Transparent array of graphene SGFETs for *in vitro* electrophysiology

Jose de la Cruz[a]
Xavier Illa[a,b], Elena del Corro[a], Clément Hébert[a], J.A. Garrido[a,c]

[a]*Catalan Institute of Nanoscience and Nanotechnology (ICN2), CSIC and The Barcelona Institute of Science and Technology, Bellaterra, Spain;* [b]*Institut de Microelectrònica de Barcelona (IMB-CNM, CSIC), Bellaterra, Spain;* [c]*ICREA, Barcelona, Spain*

Jose.cruz@icn2.cat

Graphene has proved to be an outstanding material for the fabrication of biocompatible solution-gated field effect transistors (SGFETs). Motivated by their high sensitivity, low noise, scalability and stability in aqueous electrolyte, graphene based SGFETs have been used for the detection of relevant molecules and biomolecules as well as electrical cell signals, either *in vivo* or *in vitro*. [1, 2]. In addition, when using an appropriate combination of graphene substrate and electric contacts, a fully transparent SGFET can be achieved, opening new avenues for the graphene technology.

In this work, we present the fabrication, characterization and biocompatibility assessment of a transparent device that allows simultaneous electrical measurements and optical microscopy characterization in a cell culture. Using electron beam evaporated Indium Tin Oxide (ITO) as transparent conductor we show that an optimum balance between conductivity and transparency can be achieved by tuning the temperature and the atmosphere composition of the annealing process. We present a complete characterization of the devices by means of transconductance and low-frequency noise measurements. Finally, we also use cell cultures on top of the transparent graphene SGFETs in order to test the biocompatibility of the devices.

References

[1] Hess et al., Advanced Materials, 43 (2011) 5045–5049.
[2] Blaschke et al., 2DMaterials, 4 (2017), 025040.

Figures

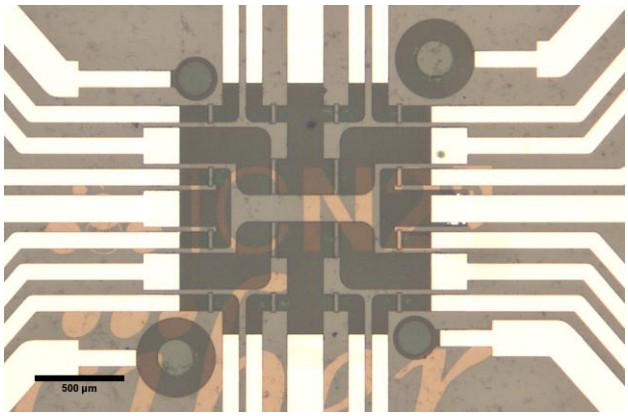

Figure 1: Transistor array on top of the ICN2 logo.

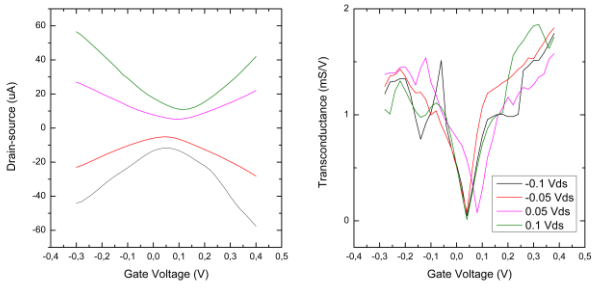

Figure 2: Drain-source current and transconductance of a transparent graphene SGFET.