Ultrathin Au-Pt nanowires grown on graphene sheets and their application for carcinoembryonic antigen detection

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Abstract

In this work, for the first time, a novel, label-free and inherent electroactive redox biosensor based on ultrathin Au-Pt nanowire-decorated thionine/reduced graphene oxide (AuPtNWs/THI/rGO) is developed for carcinoembryonic antigen (CEA) detection. Ultrathin AuPtNWs are prepared by a one-pot synthesis method without the use of any stabilizer or template. The AuPtNWs/THI/rGO composites are obtained by the THI/rGO composites surface functionalized with -NH_2 group employed as a support for loading ultrathin AuPtNWs by coordination. The AuPtNWs/THI/rGO composites not only favor the immobilization of antibody but also facilitate the electron transfer. It is found that the resultant AuPtNWs/THI/rGO composites can be designed to act as a sensitive label-free electrochemical immunosensor for CEA determination. Under the optimized conditions, the linear range of the proposed immunosensor is estimated to be from 50 fg·mL^{-1} to 100 ng·mL^{-1} (R= 0.998) and the detection limit is estimated to be 6 fg·mL^{-1} at a signal-to-noise ratio of 3, respectively. The prepared immunosensor for detection of CEA shows high sensitivity, reproducibility and stability. Our study demonstrates that the proposed immunosensor has also been used to determine CEA successfully in diluted blood samples.

Keywords: Au-Pt nanowire; reduced graphene oxide; carcinoembryonic antigen; immunosensor

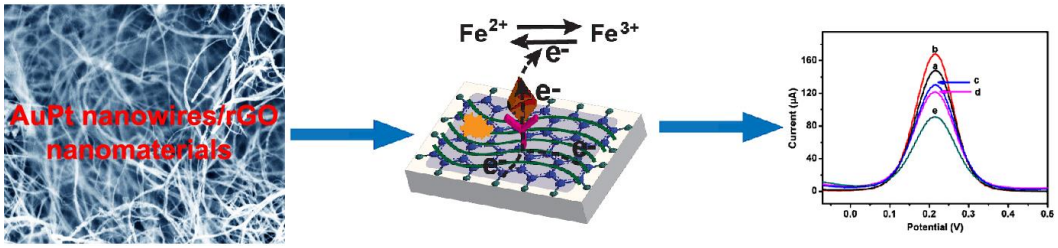

Figure 1 A sensitive label-free electrochemical immunosensor based on AuPtNWs/THI/rGO composites is used for carcinoembryonic antigen (CEA) determination. It is the first CEA biosensor with the use of AuPtNWs/THI/rGO composites.