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Experimental analysis using thermocouple and infrared thermography of the temperature evolution of lithium-ion polymer cells at different charging rates

Abstract

An experiment was designed to investigate the temperature revolution of lithium-ion polymer (LiPo) cells using two different approaches, thermocouples and infrared thermography. The cells were charged under controlled conditions at rates of 2.0 A, 4.0 A, 6.0 A, 8.0 A, and 10.0 A. The analysis focused on the maximum surface temperature, temperature changes over time, and surface temperature distribution. The findings revealed that higher charging rates result in increased heat generation, causing greater temperature rises, steeper temperature gradients, and higher maximum temperatures. During the charging process, the study also observed endothermic behavior and uneven temperature distribution across the cells. However, upon completing the charging, the surface temperature became evenly distributed without any critical hotspots. Notably, maximum temperatures were observed in the lower regions of the cells for lower charging rates (2.0 A, 4.0 A, and 6.0 A) and in the upper regions for higher rates (8.0 A and 10.0 A). Additionally, infrared thermography provided a clearer and more precise method for measuring surface temperatures compared to thermocouples, as indicated by experimental uncertainty analysis. IR imaging also showed a faster temperature increase at higher charging rates, offering deeper insights into the thermal characteristics of LiPo cells.

Keywords

Cell-be; Cell/B.E; Cell/BE; Charging rate; Experimental analysis; High charging rates; Lithium-ion polymer cell; Maximum temperature; Surface temperatures; Temperature rise