

# Electric Field-Assisted Immobilization of PBASE and DNA on graphene field-effect transistors

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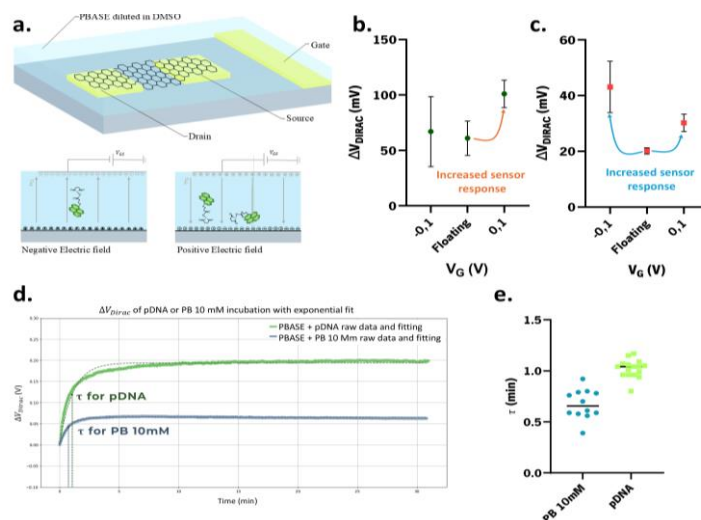
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Graphene field-effect transistors (GFETs) are highly promising as biosensors, capable of detecting biomolecules with attomolar detection level [1]. Biosensors' performance strongly depends on probe density, and rely on Brownian motion for the biomolecules to find the surface. In this work, we used the gate electrode GFET to apply an electric field during the bio-immobilization steps of the PBASE dissolved in DMSO and probe DNA in phosphate buffer. Our results show that voltages  $\pm 0.1$  V increased the sensor response during linker immobilization by up to 73%, and subsequently the pDNA response increased by 50%. Contrary to previous reports [2] [3], both positive and negative applied voltages produced a similar increase, and strongly correlated with changes in the Raman spectroscopy of the graphene. Real-time sensor signal acquisition enabled to measure the time constant of the immobilization, which was 3 times faster when the applied voltage favoured the reaction.

## References

- [1] M. Abrantes et al., *Journal of Nanobiotechnology*, 20(1) (2022) 533.
- [2] Z. Hao et al., *ACS Sensors*, 5(8) (2020) 2503–2513.
- [3] C. H. Lee, W. P. Hu, W. Y. Chen, *Biosensors & Bioelectronics*, 268 (2025) 116909.

## Figures



**Figure 1:** (a) Illustration of the experiment. (b) Dirac point shift after immobilization of PBASE as function of the applied voltage. (c) Dirac point shift after pDNA, as function of the voltage at the previous step. (d) immobilization kinetics observed by monitoring the device current in real time, for the PBASE (green) and pDNA (blue). (e) Observed kinetics time constant.