Sensors and Actuators B: Chemical

Influence of mesoporous defect induced mixed-valent NiO(Ni2+/Ni3+)-TiO2nanocomposite for non-enzymatic glucose biosensors

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Abstract:
An extraordinary sensitive and selective non-enzymatic glucose sensor has been demonstrated based on the electrochemically highly stable NiO-TiO2 mixed oxide comprising the defect induced mesoporous TiO2 nanoparticles with Ni2+ and Ni3+ ions scattered on the surface. The defects on TiO2 nanoparticles have been successfully introduced using NiO to investigate the interfacial properties between NiO and TiO2. This defect induced interfacial behavior was characterized using X-ray diffraction, X-ray photoelectron spectroscopy and high-resolution transmission electron microscopy analyses. The obtained mixed oxide NiO-TiO2 nanocomposite dispersion was drop casted on glassy carbon electrode to form a NiO-TiO2/GCE modified electrode for non-enzymatic glucose sensor. The defects along with high surface area of mixed oxide enabled excellent electrocatalytic activity for glucose oxidation with sensitivity of 24.85 µA mM-1 cm-2 and detection limit of 0.7 µM (S/N = 3). The Ni ions scattered on the surface of TiO2 nanoparticles, enabling effective charge transfer process, circumventing the agglomeration during prolonged detection, and resulting the unprecedented long-term stability and sensitivity. Thus, this defect induced mesoporous metal oxide nanocomposite is an outstanding candidate for application as redox active material in electrochemical biosensors.