

Graphene-based platforms for electrical and optical biosensing

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Graphene is increasingly attracting attention and it is under intensive research by biosensing technology community thanks to its interesting chemical, mechanical, electrical and optical properties. Between the various graphene forms, graphene oxide (GO) shows advantageous characteristics as a biosensing platform due to its excellent capabilities for direct wiring with biomolecules, heterogeneous chemical and electronic structure, the possibility to be processed in solution and the availability to be tuned as insulator, semiconductor or semi-metal. Moreover, GO bears the photoluminescence property with energy transfer donor/acceptor molecules exposed in a planar surface and even can be proposed as a universal highly efficient long-range quencher, which is opening the way to several unprecedented biosensing strategies. The possibility to be processed in solution combined with easy chemical or electrochemical reduction makes GO an interesting and advantageous material to fabricate electrodes with various forms and shapes through either ink-jet printing or other simple transferring technologies.

Some of our most important and recent graphene-based biosensing systems with interest for health and safety&security will be presented. The developed electrical /electrochemical devices include screen-printed electrodes modified with graphene (for phenolic compounds detection), graphene-based FET (gases detection) as well as transparent & flexible graphene based impedancimetric devices for cell studies. In addition some novel optical-based detection systems that involve graphene will also be described. A graphene-based microarray that can be turned ON by a pathogen will be shown. This system has been designed and evaluated for the sensing of E. coli

bacteria in diverse matrices. It employs antibody-quantum dot probes and exploits the extraordinary two-dimensional structure and fluorescence-quenching capabilities of graphene oxide.

References

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