
BURNING ISSUES
SURROUNDING LITHIUM ION
BATTERY FIRES

FIRECHIEF®
making the world a safer place

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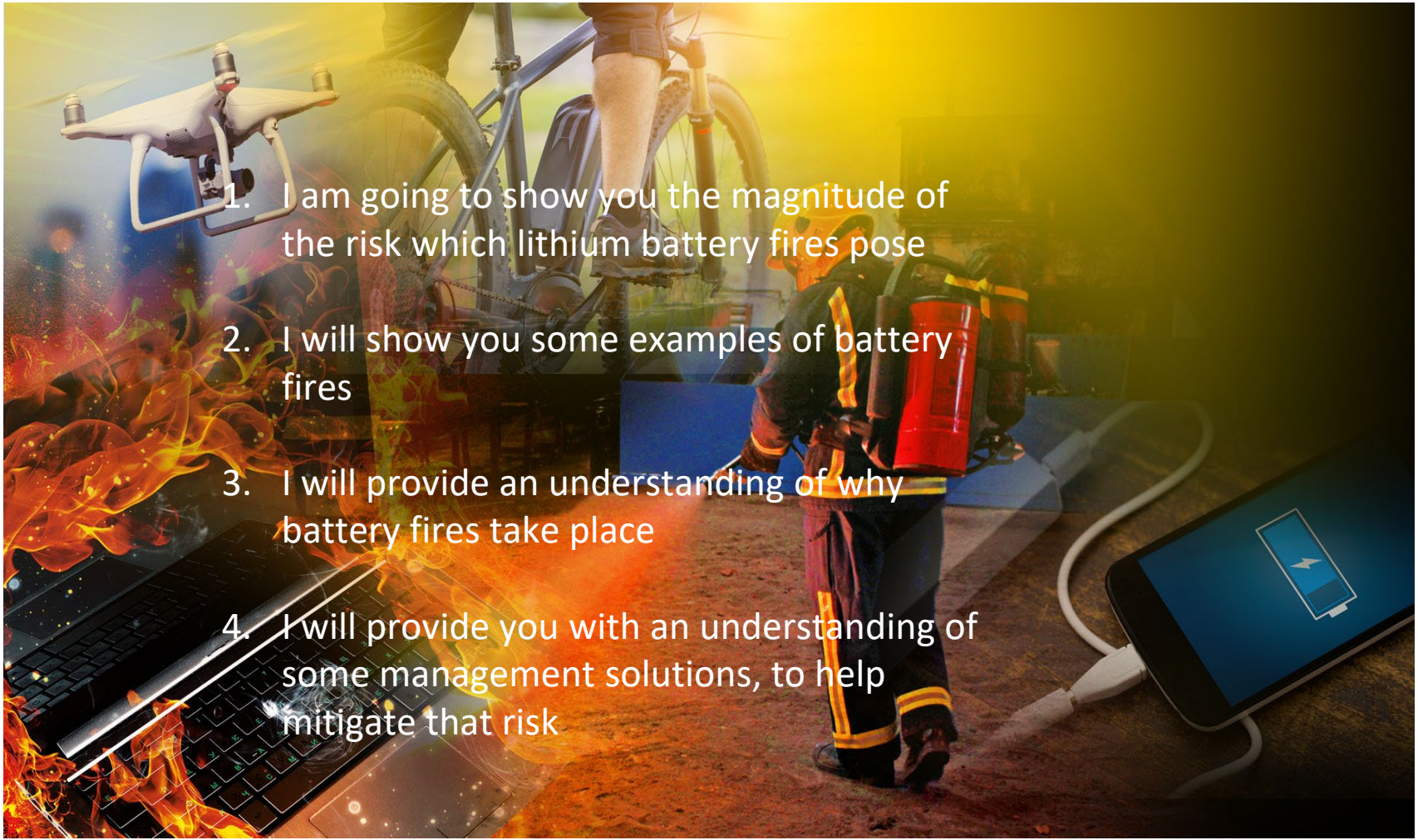
ABOUT US – Fire Depot

- Part of Sentura Group Ltd, a 3rd generation family business
- Long-standing supplier in the fire safety industry providing top quality UK approved fire equipment
- Stock of over 2000 product lines
- Established network of 2,500 distributors and installers

OUR OBJECTIVES TODAY




MOBIRA
TALKMAN

WHAT IS A LITHIUM-ION BATTERY?

