PROTEIN IMMOBILIZATION ON SURFACE OF ZnO NANOSTRUCTURES FOR OPTICAL BIOSENSOR DESIGN

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Optical biosensors exhibit good performance in detecting biological systems and promote significant advances due to high sensitivity, immunity to external disturbance, stability, and low noise [1]. Photoluminescence (PL) from nanomaterials is a suitable and simple method for detection of various analytes. One of the most interesting metal oxide materials is ZnO with a wide band gap (3.37 eV), high isoelectric point (pH 9–9.5) and intense room temperature photoluminescence [2]. Zinc oxide nanostructures have also shown beneficial physico-chemical properties for use in bioanalysis as transducers due to their biocompatibility, high surface/volume ratio and surface tailoring ability which allows for various types of biomolecules to be immobilized [3]. In this work polyacrylonitrile (PAN) nanofibers synthesized by electrospinning and modified by ZnO using ALD technique [4] were used as a substrate for protein immobilization.

The main aim of this study was to choose the optimal method of protein immobilization on the surface of polyacrylonitrile PAN/ZnO nanostructures for optical biosensor design. Several strategies for the modification of PAN/ZnO samples were chosen. The PAN/ZnO nanostructures were modified by silanization using (3-aminopropyl)triethoxysilane (APTES) or (3-mercaptopropyl)triethoxysilane (MPTES). Other samples were modified by formation of Au nanostructures on the surface of ZnO using UV irradiation. Self-assembled monolayer (SAM) of 11-mercaptoundecanoic acid was subsequently formed on the surface of Au nanostructures. FTIR analysis was used to confirm successful silanization and SAM formation. Finally, antibodies labelled with the enzyme horseradish peroxidase (HRP) were covalently immobilized on the modified PAN/ZnO surfaces *via* their carboxyl groups. Immobilization of antibodies was evaluated using the enzymatic reaction between HRP and 3,3′,5,5′-tetramethylbenzidine which results in colour change of solution. Moreover, an optical system of PL detection was carried out for antibodies immobilization control. ZnO nanostructures were excited by LED (λ = 325 nm) and PL spectra were collected by fiber optic spectrometer QEPro from Ocean Optics.

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