Optimization of Au-Cu Codeposition for Enhanced Electrochemical Performance on Screen-Printed Graphene Electrodes

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Abstract:

This study investigates the effect of Au ratio in Au-Cu codeposition on the electrochemical response of a screenprinted graphene electrode (SPGE). The current response was measured at different precursor concentrations (55 nM, 110 nM, 165 nM, 220 nM, and 275 nM) to determine the optimal Au-Cu composition for enhanced electrochemical performance. The results show a non-linear trend, with the highest current observed at an Au ratio of 0.50, exhibiting an increase of approximately 100–250% compared to other compositions. This significant enhancement is attributed to the formation of a well-balanced Au-Cu alloy, which maximizes electron transfer and improves conductivity. At lower Au ratios, the presence of excess Cu may lead to a less stable deposition structure, reducing electrochemical efficiency. Conversely, at higher Au ratios, the reduction in Cu content likely disrupts the alloy's catalytic synergy, leading to a decline in current. These findings highlight that an Au ratio of 0.50 provides the optimal composition for Au-Cu codeposition, offering superior electrochemical properties for potential applications in biosensors and electrocatalysis.

Keywords:

Au-Cu co-deposition, Biosensor optimization, Current enhancement, Glucose detection, Electrochemical performance.