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As the name suggests, Lithium-Ion batteries use lithium ions to generate power required by our devices.

You can have **a Lithium battery single, double cell**, once the cell has released all the energy the battery has finished its life.

Lithium Ion batteries have a number of cells from two to thousands and can be re-charged many times.

Most common cells come in three types within a battery - cylindrical, prismatic, and pouch cell

These batteries will be in devices such as mobile phones, laptops, power tools and vehicles - EVs

WHAT IS A LITHIUM-ION BATTERY?

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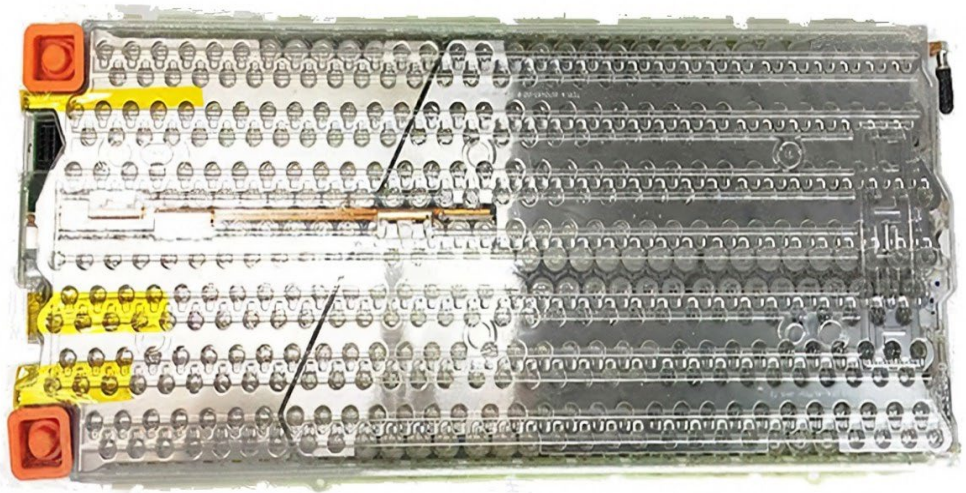
Many cells in a battery will make a module

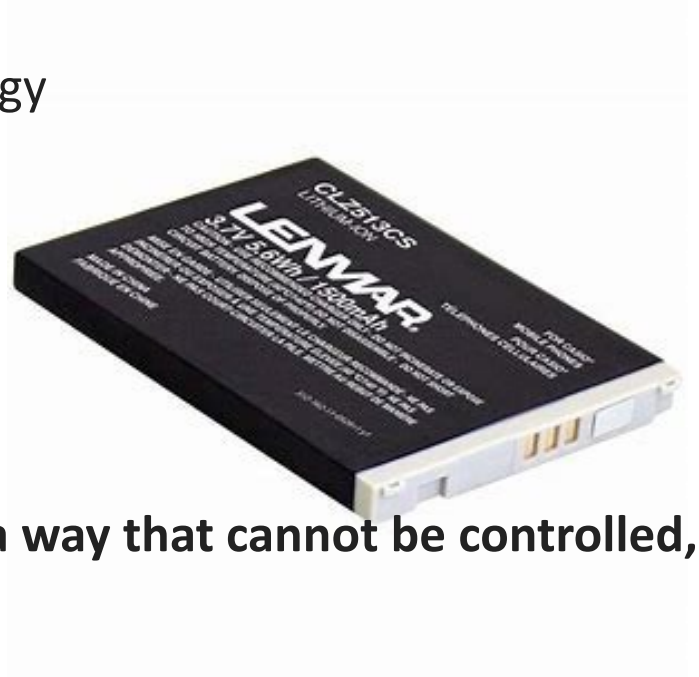
And many modules will make a battery dependent on size, so from 10 plus cells in small Lithium-Ion batteries to over 7000 cells that are placed within an EV such as a Tesla, with 15-24 modules in place



