Assessment of Thermo-electrochemical Performance on Cathode Materials for Lithium Ion Cells

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In this paper, we adopted electrochemical-calorimetric method to study the heat production of lithium ion batteries in which LiNi₀.₅Co₀.₂Mn₀.₃O₂ acted as cathode materials at a constant ambient temperature (313.15 K) during different charge-discharge processes. And the results of thermo-electrochemical properties on LiNi₀.₅Co₀.₂Mn₀.₃O₂ cathode materials have been compared to the results on LiFePO₄ and LiMn₂O₄ materials from our previous studies [1,2]. By comparing results of different electrode materials, we concluded that charge-discharge rate was one of the key factors affecting the lithium-ion batteries. With the increasing of rate, heat production and enthalpy change of different cathode materials increased and discharge capacity decreased. The greater the entropy value was, the greater the confusion degree and reversible worse were. At low rate (0.2 C) entropy value of LiFePO₄ was the largest, followed by LiMn₂O₄ and LiNi₀.₅Co₀.₂Mn₀.₃O₂. Cycle performance of LiFePO₄ was the worst, which was consistent with electrochemical performance analysis. These results provide a theoretical basis for optimizing design of the battery structure and reveal that the choosing of suitable charge-discharge rate is critical to the thermal management.

Keywords: assessment, lithium ion cell, thermo-electrochemistry, cathode material, electrochemical-calorimetry

FULL TEXT

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