



AVD[®]



fire protection
TECHNOLOGIES



ADDRESS THE BURNING
ISSUES SURROUNDING
**LITHIUM-ION
BATTERY FIRES**



AVD FIRE IS A DIVISION OF DUPRÉ MINERALS.

DUPRÉ MINERALS WAS FOUNDED IN THE EARLY 1950'S. BASED AT NEWCASTLE-UNDER-LYME, STAFFORDSHIRE, WE MANUFACTURE AN EXTENSIVE RANGE OF HIGH QUALITY PRODUCTS, SERVICING THE VERMICULITE, PRECISION CASTING, FRICTION AND REFRACTORY INDUSTRIES.

The processing and manufacture of Vermiculite continues to be one of our core business markets. The established Dupré brand inspired the development of some of the world's most advanced Vermiculite product formulations.

Applications for crude and exfoliated Vermiculites include fire extinguishing agents, dispersions, insulation, friction, horticulture, construction, packaging and wherever lightweight or heat resistant properties are required.

Dupré Minerals is a 100% owned subsidiary of Goodwin PLC based in Stoke-on-Trent. Goodwin PLC have patents worldwide covering the use of AVD as a fire extinguishing agent.

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AVD IS A REVOLUTIONARY NEW FIRE EXTINGUISHING AGENT SPECIFICALLY DESIGNED FOR LITHIUM-ION BATTERY FIRES.

AVD is made from the naturally occurring mineral vermiculite combined with water and when compared with conventional agents, offers superior performance to both control and extinguish lithium-ion battery fires.

AVD is applied in the form of a mist which is composed of fine droplets of water containing vermiculite platelets. When deposited on the surface of the burning fuel the water suppresses the flames and cools the fuel source bringing the fire under control. As the water evaporates the high aspect ratio vermiculite platelets overlap and bind together, producing a barrier film which completely extinguishes the fire.

The AVD barrier film serves three main functions:

- To reduce the amount of thermal propagation.
- To isolate the fuel source.
- To provide an oxygen barrier.

AVD has passed the 35 kV dielectric test of EN3 and acts as an electrical insulator.

AVD high performance Lith-Ex extinguishers are designed to target high risk fires of a limited size. They are offered in a range of sizes and should be used to suppress fires in their infancy.

Make AVD your primary choice for all types of lithium ion battery fire.



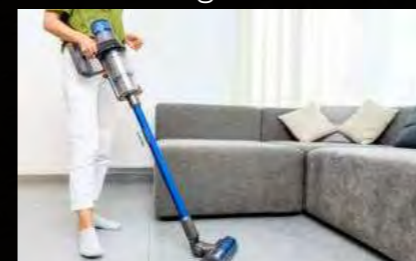
e-Cigarettes



Laptops



Mobile Phones



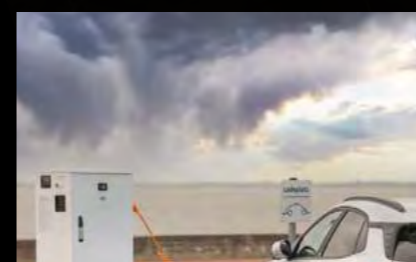
Domestic



e-Bikes & Scooters



Drones



Automotive



Industrial



Aviation



Marine

Are you prepared for a
lithium-ion battery fire?

WHAT IS AVD?

AQUEOUS VERMICULITE DISPERSION



AVD is a new and revolutionary extinguishing agent which has been developed during the past few years in response to the demand for products which can deal with high temperature lithium-ion battery fires.

AVD offers a significant performance improvement over conventional extinguishing agents when applied to these very particular fire types.

WHAT IS AVD?

AVD fire extinguishing agent is composed of high aspect ratio vermiculite platelets suspended in water and is a golden brown colour.

Vermiculite is a naturally occurring mineral and is the name given to a group of hydrated laminar aluminium-iron-magnesium silicates.

AVD is non-flammable and has excellent thermal insulation properties.

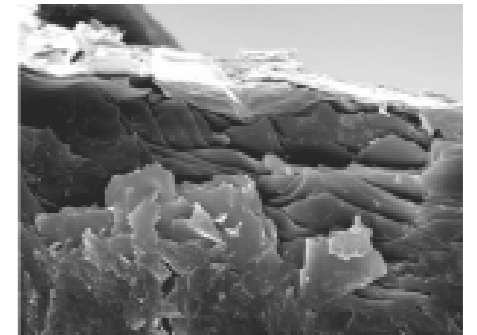
TYPICAL PROPERTIES OF AVD

AVD has a solids content of 16-18%
(the solids are vermiculite platelets of varying size)

AVD is a stable suspension

AVD has a viscosity of 2,000 to 4,000 cP.