CHARACTERISTICS OF LITHIUM-ION BATTERIES

- ✓ Capable of storing large amount of energy
- ✓ Small
- ✓ Lightweight

= **VOLATILE UNDER STRESS**



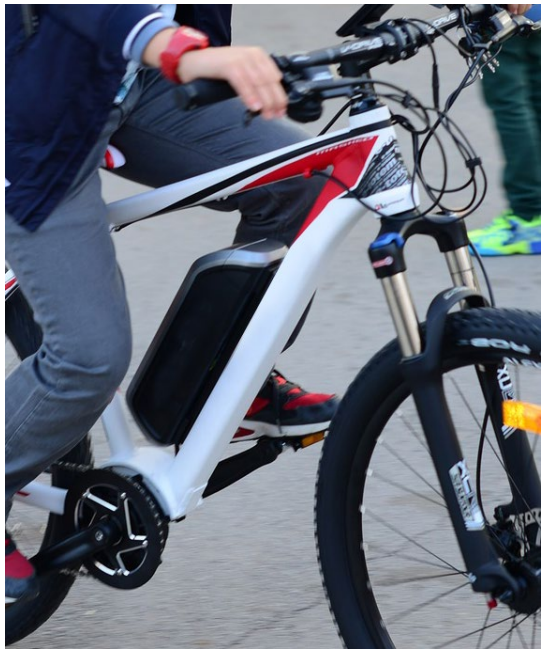
If the energy comes out of the battery in a way that cannot be controlled, it results in fire, and explosion.

LITHIUM ION BATTERY APPLICATIONS

Phones & Laptops

Drones

E-bikes

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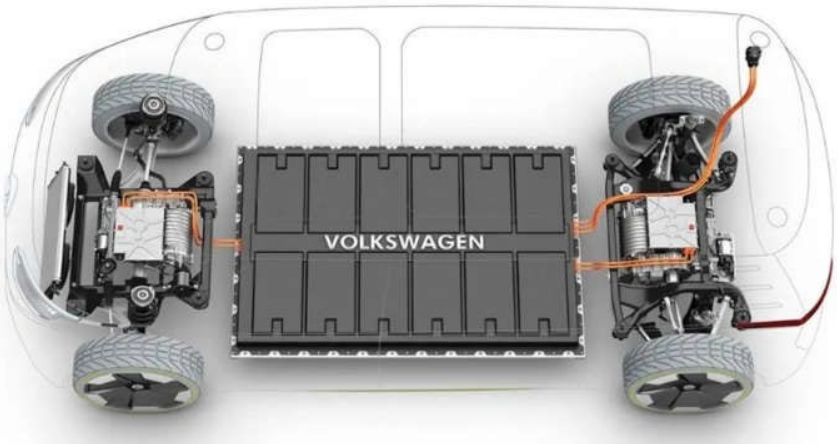

