Battery overcharge method

What is a battery overcharge?
Overcharge is the normal continued application of charging current to a battery after the battery has reached its maximum state of charge. It impacts the steady-state values of pressure, temperature, and voltage.

How to improve overcharge performance of lithium-ion batteries?
Rupture of the pouch and separator melting are the two key factors for the initiation of TR during overcharge process. Therefore,proper pressure relief design and thermal stable separatorshould be developed to improve the overcharge performance of lithium-ion batteries.

How to protect a battery from overcharge?
The factors of battery material,charging pattern,and battery structure design on the overcharge effect are also summarized. To some extent,using external protection devices(such as BMS,OSD,CID) can improve overcharging security. But the internal protection of overcharge additives is more effective.

Does charging current affect battery overcharge performance?
The effects of charging current,restraining plate and heat dissipation condition on the overcharge performance of a 40 Ah lithium-ion battery are evaluated. The batteries overcharge behaviors show only minor changes with the increase of charging current,as the TTR remains at around 113°C and the SOC TR decreases slightly.

How is a single lithium ion battery overcharged?
In the standards or regulations,the overcharge performance of single lithium-ion battery is evaluated through several overcharge tests,during which a controlled current is applied to the tested battery (e.g. 1/3 C) up to a set of charge limits(e.g. 2.0 SOC,1.5 times the upper cut-off voltage).

How did EV-arc overcharge a battery?
During the overcharge tests, the batteries were placed inside the EV-ARC or the iron box, and electric wires and thermocouples were connected to the battery cycler and temperature logger by Pico Technology, respectively, through some holes made on side of the EV-ARC or the iron box.

After overcharge, the battery underwent obvious deformation, which significantly increased the squeezing force on batteries within a battery pack. 3.3.2. Shock Pressure . The gas generated by the battery TR causes shock-pressure harm in the form of a shock wave. In addition, LIBs are mostly arranged in enclosed or semi-enclosed spaces; their injection rapidly ...

This paper provides an early detection method for overcharge faults based on battery expansion characteristics. Firstly, the overcharge triggering and performance characterization tests are ...

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A 3D electrochemical-thermal coupled model is developed for modeling thermal and electrochemical characteristics from normal charge to early overcharge state. This model is validated by experiment at charge rates of 0.5C, 1C, and 2C. The simulation results indicate that irreversible heat contributes most to temperature rise during the normal ...

The overcharge-induced TR process of lithium-ion batteries is an electrochemical-thermal coupled process accompanied with ohmic heat generation, gas generation and a series of exothermic reactions [18].At first, a significant amount of ohmic heat will be generated during overcharge process, following the Joule"s first law (Q ohm = I 2 ·R ...

The research determined warning threshold ranges and risk levels by monitoring voltage, temperature, and gas indicators during lithium-ion battery overcharge TR ...

Battery overcharge experiment results show that this method can diagnose internal pressure abnormalities within 260 s after overcharging and alarm. At this time, the battery has slight bulging, and the SOC is 102.1%. By conducting charging experiments under different conditions, the low false alarm rate of this method is only 0.575%. The ...

The battery was initially prepared to be 100% SOC by constant current and constant voltage (CC-CV) charging. After two hours, the LiFePO 4 cell was placed in the explosion-proof chamber and overcharged in constant current. The overcharge test was ended when the voltage of the cell dropt to 0 V due to the serious internal short circuit [29]. To ...

The influences of charging current, restraining plate and heat dissipation on battery overcharge behaviors are evaluated through a series of well-designed overcharge ...

The research determined warning threshold ranges and risk levels by monitoring voltage, temperature, and gas indicators during lithium-ion battery overcharge TR experiments. Subsequently, a multi-parameter fusion approach combining cloud model and DS evidence theory was utilized to confirm the risk status of the battery at any given moment ...

To ensure the safety of battery use, this paper introduces the Gramian Angular Summation Fields (GASF) theory into the diagnosis of overcharge-induced TR of lithium-ion energy storage batteries. With the advantages of deep Residual Network (ResNet) to fully explore data features, we propose a method for very early diagnosis of overcharge ...

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Lyu et al. [37] obtained dynamic impedance at the beginning of overcharging with 70 Hz impedance as an

example cutting off the charging process at the slope turning point, thermal runaway was avoided with a 580 s warning. Srinivasan et al. [38] found that the internal temperature of a battery is strongly correlated with the impedance spectrum of SEI film of the ...

They found that the expansion force of the battery showed abnormal changes earlier than the temperature signals, and proposed an overcharge early warning method based on the expansion force. Wang et al. [31] conducted a study on lithium cobalt oxide batteries, focusing on the characteristics and changes during the TR process.

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This article proposes a battery overcharge internal pressure abnormality diagnosis method based on the detection of safety vent strain. First, this method establishes a ...

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