AVD has undergone extensive testing in fire extinguishers and with a variety of fixed and portable delivery systems. It is suitable for application using standard fire extinguishing equipment via a specialised misting nozzle.*



*This nozzle can be supplied by AVD Fire upon request

LITH EX

Battery
Recycling
Facilities

Workshops



2Ltr

6Ltr

9Ltr

E-Scooter & E-Bike
Manufacturers
& Rental

Home & Office



1Ltr

100-250 Wh

250-500 Wh

500-750 Wh

E-Vehicle Charging

Fire & Rescue
Services

25Ltr

Mobile Phone &
Laptop
Repair Stores



500ml

Under 60 Wh

Over 750 Wh

Over 750 Wh

Energy
Storage

50Ltr

Are you
prepared for a
lithium-ion
battery fire?



LITH-EX FIRE EXTINGUISHERS

AVD offers a range of lithium battery fire extinguishers to help fight the flames and prevent the propagation of fire. Ideal for use in factories, offices and other locations where lithium battery technologies are prominent.

FIRE SUPPRESSION PRODUCTS

The complimentary product range including Fire Blankets, Fire Suppression Kits (FSK) and Fire Resistant Containers (FRC) can be applicable to the same categories and we recommend the provision of both product groups as part of your fire safety strategy.



LITH EX[®]



500 ml



1 L



2 L



6 L



9 L



25 L



50 L



**AVD IS A
REVOLUTIONARY
NEW FIRE
EXTINGUISHING
AGENT
SPECIFICALLY
DESIGNED FOR
LITHIUM-ION
BATTERY FIRES.**

Extinguisher AVD Type	LITH EX AEROSOL	LITH EX 1 L	LITH EX 2 L	LITH EX 6 L	LITH EX 9 L
Brim Full Capacity / ml	794	1,240	2,520	7,780	11,325
Fill Volume AVD Agent / ml	500	1,000	2,000	6,000	9,000
Approx. Weight Agent / kg	0.545	1.12	2.24	6.72	10.08
Approx. weight of Unit / kg	0.690	2.1	3.9	10.7	15.0
Cylinder Ø / mm	65	85	110	170	170
Cylinder Height / mm		320	380	522	664
Unit Height / mm	300	350	410	530	672
Handle		Metal - Red	Metal - Red	Metal - Red	Metal - Red
Hose		N/A	N/A	Yes with Magnet	Yes with Magnet
Base		Integral Base & Wall Bracket	Integral Base & Wall Bracket	Green PP Wall Hanger	Green PP Wall Hanger
Bracket					
Fire Rating		3A	5A	13A	13A
EN3 Certified	Not Applicable	Not Allowed	Yes	Yes	Yes
MED Approved		N/A	Yes	Yes	Yes
Propellant	Nitrogen (He Tracer)	Nitrogen (He Tracer)	Nitrogen (He Tracer)	Nitrogen (He Tracer)	Nitrogen (He Tracer)
Operating Pressure / bar	10.8	15	15	15	15
Operating Temperature Range	+5°C to +50°C	+5°C to +60°C	+5°C to +60°C	+5°C to +60°C	+5°C to +60°C
Approx. Discharge Time / s	90	25	50	120	180
Discharge Range / m	2.0	1.5 - 2.0	1.5 - 2.0	1.5 - 2.0	1.5 - 2.0
Packaged Unit l x w x h / mm	100 x 72 x 320	102 x 104 x 360	125 x 128 x 420	197 x 267 x 525	199 x 226 x 670
Units per Box	6	10	6	1	1
Box Dimensions / mm	250 x 230 x 320	394 x 535 x 226	444 x 392 x 265	N/A	N/A

Extinguisher AVD Type	LITH EX 25 L	LITH EX 50 L
Volume of Agent / l	25	50
Agent	AVD	AVD
CE / PED	Yes	Yes
Approx. Weight in Working Order / kg	55	100
Height ~ / mm	970 ± 10	1090 ± 10
Width / mm	558	558
Cylinder Ø / mm	350	350
Typical Hose Length / m	5	5
Propellant	Nitrogen (Helium Tracer)	Nitrogen (Helium Tracer)
Operating Temperature Range	+5°C to +60°C	+5°C to +60°C
Working Pressure / bar *	8	8
Supply Bottle / bar	160	160
Discharge Time / mins	3.5	7
Attack Distance / m	5	5

*These unit have an auxiliary cylinder which has a charge pressure of 160 bar regulated to 8 bar constant pressure at the nozzle.