VOLKSWAGEN

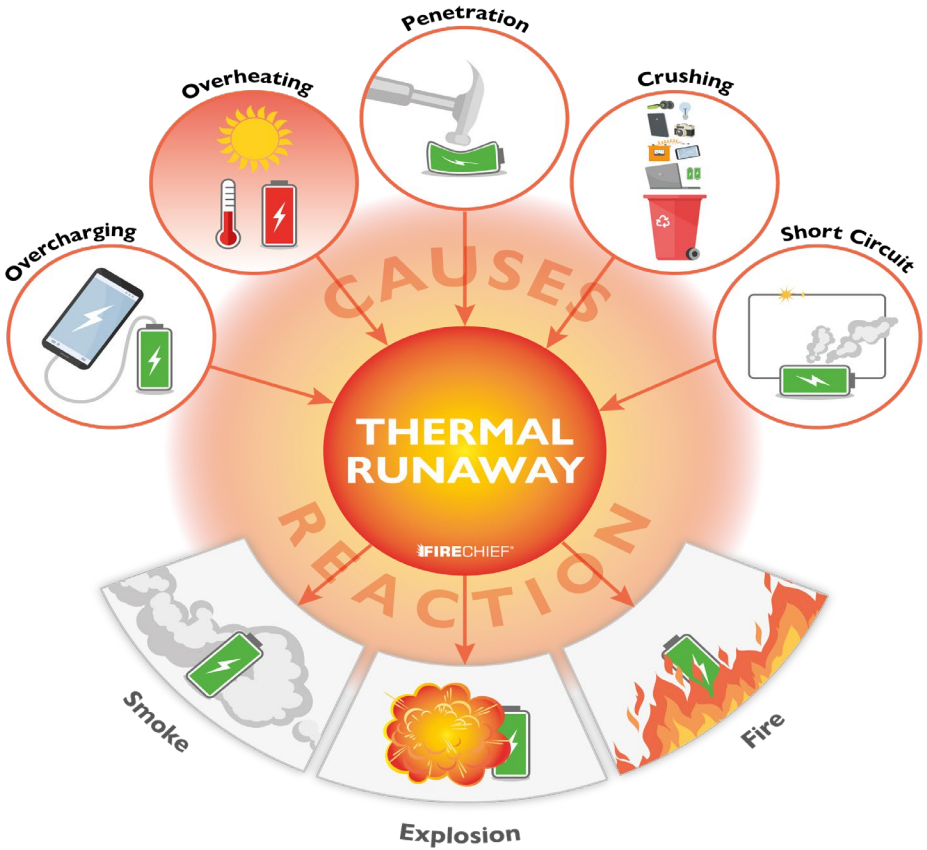
LITHIUM ION BATTERY APPLICATIONS

Energy storage modules

LITHIUM BATTERY FIRES – A GROWING PROBLEM, BUT WHY?

- From a slow start to a massive increase in awareness of the risks posed by Lithium battery fires over last 3 years
- Now recognised as a serious Health & Safety issue by many - including Health & Safety managers
- Latest high profile example of LI Battery fire risk management is TFL who have banned all e-scooters and bikes from the network.
- And you will see why on the videos in a few moments

LITHIUM BATTERY FIRES – A GROWING PROBLEM BUT WHY?



THERMAL RUNAWAY – WHAT IS IT?

Thermal runaway is the chemical process within the battery and ions, which produces heat and chemical gases very quickly, this becomes a self propelling loop the more heat the more gases are produced before any flame appears, the gases are-

- **Carbon Monoxide**
- **Carbon dioxide**
- **Hydrogen 30-50% Hydrogen fluoride**
- **Hydrogen chloride**
- **Sulphur dioxide - Hydrogen cyanide**
- **Hydrocarbons droplets such as ethane, methane.**

These gases are not something you would want to be exposed to. They are vented from the cells as a vapour cloud. No matter how big the battery the above will be vented in one form of ratio to size of battery.

THERMAL RUNAWAY

Once the battery has passed thermal runaway it will explode, with flames visible

A battery will burn very, very hot- up to 700c – 1000c. This process is also very quick, far quicker than any other fires.

