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The Influence of Argon Deposition Pressure on LiMn2O4 Thin Film Electrochemistry for Li-Ion Batteries

Advances in battery technology can lead to longer-lasting devices, cleaner energy storage, and more efficient transportation systems. LiMn2O4 is a suitable cathode material for high-capacity Li-ion batteries. Hence, it is crucial to comprehend the impact of sputtering deposition conditions on the quality and performance of LiMn2O4 to optimize battery efficiency. This research investigates the influence of argon deposition pressure on the stoichiometry characteristics and electrochemical performance of LiMn2O4. The physicochemical and electrochemical results reveal that varying argon deposition pressures, ranging from low (5 mTorr) to high (30 mTorr), result in the formation of distinct coating stoichiometries. An argon deposition pressure of 10 mTorr led to the formation of group I, which included stoichiometric LiMn2O4 cathode coatings with the highest discharge capacity (105 mAh/g). On the other hand, using small (5 mTorr) and high (20-30 mTorr) argon deposition pressures led to the formation of group II, which included non-stoichiometric LiMn2O4 with Lithium deficiency. This group showed an attenuated electrochemical behavior, reaching a discharge capacity of 70 mAh/g (5 mTorr). Medium argon deposition pressure (15 mTorr) led to the formation of non-stoichiometric LiMn2O4 with Manganese deficiency (group III). The absence of Manganese resulted in a severe reduction of electrochemical performance, due to high surface charge transfer (R2= 22,982 Ω), resulting in a low discharge capacity of 7 mAh/g.

Keywords

Lithium-ion battery, LiMn2O4 cathode materials, Sputtering deposition, storage energy.

Reference

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