MODIFICATION AND DEPOSITION OF GRAPHENE OXIDE (GO) ON GOLD SURFACE AS A PLATFORM INCREASING SENSITIVITY AND STABILITY FOR A NEW TYPE OF IMMUNOSENSORS

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Protein – ligand interactions are fundamental to almost all processes occurring in living organisms. The ligands are most often ions, low-molecular weight compounds, peptides, nucleic acids and other proteins. This binding is most often reversible, highly specific and crucial in the regulation of the cell cycle. The interaction of proteins with ligands is also important in the development of new pharmaceuticals. The research for low molecular weight compounds (new drugs) that inhibiting enzymes and modulating the processes of protein complex formation is the foundation of modern medicine. Due to such extensive meaning, understanding of protein - ligand systems has become an important issue. Currently, tests based on the interaction of proteins with ligands are used not only for scientific purposes, but also have significance in diagnostics.

Biosensors are common devices for studies the interactions of protein - ligand. Nowadays, optical biosensors based on surface plasmon resonance (SPR) are becoming more and more important (Fig.1). They are widely used in scientific and pharmaceutical research, food research and in medical diagnostics. The main advantage of SPR technique indicates of biosensing without requiring any types of labeling (fluorescent, colorimetric, radioactive), which could interfere with the biosensing process, sensitivity, and real-time monitoring of biomolecule binding. In SPR techniques, the protein - ligand interaction is monitored directly in real time. Unfortunately, label-free SPR-based biosensing has low sensitivity for applications with small molecules and low concentrations of analyte. Nowadays, to improve the biosensing performance, researchers have proposed various types of material for the enhancement of optical properties of the transducer in SPR sensor.

The aim of the work was to deposit a layer or layers of GO and GO hybrids with polyelectrolytes/metallic nanoparticles of copper (Cu) or silver (Ag) on the gold surface in a controlled and repeatable manner. The physicochemical characterization of various GO suspensions and Ag/Cu nanopartilces suspensions obtained by chemical reduction methods were also carried out, including: size, zeta potential value, stability, composition and presence of different functional groups for GO using methods: DLS, UV-Vis, SEM and XPS. Additionally, using methods; AFM, SEM and ATR-FTIR determined the topology, coverage, surface roughness, structural and spectral properties of the tested systems. Quartz Crystal Microbalance with Dissipation monitoring (QCM-D), whose surface is covered with gold, and gold SPR sensors were used as model surfaces for deposition of graphene oxide/nanoparticles. The deposited GO layers should be characterized by high surface coverage, high stability and homogeneity. The layer-by-layer (LbL) technique was used to form the layers, which is based on the adsorption of oppositely charged nano-objects using methods: immersion, spraying (air brushing) and spin coating.

The planned research will contribute to the broadening of knowledge in the field of modern materials such as graphene oxide in physicochemistry and biochemistry with a special focus on SPR immunosensors.

Acknowledgements

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References

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Figures

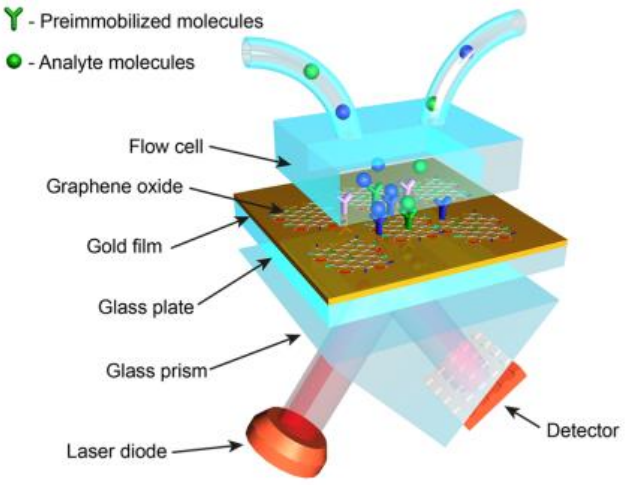

Figure 1. Schematic representation of the SPR biosensor comprising the SPR sensor chip with the graphene-oxide-linking layer, which forms in conjunction with the preimmobilized molecules that are highly selective to analyte [1].