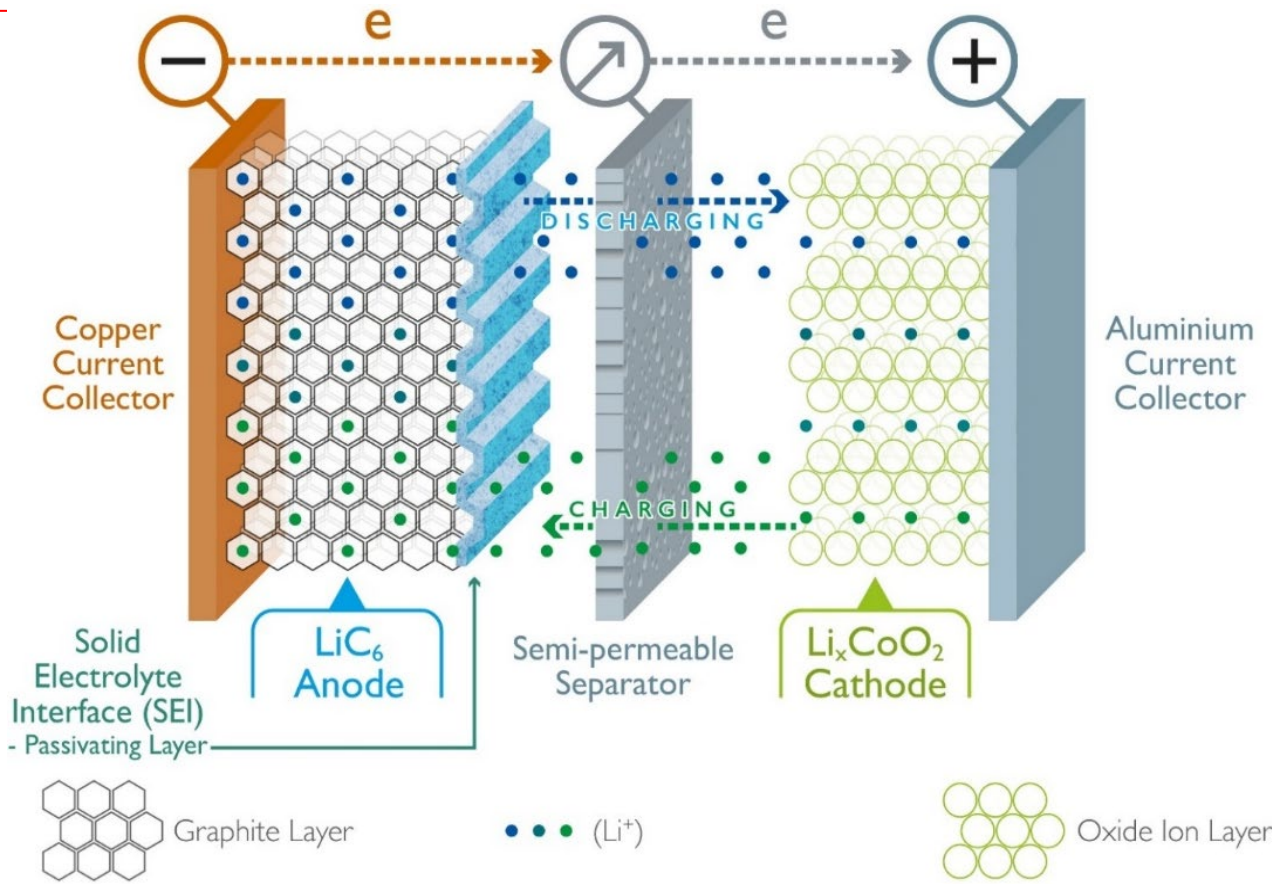
Bigger batteries such as EVs can reignite hours or days after the event, even once its been cooled

LITHIUM BATTERY COMPONENTS

While the battery is discharging (being used) the anode releases lithium ions to the cathode generarting a flow of electrons for power.

