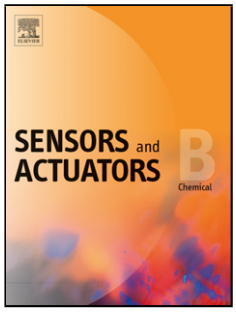

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Ultrasensitive biosensor based on Long Period Grating coated with Polycarbonate-Graphene Oxide multilayer

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Highlights

- Fiber optic biosensor using a single-ended Long Period Grating (LPG) is presented.
- LPG is coated with multilayer system of Polycarbonate and Graphene Oxide.
- It was tested towards the streptavidin-biotin binding.
- Very high sensitivity and limit of detection in attomolar range is demonstrated.

Abstract

In this work, we report about an ultrasensitive fiber optic biosensor realized using a single-ended Long Period Grating (LPG). The LPG working point is tuned in the highest sensitivity region of mode transition, through a multilayer system consisting of Polycarbonate (PC) film and much thinner layer of Graphene Oxide (GO). Due to the coexistence of hydrophobic domain from pristine graphite structure and hydrophilic oxygen containing functional groups, GO exhibits good water dispersibility, biocompatibility, and high affinity for specific biomolecules. These properties of GO provide many opportunities for the development of novel biological sensing platforms. The so prepared LPG performance level has been evaluated using the highly stable streptavidin-biotin binding. By means of a careful design of the mode transition layers, as well as the bio-functionalization protocol, the detection of biotinylated BSA (Bovine Serum Albumin) concentrations in range 0.1-1000 aM was demonstrated, with a limit of detection below 0.2 aM, which is one of the lowest reached so far with this sensing technology. Functionalized LPG is therefore proven a powerful tool for the detection of biological species even down to attomolar detection limit, providing real-time detection, small size, and simple fabrication. Finally, a plain procedure for taking into account the effects of fabrication tolerances on the sensor characteristics is successfully proposed and applied.

Keywords: biosensing, biotin, graphene oxide, fiber optic sensor, long period grating.