

# A Disposable and Label-free Reduced Graphene Oxide Electrolyte-Gated Transistor Immunosensor for Anti-Drug Antibody Detection

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The introduction of therapies based on biotechnological drugs has significantly improved the treatment of cancers and auto-immune diseases. A clear example is the extensive use of the chimeric monoclonal antibody Infliximab for the treatment of psoriasis, Chron's disease, rheumatoid arthritis, and other diseases.<sup>1</sup>

However, Infliximab and other biotechnological drugs may induce in some patients the production of anti-drug antibodies (ADAs) that bind and sequester the drug, making the treatment sometimes ineffective. In addition, the amount of the antibodies toward Infliximab (ATIs) in patient serum is found very low (from  $10^{-12}$  to  $10^{-11}$  M), which makes their detection very challenging. Current technologies available for ADA detection are based on sophisticated and expensive laboratory analysis (e.g. ELISA), and point of care (POC) biosensors for this purpose are rather limited.<sup>2</sup> Here, aiming to foster the development of POC technologies for ADA detection, we developed a disposable and label-free electronic immunosensor to detect ATI by means of plastic electrolyte-gated transistors (EGTs) based on reduced graphene oxide (rGO).<sup>3</sup> EGTs are powerful transducers for POC biosensing thanks to their high sensitivity, rapid response, and compatibility with flexible, disposable, low-cost, and miniaturized device technologies.

The reported rGO-EGTs are fabricated by combining laser micromachining of plastic electrodes, which allows rapid and scalable device manufacturing, with a green (i.e. non-toxic) production of rGO films (Fig.1). The devices exhibited low-operational voltages ( $V_{GS} = \pm 0.3$  V and  $V_{DS} = 50$  mV), reliable responses toward ATI within 15 min, and a limit of detection of ca. 0.1 fM in presence of interfering tumour necrosis factor alpha (TNF $\alpha$ ).

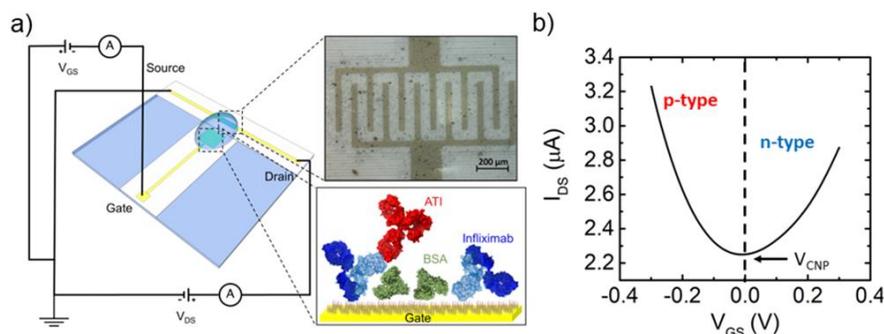


Fig. 1. EGT scheme and transfer characteristics.

## References

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