Taking a Closer Look: Extreme Case of Battery Fire

HV Temperature Measurement

Fully or partially electric cars are a promising alternative for sustainable mobility – however, the safe operation of high-voltage batteries plays a crucial role. Thermal propagation tests, i.e. the uncontrolled chain reaction of overheating that jumps from one cell to the next and can ultimately cause the battery to catch fire, are standard according to international norms. Together with measurement technology from CSM, Green Testing Lab from Austria therefore offers temperature tests on batteries during such an extreme event to develop optimization measures at an early stage and minimize potential risks.

(Image: Green Testing Lab GmbH)

Necessary security checks

High Voltage (HV) batteries in vehicles store large amounts of energy to power the electric motor. However, this is precisely where there is an enormous risk potential. If this energy is misdirected – for example, due to an extreme physical impact from the outside – an uncontrolled chain reaction and overheating of the cells can occur, which can destroy the battery. Since the aim is to ensure the longest possible time span for exiting the vehicle in the worst-case scenario, various standards – such as SAE J2464, SAE J2929, ISO 12405, UL 2580, KMVSS and many more – prescribe battery tests.

In the process, a “thermal propagation” is triggered on purpose and the exact course is examined using measurement technology. The central focus is on the temperatures over a certain period of time until the batteries catch fire or explode.

Special test environment required

Fig. 1: The test specimens are prepared for the measurements in a special test environment. (Image: Green Testing Lab GmbH)

Not only are extreme temperatures dangerous during testing, but the chemical components of battery cells also cause harmful gases to be emitted when they are destroyed by heat.

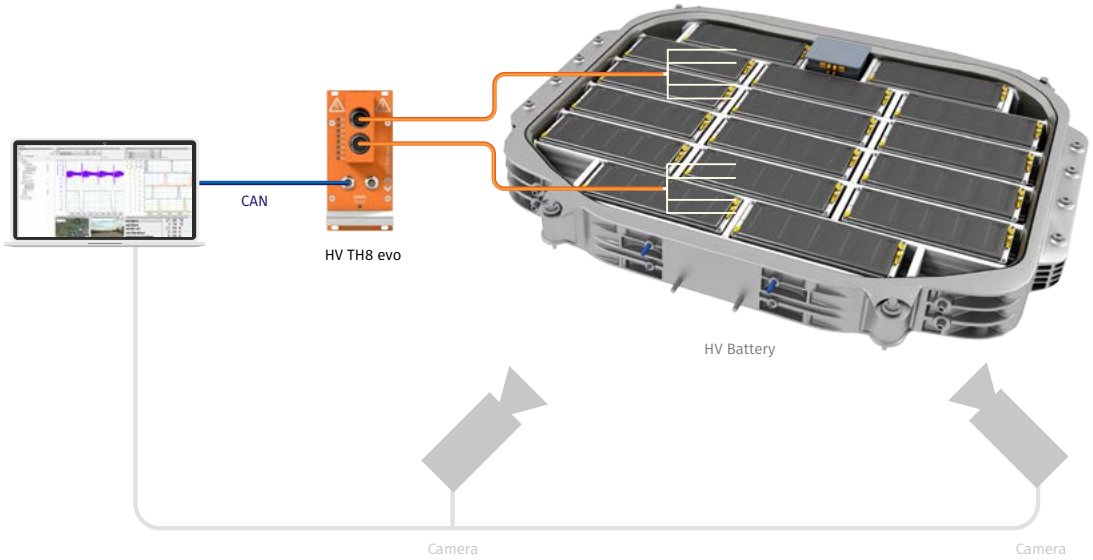
A special test procedure and a secure environment are therefore essential when conducting thermal propagation tests. Service providers such as Green Testing Lab GmbH offer expertise and specialized laboratories for this purpose.

»The thermal propagation test is a core competence of our company. The risk of thermal propagation is a critical safety factor in the development, manufacture and use of batteries.«

Max Hofer, Managing Director Green Testing Lab GmbH

Measure temperatures over time

In a test chamber specially designed for high temperatures and harmful gases, the battery packs or modules are instrumented with **Type K thermocouples** and **HV TH8 evo** temperature measurement modules from CSM. Additional infrared and high-speed cameras are set up around the test environment to record the test procedure.



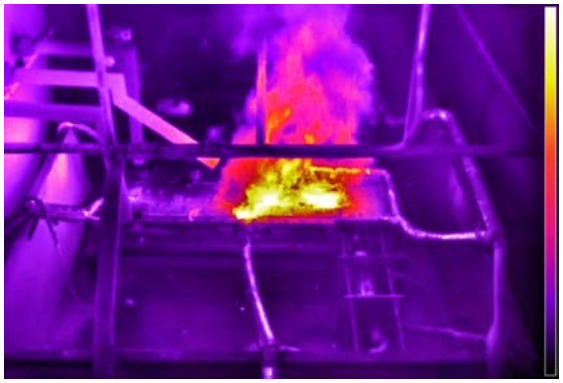


Fig. 2: Infrared cameras are used to document the temperature increase in the test object. (Image: Green Testing Lab GmbH)

»In addition to the excellent technical features of CSM's measurement technology, another factor was particularly important to us: customer service. The fast and reliable support provided by CSM's employees convinced us.«

Max Hofer, Managing Director Green Testing Lab GmbH

Then, a malfunction is provoked in one of the cells using a nail, a heating plate or by intentional overloading. After that, the heat distribution over individual cells or areas of the battery along with how much time passes is examined in detail. With the Type K thermocouples, the temperature curves can be traced over the duration of the test. At the same time, they offer a wide temperature range (up to over 1,300 °C) and are easy to use.

The HV TH8 evo measurement modules ensure the HV safety of the measurement chain and the user. The modules collect data from the sensors and forward them via CAN for analysis. If the measurement results do not meet the requirements of the underlying standard, the design must be improved and then tested again.

Safe measurement – precise results

In the proper test environment and with the appropriate measurement technology solution, standard- and safety-related tests on HV batteries can be successfully performed. The measured data allows conclusions to be drawn about adequate design and safety precautions in an emergency, which must be addressed before the vehicle is approved. The combined expertise of Green Testing Lab and CSM enables accurate temperature measurement and testing for safer operation of HV batteries.

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