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Charge storage, electrocatalytic and sensing activities of nest-like nanostructured Co_3O_4

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Abstract

We synthesized nanostructured Co_3O_4 samples using anionic (SDS), cationic (CTAB) and nonionic (TritonX-100) surfactant molecules in hydrothermal conditions and subsequent calcination. This approach facilitates the synthesis of porous Co_3O_4 material with bundle-like-sheet, nest-like and flake-like morphologies with specific surface areas in the range of 50 to 77 $\text{m}^2 \text{g}^{-1}$. Among these materials, the nest-like nanostructured Co_3O_4 material has unique pore architecture, larger pore volume, low solution and charge transfer resistance, and found to be an active material for charge storage, electrocatalytic and sensing applications. The specific capacitance value of the nest-like Co_3O_4 is 404 F g^{-1} at a current density of 2 A g^{-1} with 80% specific capacitance retention. The electrocatalytic oxidation of methanol occurs at lower onset potential on this material with good electrochemical stability. It has good sensing ability for glucose with high sensitivity of 929 $\mu\text{A cm}^{-2} \text{mM}^{-1}$, fast response time of ~ 0.5 s and detection limit as low as ~ 1 μM . These results show that the nest-like nanostructured Co_3O_4 material is a versatile candidate for various applications.

Keywords: Co_3O_4 ; Supercapacitor; Electrooxidation; Glucose sensor

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