Controlled Synthesis of CuO from needle to flower-like Particle Morphologies for Highly Sensitive Glucose Detection

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CuO particles with morphologies ranging from “needle”, “flat flowers” to “peony-like” flower shape were prepared by varying hydrothermal reaction times. The structure and morphology of the CuO samples were characterized by X-ray diffraction, BET and scanning electron microscopy, and these samples were evaluated as catalysts for glucose oxidation in alkaline solution. Of the three particle morphologies, peony-like CuO produced the highest glucose sensitivity of $1322 \mu\text{A mM}^{-1} \text{cm}^{-2}$, with a broad detection range of $1.0 \mu\text{M}$ - 4.0 mM , and a detection limit of $0.5 \mu\text{M}$ under an applied potential of $+0.5 \text{ V}$ vs. Ag/AgCl. The peony-like CuO electrode also had excellent selectivity in the presence of interfering agents which usually co-exist in solution, for example uric acid, ascorbic acid and sodium chloride). Overall, we conclude that complex particle structure (of possible multiple grain boundary content) improves sensitivity for glucose detection and forms a target for developing effective non-enzymatic sensors.

Keywords: Copper oxide; Hierarchical structure; Glucose oxidation; Sensor.

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