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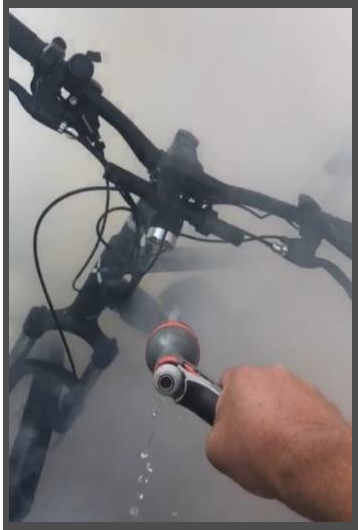
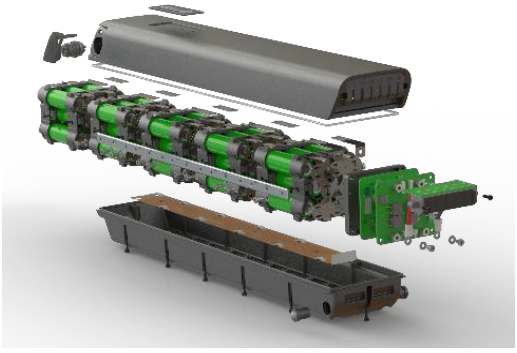
The danger of bicycle batteries
E-bikes are becoming more and more popular by young and old people. Although the electric bicycles offer a more comfortable ride, spontaneous fire of bicycle batteries causes more and more problems.

For example, the Netherlands fire department needs to take action twice a week for a battery fire on average. This will only increase due to the increasing popularity of electric bicycles. A bicycle battery consists several battery cells, these are usually lithium-ion cells. Lithium-ion cells are known for their high energy density and long lifespan, nevertheless they are sensitive to deep discharge and overcharging.

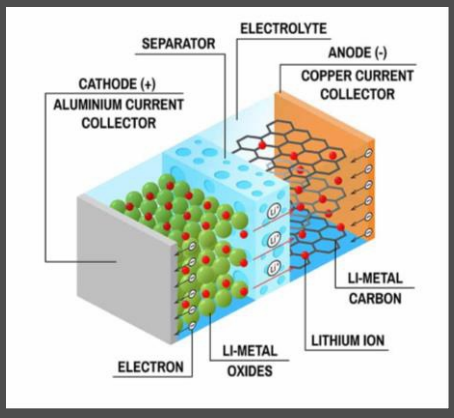
Although a bicycle battery is equipped with a battery management system, which must prevent discharging and overcharging too far, this system can become defective due to vibrations or mechanic impact. This can result in dangerous situations.

The battery cells in a bicycle battery are also sensitive to high temperatures, when the battery is exposed to high temperatures the separator in the cell can melt. The separator is a membrane that separates the cathode (+) and anode (-) in the cell. A melting separator will lead to an internal short circuit.





Composition bicycle battery



Cross section Lithium-battery-cell

lominck mobility

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The battery cells in a bicycle battery consist of chemicals that contain lithium. These chemicals are unstable and decompose easily. The chemicals can start to decompose in various ways:

- Too high charging current
- Too large discharge rate
- Mechanical damage
- Environmental heat
- Manufacturing defect
- Aging

E-bike fire

A bicycle battery fire is unpredictable. If, for example, a battery is damaged or contains a manufacturing defect, this is not visible on the outside. When a decomposition reaction of the chemicals in the battery starts, is not predictable.

During the decomposition of these chemicals, many dangerous gases are released (including hydrogen fluoride, lithium hydroxide, hydrochloric acid) which are harmful to humans and the environment. lithium-ion fire is not a metal fire, but a chemical decomposition reaction, during this reaction a lot of energy is released. This creates a lot of heat, the decomposition reaction spreads further into the cell and can also cause the decomposition reaction in surrounded cells. This is also called a "thermal runaway". During a thermal runaway, the pressure and temperature in the cell will increase, causing the cell to burst open and shoot burning parts away. This allows a fire to spread quickly. A battery usually contains more than 40 cells, which together contain so much energy that they are almost impossible to extinguish. It may even take several days for the decomposition reaction to stop. The decomposition reaction can also resume later. Example: a lithium-ion battery started smoking again and developing heat 3 weeks after it had been on fire.

Damage after fire

Due to the many problems with bicycle batteries and the increasing fire damage that these batteries cause, new guidelines are under development with regard to safe and protected storage and charging of bicycle batteries.

The expectation is insurance companies will soon set additional requirements with regard to safe storage and safe charging of bicycle batteries. It seems highly likely that open and exposed charging of bicycle batteries through wall sockets or integrated charging points in bicycle racks will be prohibited.

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Safe storage and charging of bicycle batteries
Because of the fire hazard of bicycle batteries, stricter regulations from both the government and insurance companies and taking into account the described process steps, Kinetic Parking Solutions has partnererd with Lo Minck from the Netherlands who have developed two product concepts; the Battery Charging Locker and VeloVolt.

First of all, a battery fire must be detected at the earliest stage possible. Since a battery fire usually starts with smoke development, smoke detection appears to be the most effective detection method. As soon as a (starting) fire has been detected, the surrounded area must be alerted as quickly and effectively as possible, so action can be taken timely.

Process steps battery fire
To successfully manage a battery fire, Lo Minck Systemen distinguishes a number of process steps:
- Detection
- Alerting
- Suppression
- Isolation
- Removal

Battery Charging Locker

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At the same time, a starting fire must be suppressed as effectively as possible, so a rapid spread of fire and the associated smoke are prevented.
Insulation of the fire, for example by compartmentalization, prevents a rapid spread of the fire.
Ultimately, the object must be removed from the room as quickly as possible.

VeloVolt

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