FLUORINE FREE

FIRE, VAPOR AND CONTAMINATION CONTROL SOLUTIONS

ECO-FRIENDLY ENCAPSULATOR TECHNOLOGY FLUORINE FREE

Lithium-ion Battery Hazards

Industry Solutions

Industry Overview

Expansive Utilization

The global lithium-ion battery market size is projected to grow from USD 41.1 billion in 2021 to USD 116.6 billion by 2030. Lithium-ion batteries continue to be utilized heavily in **Personal Electronics** such as smartphones, power tools and digital cameras.

Demand continues to skyrocket in the **Transportation** industry for utilization in passenger cars, trucks, buses, railway systems, aircrafts and much more. **Manufacturing** sectors and **Solar Power** are likely to surge as well with the rising need for mass **Energy Storage Systems (ESS)** to fuel the world's growing need for lithium-ion energy to transform **Power**. As utilization increases, so do hazards faced by the **Waste & Recycling** industry as lithium-ion batteries and various lithium-ion battery powered electronics find their way into these facilities.

Lithium-ion battery hazard protection is a must throughout the lifecycle of the battery.

Hazard protection is essential in production, storage, transportation, usage and disposal of lithium-ion batteries.

Hazard Overview

Lithium-ion Batteries

To better understand the extent of Lithium-ion Battery Hazards, it's important to explore the following factors:

Short Circuiting

Lithium-ion batteries can become unstable and short circuit. This makes some battery fires unpredictable.

Damage

Lithium-ion batteries that experience trauma or damage can become unstable, increasing the risk of a fire.

Overcharging

Overcharging lithium-ion batteries can cause them to overheat, triggering thermal runaway.

Extreme Temperature

Exposing lithium-ion batteries to either extreme heat or extreme cold can trigger cell ignition.

Material Diversity

Lithium-ion batteries contain diverse materials. A lithium-ion battery fire contains Class A, B and C elements. A proper NFPA classification and set of suggested guidelines in the event of a lithium-ion battery fire has yet to be agreed upon due to the innovative and complex nature of the hazards they pose.

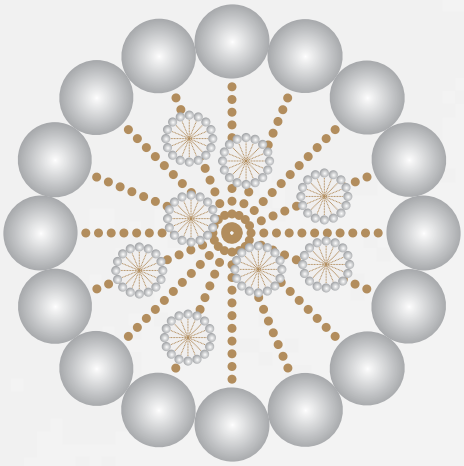
Concentrated Energy

Lithium-ion batteries contain a high energy density. This means even a partially charged battery can cause a powerful fire that can be extremely difficult to extinguish. Even previously extinguished lithium-ion batteries can re-ignite hours or days later.

Toxicity

Lithium-ion batteries emit toxic gasses and release flammable electrolyte as they burn.

Encapsulator Agents



NFPA 18A 7.7

Encapsulator - Spherical Micelle Stability Test

This section covers the test procedures to evaluate the ability of a water additive solution to form and maintain stable spherical micelles capable of encapsulating combustible and flammable liquids (nonpolar and polar), rendering the flammable liquids nonflammable, nonignitable and nonexplosive and maintaing that encapsulation in the presence of high heat over an extended period of time.

Encapsulator Agents work on all four legs of the Fire Tetrahedron at once, removing the heat, neutralizing the fuel by separating it from the oxygen on a chemical molecular level and interrupting the free radical chain reaction.

F-500 EA is mentioned under NFPA 18A Annex 4.3, Encapsulator Agents.

Water additive based on spherical micelle technology (Encapsulator Agents) conforming to Section 7.7 has been tested extensively by independent third-party testing organizations, including Kiwa, Dekra, Daimler, Dutech, Bosch, Fraunhofer, University and TU Clausthal.

This testing has been controlled, scientific and highly instrumented, documenting fire suppression, control and elimination of thermal runaway and encapsulation of both flammable electrolyte and other explosive off-gases, rendering them nonexplosive.

Encapsulator Technology reduces the toxicity of HF gas exposure to humans.

Third-party Tested Agent

F-500 Encapsulator Agent (F-500 EA)

F-500 EA works on a chemical molecular level, effectively extinguishing Class A, B (Polar & Non-polar), C, D, K and Lithium-ion Battery fires without the use of fluorinated ingredients. F-500 EA is fluorine free, biodegradable and noncorrosive, making it the economical and environmentally friendly option.

F-500 EA is backed by over a decade of third-party testing, including testing completed by KIWA Institute, a global specialist in testing, inspection and certification in the Netherlands, Fraunhofer Institute and TU Clausthal located in Germany. Testing overseen by HCT Europe points to one conclusion:

F-500 EA is the only agent on the market today proven to stop thermal runaway in its tracks, safely extinguishing lithium-ion battery fires and greatly reducing the risk of re-ignition.

F-500 EA is available in multiple sizes for your convenience. We offer a full line of engineered Mobile Equipment and Fixed System solutions powered by Encapsulator Technology.

- 5G Pails
- 55G Drums
- 250G Totes
- 275G Totes

Multi-level Protection

Thermal Runaway

The leading cause for unexpected lithium-ion battery fires is thermal runaway. F-500 EA provides **Rapid Cooling** that can successfully halt thermal runaway.

Reignition

The chance of reignition after a lithium-ion battery fire can be high due to an inability to cool all cells effectively. **Rapid Cooling** and **Encapsulation** can prevent reignition.

Toxic Gas

Toxic gas during a lithium-ion battery fire can exceed the NIOSH limit and result in adverse health effects. **Encapsulation** can stop toxic gas production and reduce concentration below the NIOSH limit.

Electrolyte

Flammable and toxic electrolyte released during a lithium-ion battery can increase with the use of plain water. **Encapsulation** can render this electrolyte non-flammable.

▫ Water

Thermal Runaway: No Rapid Cooling
Reignition: No Encapsulation, No Rapid Cooling
Toxic Gas: No Encapsulation, No Reduction
Electrolyte: No Encapsulation, Flammable

▫ Foam

Thermal Runaway: No Rapid Cooling
Reignition: No Encapsulation, No Rapid Cooling
Toxic Gas: No Encapsulation, No Reduction
Electrolyte: No Encapsulation, Flammable

▫ Dry Powder

Thermal Runaway: No Rapid Cooling
Reignition: No Encapsulation, No Rapid Cooling
Toxic Gas: No Encapsulation, No Reduction
Electrolyte: No Encapsulation, Flammable

▫ CO2

Thermal Runaway: No Rapid Cooling
Reignition: No Encapsulation, No Rapid Cooling
Toxic Gas: No Encapsulation, No Reduction
Electrolyte: No Encapsulation, Flammable

Engineered Equipment

Our engineered equipment is powered by Encapsulator Technology. Contact us for a full line of loose equipment and fixed system offerings.

Multi-class Fire Extinguishers

Quick Attack Mobile Unit

Diamond Doser Systems

Hazard Control Technologies, Inc.

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