GRAPHENE BIOSENSORS IN DIAGNOSTICS

Arben Merkoçi

ICREA & Catalan Institute of Nanoscience and Nanotechnology (ICN2), Bellaterra (Barcelona), Catalonia, Spain
E-mail:arben.merkoci@icn.cat
www.nanobiosensors.org www.icn.cat

Abstract

There is an increasing demand for biosensing systems based on simple electrical/optical transducing schemes able to achieve cost efficient detection. Among the various biosensing system performance requirements the high sensitivity and selectivity of the response are crucial for applications in diagnostics. Due to the fact that the analytes to be detected in clinical, environmental or food sample are present in very low concentrations the need for biosensing systems that can detect with high sensitivity and selectivity that include very low detection limits along with high reproducibility is an important challenge. To overcome the difficulties in accomplishing all these requirements the main efforts are driven toward signal amplification and noise reduction of biosensing systems by the incorporation of nanomaterials. Since graphene exhibits innovative mechanical, electrical, thermal and optical properties this two-dimensional material is increasingly attracting attention and it is under active research. Graphene-based materials (GBMs) display advantageous characteristics to be used in biosensing platforms due to their interesting properties such as 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, GBMs such as graphene oxide (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 rational behind the use of GO and GBMs in optical and electrochemical biosensing is being studied and explored. We are developing simple, sensitive, selective and rapid biosensing platforms based on the advantageous properties of GBMs while used as electrochemical transducers or revealing agents in a variety of biosensing systems. Examples related to diagnostics applications including bacteria and other analytes (ex. contaminants) detection will be shown. The developed devices and strategies are intended to be of low cost while offering high analytical performance in screening scenarios beside other applications. Special emphasis will be given to (nano)paper/plastic-based platforms that operate in microarray or lateral flow formats with interest for various detections.

References

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