Effects of Environmental Temperature and Heat Dissipation Condition on Thermal Runaway of Lithium Ion Battery During Charge-Discharge Process

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Fire and explosion due to thermal runaway are the main hazardous characteristics of lithium ion battery. This paper focuses on the thermal behavior of lithium-ion battery during charge-discharge process under different environmental temperature and heat dissipation conditions. The effects of environmental temperature and heat dissipation conditions on thermal runaway of lithium-ion battery are investigated by experiments and theoretical analysis. Electric heating testing apparatus has been set up to make a series of experiments. Results show that the critical temperature of thermal runaway is between 40 °C and 60 °C under 7.8 A charging current. Meanwhile, the average heating rate of battery rises with the increase of environmental temperature when which is less than 40 °C. On the contrary, when the environmental temperature exceeds 80 °C, the average heating rate of battery declines with the increase of environmental temperature. The critical charging current of thermal runaway also declines with the increase of environmental temperature. Moreover, the average heating rate of battery decreases obviously when environmental temperature exceeds 20°C. During the charge-discharge process, the better heat dissipation condition can ensure the lower heating rate of battery. These results can provide an important basis for the safety design and storage of batteries to prevent fire and explosion accidents.

Keywords: Lithium ion battery, Thermal runaway, Environmental temperature, Heat dissipation condition, Charging-discharging