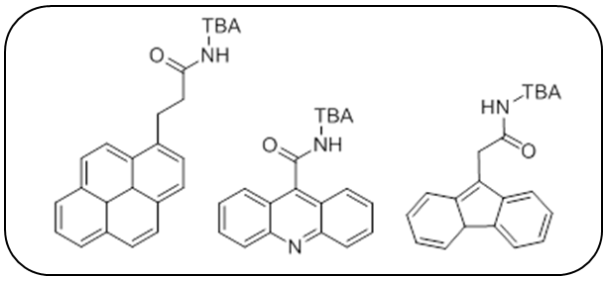

Figure 2: Thrombin Aptamer (TBA) derivatized with Pyrene, Acridine and Fluorenylmethyl molecules