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Plasmonic refractive index sensitivity of silver nanoparticles with graphene coatings layers used for LSPR biosensor applications

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A new hybrid graphene layer structure of the resonance of localized surface plasmon (LSPR), with silver nanoparticles (AgNPs) and substrate has been proposed to obtain a broadband absorption response for plasmon biosensors. The resonance peaks in the absorption spectra of the nanostructure SiO₂/AgNPs/Graphene, demonstrate significantly different profiles such as the thickness of the graphene, and the refractive index of the surrounding environment which is, gradually, diverse. Numerical simulation reveals a shift in plasmon resonance peaks which result from coupling between the AgNPs networks and the covering graphene layer. In addition, the LSPR modes swing to red from 412 nm to 548 nm when the thickness of the graphene layer deposited on silver nanoparticles changes from 0.34 nm to 9 nm. We have found that the LSPR modes can lead to an improvement in terms of sensitivity to a deposit of a graphene layer. While being sensitive to variations of the graphene layer with the incidence wave normal to the substrate and leading to a gain of 304.60% (4.04 times) when the pure AgNPs conventional biosensor was coated with graphene layer of the 9 nm. These characteristics should make these biosensors a choice preferred for biosensors applications, compared to other contemporary biosensors.

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