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ELECTROCHEMICAL PERFORMANCE OF CuO ANODE MATERIAL SYNTHESIZED BY CHEMICAL PRECIPITATION METHOD FOR RECHARGABLE LITHIUM-ION BATTERIES

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Abstract: CuO has received more attention for the anode application of the rechargeable Lithium-Ion Battery (LIB) than the other competing materials because of its high theoretical capacity (674 $mAhg^{-1}$), good capacity retention, affordability, non-toxicity and ease of storage. The electrochemical performance of CuO mainly depends on crystallinity and morphology, which significantly depend on the synthesizing technique. Simple and convenient chemical precipitation technique, which is a promising technique that enhances the crystallinity with favorable morphology for electrode materials, has not been studied. Therefore, this study aims for synthesizing CuO anode materials by the chemical precipitation technique, with improved crystallinity and morphology. The coin cells were assembled in an argon-filled glove box with anode electrodes fabricated with synthesized CuO, lithium as the reference electrode and counter electrodes together with the non-aqueous electrolyte of 1M $LiPF_6$ in ethylene carbonate and dimethyl carbonate (1:1 wt%). The electrochemical performances have been analyzed by galvanostatic charge- discharge measurements. It was found that CuO electrode exhibited a high initial discharge capacity of 3371.9 $mAhg^{-1}$ at a rate of C/5. The electrode showed a discharge capacity of 442.9 $mAhg^{-1}$ with Columbic efficiency of 97.4%, after 50 cycles. Even though it reported a higher irreversible capacity of 2002.2 $mAhg^{-1}$ at the 1st cycle, it lowered down to 11.4 $mAhg^{-1}$ at the 50th cycle. The enhanced electrochemical performance can mainly be attributed for the enhanced contact surface area for CuO and electrolyte. It could have led to the enhanced contact between CuO and electrolyte and by decreasing diffusion lengths for lithium ions. Electrochemical impedance spectroscopy and cyclic voltammetry analyses also showed improved electrochemical performance. Altogether, this study reveals that CuO synthesized by simple, cost - effective, non - toxic and environmentally friendly chemical precipitation method has very promising electrochemical performance for the anode application of next-generation high - performance LIBs.

Keywords: Anode materials; CuO; Chemical precipitation; Li-ion battery