Thermal runaway behavior of commercial 18650 Li-Ion batteries

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Li-Ion batteries with high energy-density are playing an important role in everyday's life. The aim of this work is to give a better understanding of possible risks that are emanating from those devices.
The possibly most important abusive reaction that a Li-Ion battery can undergo is the so-called thermal-runaway. For commercially available Li-Ion cells, the thermal-runaway reactions can be initiated by heating the cell far beyond the temperature rating that is specified by the manufacturer [1–5].

Data from thermal-runaway experiments covering the temperature evolution and gas production during the abuse tests, as well as analysis of the main gas components will be reported in the present work.

The thermal-runaway experiments were performed using a custom build test rig. The Li-Ion cells were placed inside a pressure-tight heat-able reactor. The heater temperature was increased slowly, starting at room temperature and continuing up to ~300°C. At elevated temperatures several events can occur. These events may include cell venting, cool down by the Joule-Thomson effect, slow thermal-runaway or rapid thermal-runaway.

The presence and magnitude of those effects depend on the cell chemistry and state-of-charge of the cell. Experiments were performed with different types of commercially available consumer Li-Ion cells, of the standardized 18650 format. Tested Li-Ion batteries include those with iron-phosphate and metal-oxide based cathodes.

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