Thermal runaway mechanisms of commercial LiFePO4/graphite batteries

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Safety issues of the lithium ion batteries have aroused extensive attentions because of the hazards reported, which are mainly contributed by thermal runaway1. The heat sources in the thermal runaway processes of commercial LiFePO4/graphite (LFP/G) batteries are probed through the adiabatic thermal runaway features tested by accelerating rate calorimetry (ARC) and the reaction characteristics of the component materials tested by differential scanning calorimetry (DSC). The peaks and valleys of the electrode materials and separator reactions measured by DSC can match the fluctuations in the temperature rise rate and the drop of the voltage measured by ARC, separately. Therefore, the correlation between the heat flow curves and the temperature rate, voltage curves is utilized to probe the heat sources during the thermal runaway process and reveal the thermal runaway mechanisms. The results and analysis indicate that the reactions of cathode and anode materials generate the major heat during the thermal runaway process in LFP/G batteries, not internal short circuit. The thermal runaway mechanisms composed of various materials can also be revealed by the method.

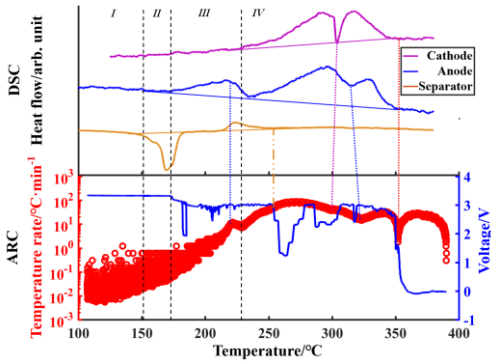

Fig.1 The heat flow, temperature rate and V-T curves

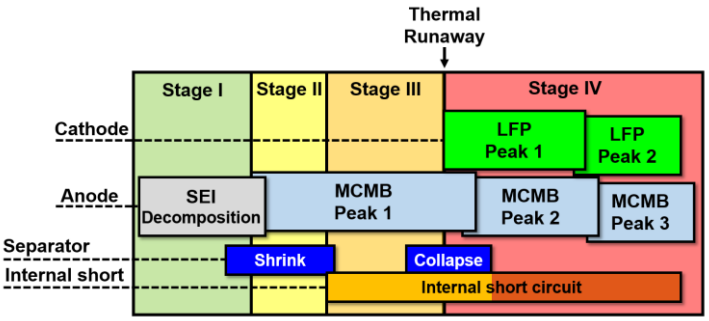

Fig. 2 Thermal runaway time sequence

References:
[1] Y. Zheng, L. Lu, X. Han, et al., J. Power Sources 226 (2013) 33-41.