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A novel hierarchical 3D N-Co-CNT@NG nanocomposite electrode for non-enzymatic glucose and hydrogen peroxide sensing applications

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Abstract

A novel 3D nanocomposite of nitrogen doped Co-CNTs over graphene sheets (3D N-Co-CNT@NG) have been successfully fabricated via a simple, scalable and one-step thermal decomposition method. This hierarchical 3D N-Co-CNT@NG provides an admirable conductive network for effective charge transfer and avoids the agglomeration of NG matrices, which provides better access to the electrode material for glucose and H_2O_2 sensing applications. The 3D N-Co-CNT@NG demonstrates direct as well as non-enzymatic responses to glucose oxidation and H_2O_2 reduction at a low potential. The novel electrode showed excellent electrochemical performance towards glucose oxidation, with high sensitivity of 9.05 μAcm^{-2} mM^{-1}, a wide linear range from 0.025 to 10.83 mM, and a detection limit of 100 nM with a fast response time of less than 3 s. Furthermore, non-enzymatic H_2O_2 sensors based on the 3D N-Co-CNT@NG electrode exhibited high sensitivity (28.66 $\mu A\ mM^{-1}\ cm^{-2}$), wide linear range (2.0–7449 μM), low detection limit of 2.0 μM (S/N = 3), excellent selectivity, decent reproducibility and long term stability. Such outstanding electrochemical performance can be endorsed to the