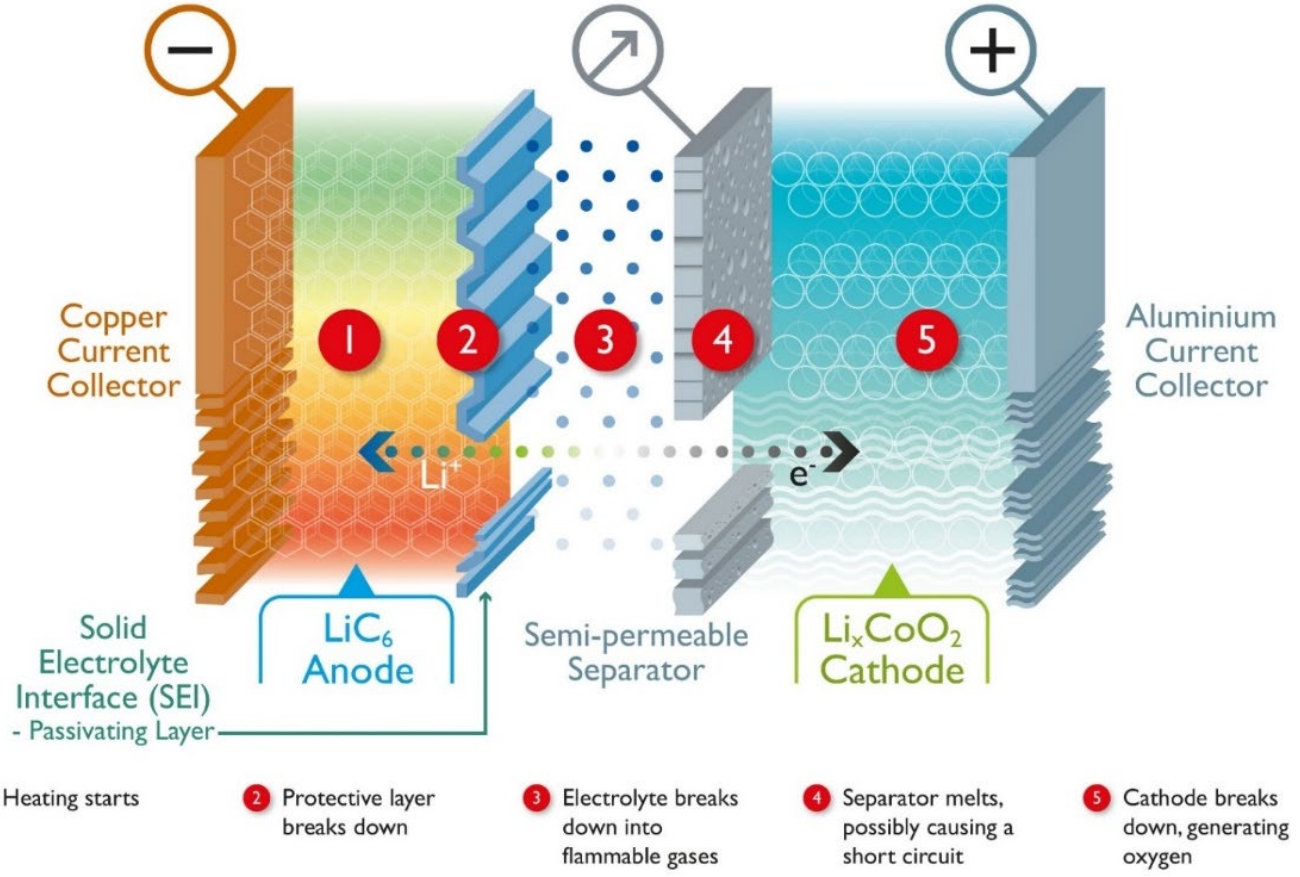
While charging the ions move back to the Anode through speparator / electrolyte

A battery is made up of an anode, cathode, separator, electrolyte, and two current collectors (positive and negative).



BREAK DOWN OF THE SEPARATOR

Thermal runaway in a Lithium Ion Battery Assembly




BATTERY FIRE INCIDENTS


554
Camera 01


ELECTRIC BUS BURSTS INTO FLAMES,
SETS NEARBY VEHICLES ON FIRE


EFFECTIVENESS OF
EXTINGUISHING AGENTS

CONVENTIONAL AGENTS ARE NOT EFFECTIVE

Several firefighting agents have no cooling effect on the fire.

AVD Fire has a number of key benefits over existing solutions.


