

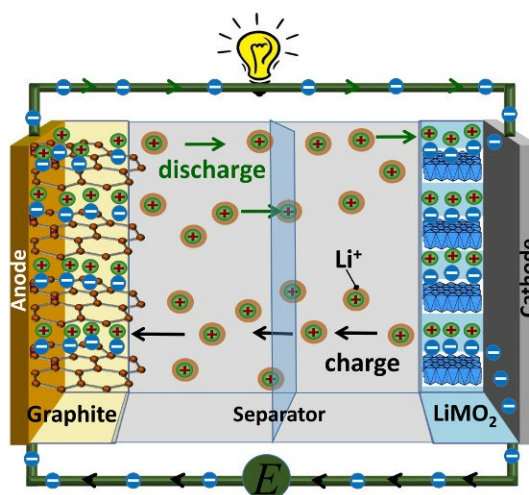
Safety guidance for Lithium ion battery use

Lithium-ion batteries are a vital part of our modern society. These batteries form the backbone of most modern technologies that require battery support, from everyday household electronics such as laptops, mobile phones, and tablets, to large-scale energy storage systems and electric vehicles (EVs).

With their growing prominence, lithium-ion batteries also carry a fire safety risk that needs to be considered. It is worth noting that the frequency of fire from lithium-ion batteries is actually very low, **but** the consequences can be significant. This advice and guidance protocol details how lithium batteries work, their fire safety risks, why they can catch fire, and methods to minimize the risk.

How do lithium-ion batteries work?

The US Department of Energy states that a lithium-ion battery is made up of an anode, cathode, separator, electrolyte, and two current collectors (positive and negative). The electrolyte carries positively charged lithium ions from the anode to the cathode and vice versa through the separator. The movement of the lithium ions creates free electrons in the anode which creates a charge at the positive current collector. The electrical current then flows from the current collector through a device being powered (cell phone, computer, etc.) to the negative current collector (see figure below).



Why do lithium-ion batteries may catch fire and/or explode?

Lithium-ion battery cells combine a flammable electrolyte with significant stored energy, and if a lithium-ion battery cell creates more heat than it can effectively disperse, it can lead to a rapid uncontrolled release of heat energy, known as **‘thermal runaway’**, that can result in a **fire or explosion**.

Thermal runaway can result in the ejection of a range of flammable and toxic gases from battery casings. The flammable gases generated often ignite immediately, but may also

spread out unignited, until an external ignition source is encountered, resulting in an explosion.

Therefore, please follow the guidelines for charging Lithium-based Batteries:

- **Turn off** the device. This allows the battery to reach the set voltage threshold and current saturation point unhindered.
- **Charge at a moderate temperature (0°C – 35°C).**
- Lithium-ion does **not need to be fully charged**; a partial charge is safer.
- Not all chargers apply a full topping charge and the battery may not be fully charged when the “ready” signal appears; a 100 percent charge on a fuel gauge may confuse.
- **Discontinue** using charger and/or battery if the battery gets excessively warm.
- **Electric Bicycle and electric scooter** use a relatively **large Lithium battery**. Due to the risks of fire and/or explosion, according to the Weizmann Institute’s regulation, it is forbidden to recharge those devices at home or inside a WIS buildings including student dormitories or WIS apartments. **For your safety** use only designated and authorized charging points spread across the institute (see picture below for example).

