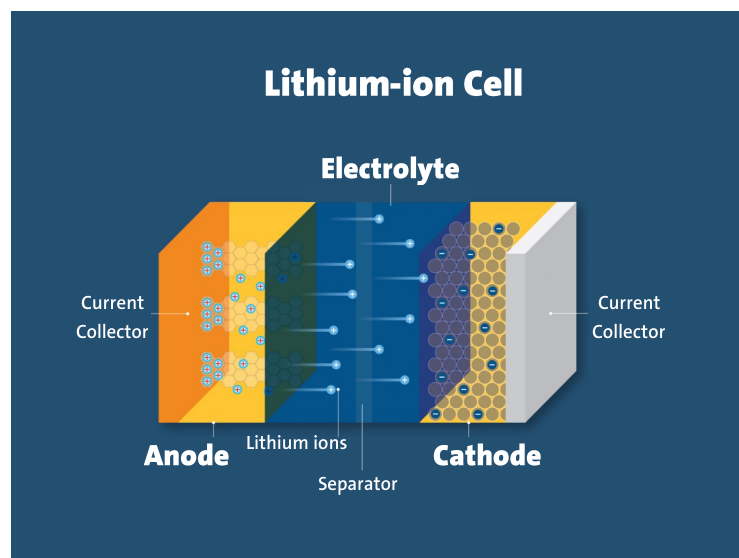


Faults, internal or external to a lithium-ion cell, can cause a thermal runaway: a phenomenon in which the lithium-ion cell enters an uncontrollable, self-heating state.

One example of such internal failure is an internal short circuit. In a lithium-ion cell, the cathode and anode electrodes are physically separated by a component called the separator.

Defects in the cell that compromise the separator's integrity can cause an internal short circuit condition that can result in thermal runaway. This is especially likely in cells of poor quality.

External, off-nominal conditions can also cause thermal runaway.



What causes thermal runaway?

Examples of off-nominal conditions include:

- **Overcharge:** Can be due to incompatibility between cell and charger, or poorly designed battery management system (BMS)
- **Multiple overdischarges followed by charge:** Discharging the cell or battery below the cell manufacturer-recommended lower voltage threshold multiple times, then charging the cell
- **External short circuit**
- **High- and low-temperature environments**

Batteries are manufactured with controls intended to protect against off-nominal conditions. However, these conditions can lead to thermal runaway if the proper controls are not incorporated.