LITHIUM ION BATTERY FIRE TEST


HOW DOES IT WORK?

WHAT TO USE ON LITHIUM-ION BATTERY FIRES

Water

When dealing with Lithium-Ion battery fires, water-based extinguishers will provide essential cooling effect, but they are not able to form a thermal barrier around the fire.

When you run out of water/foam, you've run out of fire suppressing power. The battery forms its own flammable gases (including oxygen) and heat, and will re-ignite, burning until the cell fully discharges its energy.

Foam

Foam is designed to smother with a film on the surface of the fire, but the film will not survive the high temperatures reached in a Li-Ion fire. Same applies to Wet Chemical.

Powder

Powder is completely ineffective, as it has no cooling effect, and will not cling to vertical surfaces of the cell. Please note that Lithium-Ion battery fires are NOT Class D fires.

A Lithium-Ion battery fire is not a Class D fire risk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WHAT TO USE ON LITHIUM-ION BATTERY FIRES

AVD

AVD is, in brief, Vermiculite particles suspended in water.

Its discharged in a fine mist to provide both cooling effect, and form a heat-proof barrier around the burning battery cell to prevent propagation and re-ignition.

Vermiculite has very strong thermal insulation properties

It prevents heat transfer from the burning cell to its surroundings.

This means the chemical reaction is contained inside a heatproof cell so that external flames can be dealt with by the cooling effect of the water.

WHAT IS VERMICULITE?

Vermiculite is a naturally occurring mineral: aluminium – iron – magnesium – silicate that is mined all over the world.

It is non flammable and has excellent thermal insulation properties.

It is chemically and physically inert.

Vermiculite mineral is exempt from REACH regulations.

WHAT IS AVD?

AQUEOUS VERMICULITE DISPERSION

- AVD is a stable suspension of vermiculite platelets with a D90 of 180 microns (0.18mm).
- AVD is non flammable and has excellent insulation properties.
- It is approximately 17% Vermiculite / 83% water.
- It has a viscosity of 3000 cPs, feels like double cream.

HOW DOES AVD WORK?

3

The AVD is applied as a mist and the water content knocks down the flames and cools adjacent cells

4

As the water is driven off, AVD forms a film over the cells, providing 3 functions:

1. A thermal barrier
2. An oxygen barrier
3. An electrical barrier

MANAGING RISK

Avoid	Avoid storing devices with lithium-ion batteries in places with high temperatures, eg; a hot vehicle, near heat
Keep	Keep batteries out of direct sunlight
Avoid	Avoid overcharging devices – 30-70% charge only not 0-100%
Avoid	Avoid keeping all lithium-ion battery devices together, especially in a bag
Avoid	Avoid dropping, crushing, damaging batteries etc

LITHIUM-ION

BATTERY SAFETY RANGE

LITHIUM-ION
BATTERY SAFETY RANGE

AVD ACCREDITATIONS

FIRECHIEF®

- Certified to EN3-7 (Class A) Characteristics, performance requirements, test methods
- Certified according to the Marine Equipment Directive (M.E.D)
- CE Marked (awaiting UKCA)
- Kite Marked


FIRE STANDARDS

Kitchen fires are the biggest cause of domestic fires within the UK OVER 48% and in America over 62%?

- Cooking Fires are still the biggest cause of fires within the UK, and America in the home
- BSEN 50615 is a standard regarding a product that can provide protection against cooking fires
- We provide a product that covers this standard its called Firechief Stove Guard
- Its reducing these fires and is playing an important role for the FRS

LITHIUM BATTERY FIRE STANDARDS

- There are no recognised test standards for lithium battery fires in the UK which provide a BS certificate.
- There are no recognised test standards for lithium battery fires in Europe which provide an EN certificate.
- There are no recognised test standards for lithium battery fires in North America which provide a UL certificate.

THE STANDARDS NOW NEED TO CATCH UP

THANK YOU FOR BEING HERE - HOW TO GET IN TOUCH!

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