

Graphene oxide linking layers for copper plasmonic biosensors

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Graphene and its derivatives are opening up many new opportunities for biosensing applications, as these materials have been shown to increase the sensitivity of commercial surface plasmon resonance (SPR) biosensors [1]. Current SPR instruments use gold as a plasmonic material, which possesses excellent optical properties, but not fully compatible with mass-scale production. Copper is the excellent substitution of gold, because of its high efficiency for plasmonics applications and compatibility with microelectronics technological processes [2].

Here, we are proposing copper sensor chips for SPR biosensing. Copper films in these chips are covered by thin dielectric layers for oxidation protection, which does not allow to use standard sulfur-based immobilization chemistry. We demonstrated that graphene oxide-based linking layers could simultaneously enhance biosensing performance and could be deposited on different types of substrates. In the present study, we developed copper SPR chips with graphene oxide linking layers to use with a commercial SPR instrument (Fig. 1-2). Their performance was confirmed in the investigation of biochemical reactions of neutravidin proteins with biotinylated oligonucleotides. The same structures of biosensing interfaces could be developed for a wide range of compact plasmonics biosensors based on plasmonic gratings, localized SPR, long-range surface plasmons, and plasmonic waveguides. Further development of this technology will

ultimately lead to the creation of versatile graphene-assisted compact plasmonic biosensors integrated with portable gadgets and wearable electronics.

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References

- [1] Stebunov et al., ACS Appl. Mat. Interfaces 7 (2015), 21727-34.
- [2] Fedyanin et al., Nano Lett., 16 (2016), 362-366.

Figures

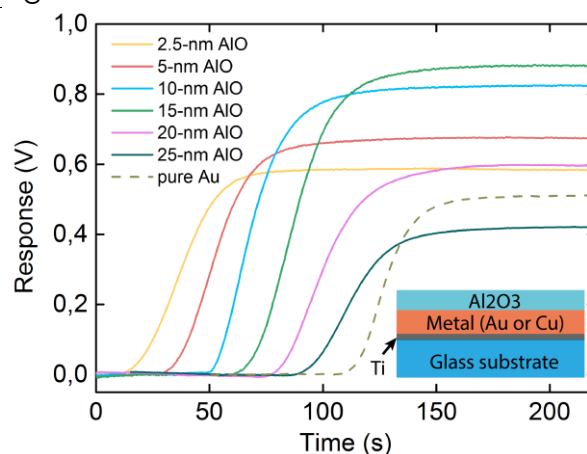


Figure 1: Sensograms show the responses of the copper sensor chips covered by the aluminum oxide protecting layers (solid lines) to the injections of 0.5% NaCl in PBS buffer. The commercial bare gold chip was used as a reference (dashed line).

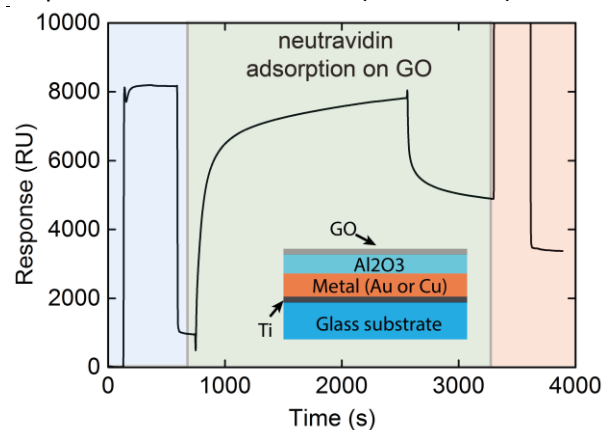


Figure 2: Neutravidin protein adsorption on the graphene oxide-based copper SPR chip.