FOGTEC®
FIRE PROTECTION

*The Smarter Way of Fire Fighting*

EN

– Fire protection for New Energy Carriers –

# Fire protection for New Energy Carriers

## *Background*

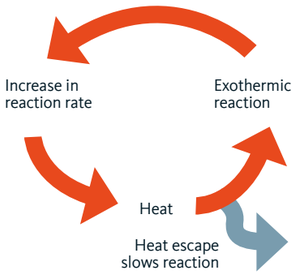
The basic functional principle of the energy carrier of the future was researched in the 1970s at the Technical University of Munich. In this time, the practical applicability was not yet recognized. Thus, the first commercial lithium-ion batteries were only launched in the early 1990s. In the following years, the technical development progressed quite well and the technology became more compact and also more efficient.

## *Where are we now?*

Today's applications are variegated and the number of applications is constantly growing, from telecommunication, digital cameras, tablets, laptops to power tools until electro mobility like engine supported bicycles , electric- and hybrid vehicles of many kinds. There seem to be an unlimited scope of application for all energy based things.

## *Why is a fire of a lithium-ion battery so special?*

Of course, the use of this technique also involves risks that have not yet been fully explored and reviewed. The highest risk is certainly the so-called thermal runaway. Thermal runaway describes a process which is driven and speeded-up by increased temperature, in turn releasing energy that further increases temperature. It can be triggered very quickly by mechanical damage, overcharging, deep discharge or an internal short circuit. The thermal runaway is a reaction that becomes out of control at a certain point of time, with the consequence that it spreads to the entire battery and further increases. Thereby the entire stored energy is released. The extent of damage is depending on the charge level of the battery. The chemical reaction is a so-called redox reaction. An extinguishment is extremely difficult, almost impossible, because oxygen is released during decomposition. Particularly re-ignition may occur up to 24 hours after damaging. Considering the fire triangle, the only point to fight this process is on the energy side, as oxygen and material are available and cannot be limited. But if it is possible to bind the energy/heat, it would have a substantial effect on the acceleration of the process as heat is the major catalyst.




## *Consequences in daily use*

Various incidents involving lithium-ion accumulators have been known in the past. Consistently batteries tend to ignite, as in smartphones or laptops, one of the most well-known example is the batteries installed in the Samsung Note7. The frequency of incidents led that the production of this smartphone was stopped. Also the aircraft industry is facing problems. After a sequence of serious incidents, the clearance for take-off for the BOEING Dreamliner was revoked by various aviation authorities. After a bad accident in front of the Pianner Tunnel in Austria, a TESLA vehicle burnt down completely. The fire brigade was forced to cut the power supply of the batteries and to control the fire with massive use of water. Even complete houses burned down, caused by a charging default of a bicycle battery.

## *Lack of scientific knowledge*

Particularly in the case of fires, there is not much scientific knowledge about the behavior of lithium-ion batteries. This leads to uncertainty among manufacturers, users and logically also with the fire brigades, which have to fight with this problem. With the strong global growth of e-mobility, this is increasingly becoming an equally fast growing problem. In addition to this increasing problem, the use of other alternative fuels also entails risks such as explosion of pressurized gas tanks or the spread of highly flammable gases, which as a whole will change the way communities and buildings perceive risks. The most obvious risks are possible damages in underground traffic systems, underground garages, multi-storey car parks, etc. as well as research facilities in the automotive industry.

## *Perspective*

In cooperation with FOGTEC, the research project SUVEREN (safety in underground urban traffic areas using new energy sources), funded by the Federal Ministry of Education and Research, started in August 2017. Together with the Federal Institute for Materials Research and Testing BAM, and STUVA, FOGTEC develops scenarios and guidelines as well as a training program for planners, operators and owners of underground traffic facilities. Associated partners of the project are the DB Station & Service AG (Berlin), the Munich Minicipal Fire Department, as well as the CETU Center d'Etudes des Tunnel (France) and INERIS (France). It examines potential new risks and the conditions to be met by using new energy sources in different value added chains of vehicles, especially taking into account the special requirements in underground infrastructure, with the result that recommendations for actions in form of a guideline is developed and published.

Special attention must be paid to the detection. Early detection outside the battery proves to be difficult, as these are usually installed incapsulated. As it might be very difficult to detect the reaction of gas production which is usually the first sign of a malfunction of battery, again the heat development due to the release of energy is a criterion which can be reliably detected in infrastructures like parking garage, test benches, warehouse, etc. The thermal runaway will lead to a warming of the entire battery, which can possibility be detected, if there are no cross sensitivities to other heat sources.

Previous tests have shown that water is still the first choice of firefighting due to its outstanding ability of heat absorbtion. If an initial fire can be fought with effective cooling within the first few minutes, there is a very high probability of controlling the fire. High-pressure water mist systems work with pure water, which is atomized at a pressure of 60 to 200 bar, using smallest droplets. The reaction surface of the water is thereby increased by more than a hundredfold, compared to conventional systems. Through this huge reaction surface the rate of fast energy abortion capability is extremely high which results in a very strong cooling effect, which is already proven in many different applications. The small droplets evaporate very fast, directly at the source of the fire. The vaporized water will limit the oxygen supply from the surroundings and decrease the oxygen level at the fire source substantially. As decreasing the energy supply buy the best possible cooling effect is the major target in fighting the thermal runaway, high-pressure water mist systems as fire-fighting systems are an optimal way to cool the battery, significantly slowing down the reaction and protecting the environment, especially the existing infrastructure.

# Benefits of FOGTEC Systems

- *Environmentally friendly*
- *Safe for people*
- *High cooling effect*
- *Reduction of radiated heat*
- *Low water consumption*
- *Minimal water damage*
- *No pre-warning time required*
- *Straightforward space-saving installation*
- *Minimal space requirements for system components*
- *Activation via glass bulbs or a fire detection system*
- *Alternative to gas extinguishing systems and sprinklers*

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Local Contact:

Cologne • Germany

NFPA IWMA International Water Mist Association VdS FM APPROVED TÜV SÜD