Exploring field-effect transistors based on graphene for the ultrasensitive detection of biomarkers

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Abstract

Biosensors based on graphene field-effect transistors (GFETs) are highly attractive technology, as they allow real-time label-free electrical detection, scalability, inexpensive mass production, miniaturization, the use of a low volume of sample, and the possibility of on-chip integration of both sensor and measurement systems. Besides that, graphene possesses unique properties such as: i) high charge carrier mobilities and electrical conductivity, ii) flexibility, iii) biocompatibility, iv) facile chemical functionalization, and v) large specific surface area, allowing the immobilization of high density of bioreceptors, leading to increased sensitivity [1]. This presentation will provide an overview of the fundamentals and applications of GFETs, highlighting the use of these in the ultrasensitive detection of breast cancer biomarkers (HER-2 protein) and the Spike (S) proteins of the SARS-CoV-2 virus. Furthermore, we will show how the decoration of graphene by gold nanoparticles and aptamers improved the limited detection of these devices to fM levels. Our results have shown that the GFETs exhibited a high electrical sensitivity in the detection of HER-2 proteins and the S protein, allowing us to explore this technology to detect the breast cancer biomarkers and SARS-CoV-2 virus in real samples, such as blood and saliva, respectively.

Keywords

Graphene, FETs, Bioelectronics, Cancer, COVID-19

References

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