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Electrochemical fabrication of mesoporous gold-electrode towards the ultrasensitive detection of microRNA

Nanostructured gold electrodes have attracted immense interest for a broad range of applications, especially in biosensing due to their unique biocompatibility, stability, sequence dependent adsorption of nucleic acids, and high throughput optical and electrochemical responses. Integration of tuneable mesopores into gold electrodes offers high surface area with voluminous active sites for releasing and uptaking guest biomolecules, thereby remarkably increasing electrochemical responses[1].

Herein, we report an electrochemical preparation of a new class of mesoporous gold (film) electrode (MPGE) using diblock copolymer-micelles (polystyrene-block-polyoxyethylene; PS-b-PEO) as a soft-template. The PS-b-PEO spherical micelles were formed through the interaction of aqua-AuCl4+ ions with hydrophilic EO blocks near the outer layer providing PS cores. Under the optimal applied potential, the composite micelles were deposited to the working electrode surface. After that, the PS-b-PEO micelles were completely removed. The SEM images exhibited the presence of uniformly sized (average size 25±5 nm) mesopores. In-depth electrochemical characterization of the resultant electrode were also carried out using popularly used [Fe(CN)6]3-/4- redox biomarker for nucleic acid (microRNA) sensing.3 The MPGE exhibited around 10 folds-higher activity than that of planar gold electrode. This highly active MPGE shows great potential towards the direct adsorption of miRNA and subsequent electrochemical (differential pulse voltammetry-DPV) interrogation of adsorbed miRNA in presence of [Fe(CN)6]3-/4- system.

References
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Topic

Advanced Materials

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