# Graphene field effect transistors based on interdigitated electrodes as universal platform for biosensing

Stefan Jarić[a], **Ivan Bobrinetskiy**[b*]
[a]*Biosense Institute – Research and Development Institute for Information Technologies in Biosystems*
[b]*Moscow Institute of Physics and Technology, 9 Institutskiy Per., 141701 Dolgoprudny, Russia*
bobrinet@gmail.com

One of the promising graphene-based configurations of low-cost biosensors is the field-effect transistor (FET) channel modified with target-specific receptors (aptamers, antibodies, imprinted polymers, etc.). Aptamers have attracted significant attention lately as receptors in biosensors due to a relatively low-cost manufacturing process and higher stability when compared to, e.g., antibodies. The mechanism of FET-based biosensors is based on electrostatic gating of charge carriers in graphene channel, where there is a modulation of distance or the number of charges between the graphene surface and the analyte/receptor conjugation. The most critical step in graphene FETs (GFETs) manufacturing is the electrodes and channel patterning using CMOS compatible technologies. In this work, we demonstrate the use of commercially available interdigitated electrodes (IDEs) as low cost platform for GFET manufacturing (**Figure 1**). We have demonstrated the both GFETs and rGO-FETs produced by wet transfer and drop casting, respectively. The performance toward different antibodies like pollen allergens [1] and heart failure markers [2] have been demonstrated. We have compared the both rGO and graphene FETs on IDEs and demonstrated the higher performance of rGO-FET biosensors (**Figure 2**) [3].

## References

[1] Jarić, S., Wenger, M., Bobrinetskiy, I., Stapelfeldt, A., Pena-Amelunxen, G., Šikoparija, B., & Aglas, L. (2024). Development of a graphene field effect transistor-based immersible biosensor for immunodetection of the birch pollen allergen Bet v 1 in air samples. *Heliyon*, *10*(20).
[2] Jarić, S., Kudriavtseva, A., Nekrasov, N., Orlov, A. V., Komarov, I. A., Barsukov, L. A., ... & Bobrinetskiy, I. (2024). Femtomolar detection of the heart failure biomarker NT-proBNP in artificial saliva using an immersible liquid-gated aptasensor with reduced graphene oxide. *Microchemical Journal*, *196*, 109611.
[3] Kudriavtseva, A., Jarić, S., Nekrasov, N., Orlov, A. V., Gadjanski, I., Bobrinetskiy, I., Nikitin, P. I., & Knežević, N. (2024). Comparative Study of Field-Effect Transistors Based on Graphene Oxide and CVD Graphene in Highly Sensitive NT-proBNP Aptasensors. *Biosensors*, *14*(5), 215.

## Figures

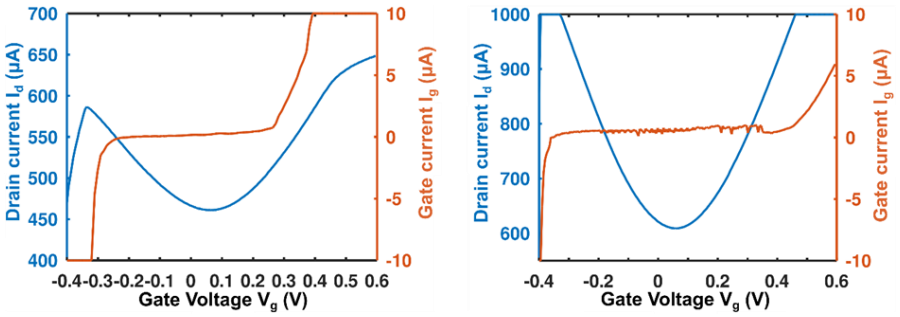


**Figure 1:** Transfer characteristics of rGO channel obtained via drop casting between IDE gold electrodes with liquid gate in 1xPBS Id-Vg (blue) and gate current Ig-Vg (orange) for Micrux ED-IDE1-Au (a) and DropSens G-IDE222 (b).

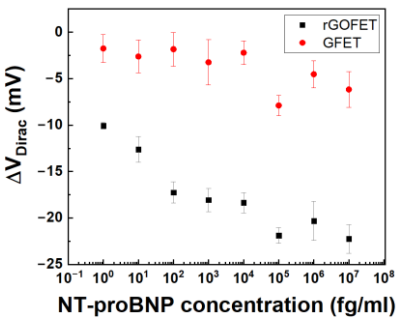


**Figure 2:** Dirac point shift for varied NT-proBNP concentration for GFET (●) and rGO-FET (■).