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Study on the Effect of the Pre-treatment Temperature on $Li_{1.2}Mn_{0.54}Ni_{0.13}Co_{0.13}O_2$ Cathode Material

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Lithium-rich manganese-based cathode materials (LMO) have been considered the most promising candidate materials for next-generation lithium-ion batteries due to their high theoretical specific capacity (>300 mAh g^{-1}). However, the low initial Coulombic efficiency, significant capacity fading and poor rate capability have restricted their commercial application. In particular, the synthesis process of lithium-rich materials plays a decisive role in their structure and electrochemical performance. This paper mainly studies the effect of the pre-treatment temperature on the structure and performance of lithium-rich materials. The calcination temperature affects the performance of the lithium-rich material by changing the structure of the metal oxide (MO). Consequently, 600°C-LMO has better cycling stability and rate performance than 700℃-LMO and 500℃-LMO. 600℃-LMO delivers a high initial charge capacity of 252 mAh g^{-1} with a large initial Coulombic efficiency of 81.4% at 0.1 C. After cycling 50 times, large and stable discharge capacities of 229 mAh g^{-1} can be obtained. Both XRD and SAED characterize the presence of a spinel structure in 600℃-LMO, and the heterogeneous lithium-rich material shows excellent cycling stability and rate performance.

Keywords: Lithium-ion battery, Li-rich, cathode, pre-treatment temperature, spinel phase

FULL TEXT