Graphene BioFET

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Graphene field effect transistor is a good candidate for the sensing element of a biosensor because of its high charge sensitivity and nonlinearity. Most of the biomolecules carry charge and can facilitate label-free detection. The challenge is to provide immobilisation of the receptors and high enough selectivity to detect the desired analytes. Here we demonstrate a biosensor exploiting fusion protein receptors based on small amphiphilic proteins, hydrophobins, which provide immobilisation and proper orientation of the receptors. Recently, genetically modified hydrophobins have been used to selectively attach nanoparticles on hydrophobic domains on surfaces [1] and to exfoliate, functionalise and stabilise graphene sheets in aqueous solutions [2].
The biosensor concept is generic as the hydrophobins used for immobilisation can be fused with a wide variety of different receptor moieties. The receptor modules self-assemble on the graphene channel and form a well-oriented dense monolayer, ensuring high detectivity. The concept has been tested using a few receptor-analyte pairs [3]. In this talk, we will discuss the potential and challenges of the label-free graphene biosensor.

References

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[3] M. Soikkeli, K. Kurppa, M. Kainlauri, S. Arpiainen, A. Paananen, D. Gunnarsson, J. J. Joensuu, P. Laaksonen, M. Prunnila, M. B. Linder, J. Ahopelto, ACS Applied Materials and Interfaces 8 (2016) 8257-8264.

Figures

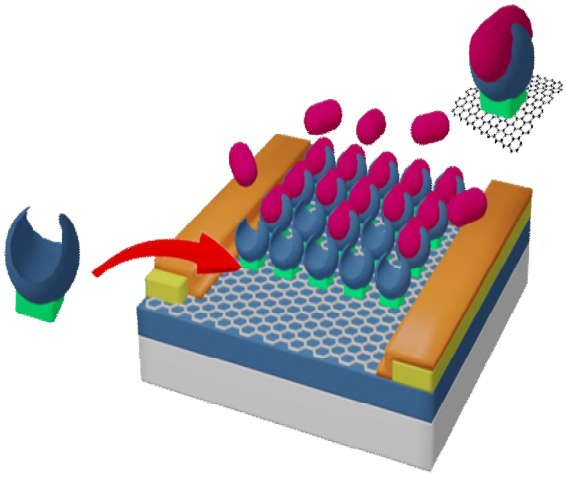

Figure 1: GFET biosensor shown schematically. The receptor modules self-assemble on the channel of the graphene FET to form a dense and well-oriented monolayer. The receptors bind selectively the analyte molecules from the sample and the charge of the molecules is detected by the FET as a shift in the location of the Dirac peak.