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Sensitive and label-free Graphene FET immunosensors for detection of Clusterin Protein Biomarker for Alzheimer's Disorder

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We report on sensitive and label-free immunosensors based on CVD graphene field effect transistors (G-FETs [1]) which we have used to detect the presence of clusterin proteins, that have recently emerged as potential biomarker of Alzheimer's disorder (AD), in blood plasma samples. Clusterin is currently being investigated as a potential diagnostic and prognostic biomarker for AD [2]. In practice, a panel of protein biomarkers may be needed to robustly establish the presence of AD in patients compared to non-AD or control patients. For panel of protein biomarker detection we are also developing G-FET sensors in a multiplex configuration. Each G-FET sensor has pyrene based bioactive ester non-covalently anchored onto the graphene channel via pi-pi bonding in order to retain the graphene sp^2 lattice [3]. The G-FET transfer characteristics showed repeatable and reliable responses in all surface modifying steps using a direct current (DC) readout system [3]. Alternative readout techniques are also being developed in order to improve the sensitivity of the detection system [1]. The G-FET sensors have been tested with human chorionic gonadotropin (hCG), a known pregnancy and cancer biomarker [4], and found to have limit of detection ~1pg/mL [3]. The corresponding concentration gradient for clusterin will be reported at the conference. The new G-FET sensors are expected to enable sensitive, selective, fast, cost effective and reliable point-of-care sensors for range of clinical applications in the near future.

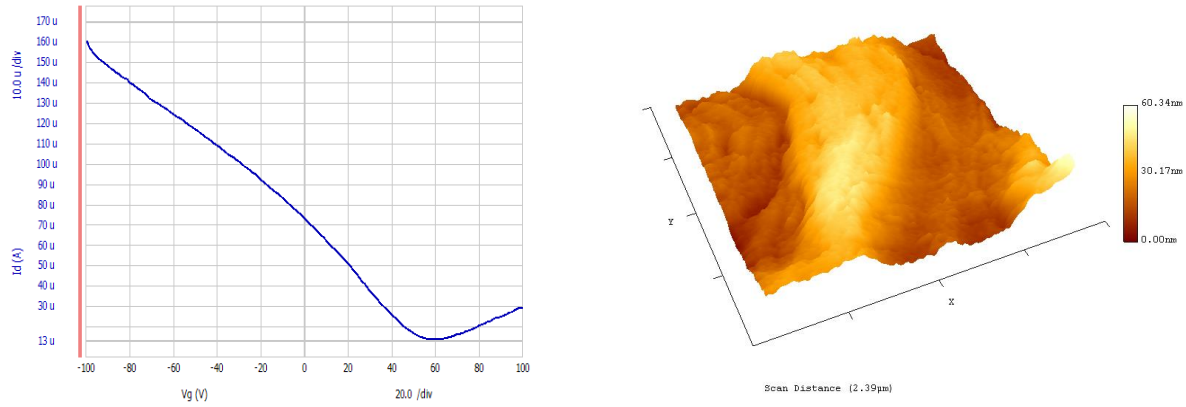

Fig. 1. Back-gated current-voltage characteristic of the G-FETs (left) and AFM image of pyrene ester on the surface of graphene (right).

References

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