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ELECTROCHEMICAL PERFORMANCE OF CuO ANODE MATERIAL SYNTHESIZED BY CHEMICAL PRECIPITATION TECHNIQUE AT DIFFERENT TEMPERATURES, FOR RECHARGEABLE LITHIUM-ION BATTERIES

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Copper oxide (CuO) is a desirable anode material for the rechargeable lithium ion battery (LIB) due to its high theoretical capacity (675 mA h g^{-1}), good capacity retention, affordability, non-toxicity, and ease of storage. The electrochemical performance of CuO mainly depends on morphology and anode/current collector interfacial properties, which can significantly be manipulated by the synthesizing technique. Therefore, this study aims for preparing CuO anode materials by a chemical precipitation technique with enhanced crystallinity, morphology, and anode/current collector interfacial properties. The lithium ion rechargeable coin cells were assembled in an argon-filled glove box with anodes fabricated with synthesized CuO at different bath temperatures (25 °C, 50 °C and 75 °C). The galvanostatic charge-discharge characterization study of the CuO electrodes reported high initial discharge capacities of 2827.1, 3371.9 and 2009.9 mA h g^{-1} with a Coulombic efficiency (CE) of 58%, 40.6% and 33.1% at a rate of C/5 for those synthesized at 25 °C, 50 °C and 75 °C bath temperatures, respectively. Further it showed discharge capacities of 466.2, 442.9 and 232.3 mA h g^{-1} with Coulombic efficiencies of 88.7, 97.4 and 95.9% after 50 cycles for those synthesized at 25 °C, 50 °C and 75 oC bath temperatures, respectively. The results revealed that CuO anodes prepared in this study show considerably better electrochemical performance compared to that of the previously reported. However, the best performance was reported by CuO synthesized at 25 °C compared to that synthesized at 50 °C and 75 °C. The enhanced electrochemical performance could be related to the enhanced contact surface area between CuO and electrolyte and anode/current collector interfacial properties. It could have led to the enhanced contact between CuO and electrolyte, hence reducing diffusion length for lithium ions. The enhanced anode/current collector interfacial properties may facilitate for electrons to transfer between current collector and active material. Accordingly, the present study reveals that the chemical precipitation method is a promising technique, which improves the crystallinity with favorable morphology and anode/current collector interfacial properties of electrode materials indicating a high potential for the anode application in next-generation high-performance LIBs.

Keywords: Anode materials, chemical precipitation, CuO, Li-ion battery