Highly Sensitive performance of SPR chips with Reduced Graphene-Oxide as Functional Layer

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Abstract

Graphene oxide (GO) has been described having a bandgap. It is proportional to the concentration of the oxygen atoms. Upon reduction of GO[1] to reduced graphene oxide (rGO) this bandgap is getting smaller, which implies higher excitation efficiency of carriers from ground states to excited states. Of this process, the non-radiative emission contributes to the generation of surface plasmon along the rGO/Au interface. Most of the recent research focus on GO-based Au surface plasmon resonance (SPR) [2][3] and it was proved that GO on top of a Au layer can increase the SPR sensitivity compared to a conventional Au layer. The underlying principle of this stronger light-matter interaction is still under debate.
In our study, in contrast to GO thin films, we demonstrate that rGO thin films exhibits even superior enhancement of surface plasmon effects for biosensing applications. A GO thin film was prepared as starting layer in wafer scale by a spin-coating technique on the surface of aminothiophenol (ATP)-functionalized Au. Afterwards it was treated by thermal reduction at mild temperatures to transform GO into rGO having a smaller band-gap. Both thin films were then compared in SPR assays. They served as functional layers to immobilize prostate cancer specific antigen (PSA) as receptor molecules for detecting its binding capability to concanavalin A (ConA lectin). Our results concretely confirmed that the average intensity of the resulting surface plasmon and the signal-to-noise ratio on a rGO-SPR platform (as shown in Figure 1) were 1.65 times and 3.03 times higher than that of the GO based SPR platform.
The working mechanism and the potential application of rGO thin film to enhance the standard SPR approach in biosensing will be intensively discussed in this contribution.

Figures

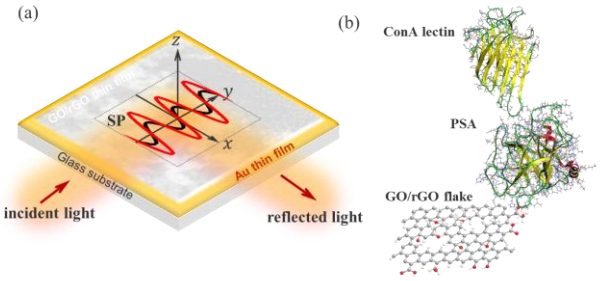

Figure 1: (a) Schematic of SPR optics. (b) PSA covalently immobilized on GO/rGO flakes acts as receptor molecule to detect ConA lectin.

References

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