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Electrochemical performance of Cu_2O anode material synthesized by electrodeposition method for rechargeable lithium-ion batteries

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Cu_2O is currently used for numerous applications, including gas sensors, solar energy conversion, photocatalysis and batteries. Recently, Cu_2O 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 (375mAhg^{-1}), good capacity retention, affordability, non-toxicity and ease of storage. The electrochemical performance of Cu_2O mainly depends on its crystallinity and morphology that significantly depend on the synthesizing technique. The electrodeposition method, which is a promising technique that improves the crystallinity with favorable morphology for electrode materials, has not been studied well for synthesizing Cu_2O. Hence, this study aims for preparing Cu_2O anode materials by the electrodeposition method with enhanced crystallinity and morphology. The coin cells were assembled in an argon-filled glove box with anodes fabricated with synthesized Cu_2O, lithium as the reference electrode and counter electrodes together with the non-aqueous electrolyte of 1M $LiPF_6$ in ethylene carbonate and dimethyl carbonate (1:1wt%). The galvanostatic charge-discharge tastings performed on the assembled coin cells showed a significantly high initial specific discharge capacity of 533 mAhg^{-1} while maintaining high Coulombic efficiency of around 99% over 50 cycles. Even though it reported a higher irreversible capacity of 362.3 mAhg^{-1} at the 1st cycle, it showed a significantly lower irreversible capacity of 0.2 mAhg^{-1} for the 50th cycle. Electrochemical impedance spectroscopy and cyclic voltammetry analyses also provide improved electrochemical performance. Altogether this study reveals that Cu_2O synthesized by electrodeposition method processes very promising electrochemical performance for the anode application of LIB.

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