Electrochemical performance of CuO anode material for rechargeable lithium ion batteries synthesized by the hydrothermal method

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Abstract

CuO is currently used in various type of applications including gas sensors, solar energy conversion, photocatalysis, and lithium-ion batteries (LIBs). Among them, CuO has been found more attentions for LIBs due to its high theoretical capacity (674 $mAhg^{-1}$), good capacity retention, low cost, non-toxic nature, and ease of storage. The electrochemical performances of CuO mainly depend on crystallinity and morphology, which significantly depend on the synthesizing technique. The hydrothermal method, which is a promising process that improves the crystallinity with favorable morphology for electrode materials has not well been studied and hence this study aims for preparing CuO anode materials using the hydrothermal method. The coin cells were assembled in an argon-filled glove box with anodes fabricated with synthesized CuO, lithium as the reference electrode and counter electrodes, and non-aqueous electrolyte of 1M $LiPF_6$ in ethylene carbonate and dimethyl carbonate (1:1wt%). Galvanostatic charge-discharge testing performed on the cells showed a significantly high initial specific discharge capacity of 987.3 $mAhg^{-1}$ while maintaining high Coulombic efficiency of around 99% over 50 cycles. Even though higher irreversible capacity of 313.8 $mAhg^{-1}$ showed for the 1^{st} cycle, a lower irreversible capacity of 7.6 $mAhg^{-1}$ showed for the 50^{th} cycle. Electrochemical impedance spectroscopy and cyclic voltammetry analyses also provide improved electrochemical performance, indicating to synthesised CuO as a potential anode in LIBs. The current study reveals that CuO synthesised by hydrothermal method has promising electrochemical performance as an anode of LIB.

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