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电池与储能

基于分层电化学热耦合模型的锂电池放电过程研究

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Research on Discharging Process of Lithium Battery Based on Layered Electrochemical Thermal Coupling Model

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History +

摘要

软包锂离子电池由许多电池单元叠压形成,其中电池单元的电和热行为对电池的整体安全性有很大的影响。为了研究电池单元与单体之间的关系,采用多孔电极理论建立了大容量软包锂离子电池的分层多维模型,并考虑了瞬态温度变化与电化学反应间的相互作用关系。利用该分层模型研究不同温度下电池放电过程中的电化学和热特性,得到更为真实的电池温度场分布。此外,介绍了表征电池单体内不同电池单元荷电状态分布的均匀指数。仿真表明,电池单体内的温度梯度差异加剧了不同电池单元间的过电位不一致和电流密度不一致程度,有利于进一步研究单体电池的衰退演化轨迹。

Abstract

A pouch-type lithium-ion battery is formed by stacking many cell units, in which the electrical and thermal behaviors of cell units have a great impact on the battery's overall safety. To study the relationship between cell units and the battery, a layered multi-dimensional model of a large-capacity pouch-type lithium battery was established by using the porous electrode theory, and the interaction between transient temperature changes and electrochemical reactions was considered. This layered model was used to study the electrochemical and thermal characteristics of the battery during discharging at different temperatures, and a more realistic battery temperature field distribution was obtained. In addition, the uniformity index that characterizes the distribution of the state of charge between different cell units was introduced. Simulation results show that the temperature gradient difference within the battery aggravates the inconsistency of overpotential and current density between different cell units, which is beneficial for further studying the battery's decay evolution trajectory.

关键词

软包锂离子电池 / 电化学热耦合模型 / 电池单元 / 电化学特性分析 / 热分析

Key words

pouch-type lithium-ion battery / electrochemical thermal coupling model / cell unit / analysis of electrochemical characteristics / thermal analysis

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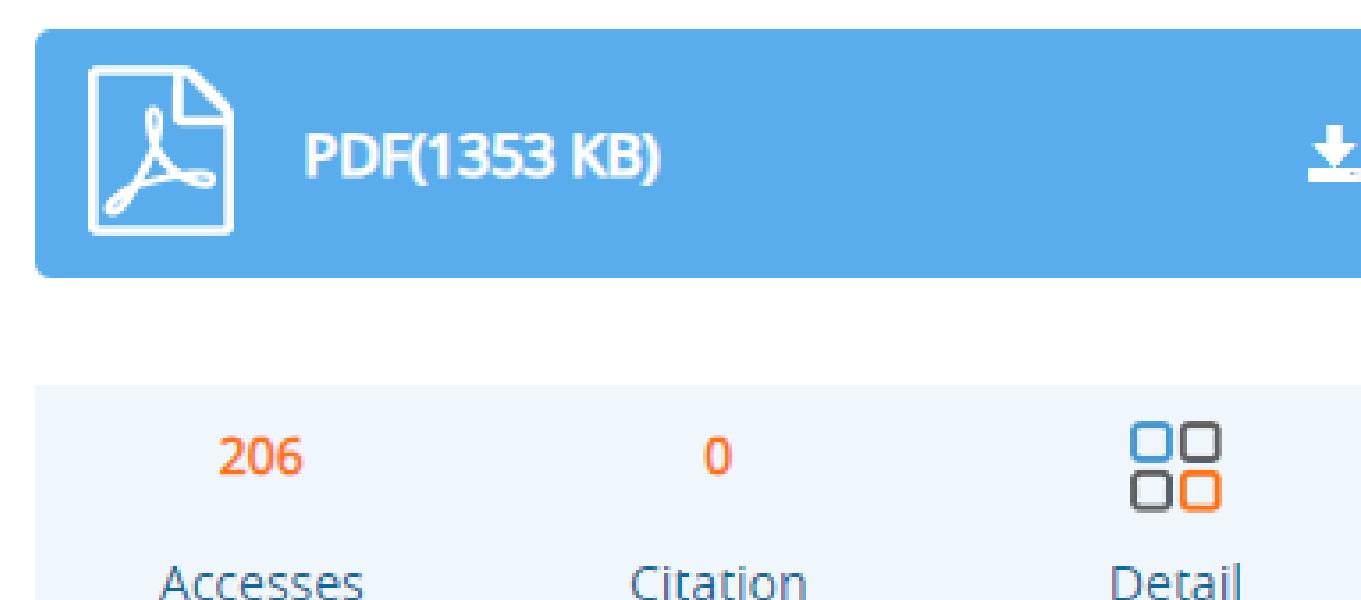
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