ELECTROCHEMICAL RESPONSE OF METAL OXIDES IN SODIUM HYDROXIDE

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Abstract

This study investigates the electrochemical behavior and surface wettability of Fe_2O_3 and CuO under alkaline conditions, aiming at non-enzymatic glucose sensing. Thermal annealing at 500 °C for Fe_2O_3 and 800 °C in the case of CuO was applied to modify their structural and surface characteristics [1]. Electrochemical behavior, assessed by cyclic voltammetry in sodium hydroxide (NaOH) solutions (pH 7 and 14), revealed pH-dependent redox responses with clearer oxidation–reduction peaks in highly alkaline environments. Contact angle measurements showed that annealing enhanced hydrophilicity, supporting better electrolyte interaction and charge transfer [2]. The importance of morphology control and functionalization in shaping hybrid structures for diverse electrochemical applications has also been highlighted [3,4].

CuO electrodes were further examined for glucose sensing in 0.5 M NaOH. They displayed a concentration-dependent current response with good electrocatalytic activity toward glucose oxidation. A calibration curve confirmed a linear correlation between glucose concentration and peak current, demonstrating reliable quantitative detection across the studied range.

Overall, thermally treated CuO emerges as a promising, low-cost, enzyme-free glucose sensor in alkaline media. These findings emphasize how surface modification and electrolyte pH critically govern the electrochemical performance of metal oxide electrodes, offering valuable insights for their future application in biosensing technologies.

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