SMALL & LARGE FIRE SUPPRESSION KIT

The Fire Suppression Kit (FSK) is the perfect solution for the effective control and suppression of Lithium-ion battery fires. Equipped with a choice of Lith-Ex extinguishers this fire resistant bag is manufactured using technical fabrics to withstand temperatures in excess of 1000°C.

The kit provides the initial extinguisher to suppress the fire and a bag for the safe suppression and removal of the extinguished device. Typical applications are mobile phones, tablets, and laptops.

PROVIDES

- Safe storage of extinguished devices
- Reduces risk of explosion after fire has been extinguished
- Withstands temperatures in excess of 1000°C



SMALL KIT INCLUDES

- Fire resistant bag
- Choice of Lith-Ex extinguisher options:
The Aerosol or the Lith-Ex 1 litre unit.
- Safety Gloves
- Safety Glasses

NB. Colour of gloves may vary due to stock availability.

Kit can be supplied without an extinguisher.

DIMENSIONS

Rolled up closed bag with extinguisher
Outer Dimension ~405 mm x 200 mm
Inner Dimension ~380 mm x 190 mm

Open bag
Outer Dimension ~405 mm x 430 mm
Inner Dimension ~370 mm x 380 mm

WEIGHT

Without extinguisher
~1.5 kg

With 500ml aerosol
~2.2 kg

With 1 litre extinguisher
~3.6 kg



LARGE KIT INCLUDES

- Fire resistant bag with flame arrester
- Choice of Lith-Ex extinguisher options: Either the
Aerosol or the Lith Ex 1 or 2 litre unit.
- Safety Gloves
- Safety Glasses

NB. Colour of gloves may vary due to stock availability.

Kit can be supplied without an extinguisher

DIMENSIONS

Packaged with 2 litre extinguisher
Outer Dimension ~250 x 140 x 535 mm

Closed bag
Outer Dimension ~535 mm x 510 mm
Inner Dimension ~480 mm x 490 mm

Closed rolled out bag
Outer Dimension ~535 mm x 690 mm
Inner Dimension ~480 mm x 650 mm

WEIGHT

Bag only
~2 kg

Packaged with 2 litre extinguisher
~5.9 kg



BATTERY FIRE BLANKET

AVD Fire have developed a specialist range of fire blankets specifically for the Lithium-ion battery market. Our Blankets are capable of withstanding extremely high temperatures for a prolonged period of time as well as being robust enough to offer protection against potential debris and shrapnel expelled during a battery fire.

These qualities make our Lithium-ion battery fire blankets an important part of your passive fire protection strategy.

If your organization is connected to the production, storage and transportation of lithium-ion batteries and associated devices you will need a comprehensive strategy which incorporates passive and active fire suppression systems.

Easy to store and easy to deploy.

Available in a wide variety of sizes, please contact us with your requirements.

TYPICAL PROPERTIES

- Working temperature up to 1000°C
- Fire resistant technical fabrics
- Fire resistant re-enforced multi-layered edge lining
- Fire resistant industrial stitching
- Handling loops on all corners



FIRE RESISTANT CONTAINER

The Fire Resistant Container (FRC) is an innovative product that protects potentially flammable goods against the threat of fire. The exceptional insulation properties are achieved by the use of a unique combination of technical textiles which prevent the propagation of both internal and external fires.

The Fire Resistant Container provides the perfect solution for the transportation and storage of lithium-ion batteries.

Independent tests have been successfully completed with lithium-ion batteries up 880 wH - see website for video footage.

FRC DIMENSIONS:

- 300 mm x 250 mm x 250 mm
- Flame arrestors included





EV Industrial Machinery

Buses & Coaches



Fixed System Applications Lithium-Ion Battery Fire Suppression

Automobile Charging Stations

Railway, Tram & Underground

Lithium-ion batteries are now in regular use in a wide range of applications from personal transportation to large scale energy storage containers.

In order to mitigate the risk of a fire in these locations and devices there is a growing requirement for the bespoke design of complete fire suppression systems dedicated to applications utilising lithium-ion batteries.

AVD Fire continue to work in collaboration with systems developers to design automated fire suppression systems utilising the unique characteristics of AVD in both OEM and retrofit applications.

Are you prepared for a lithium-ion battery fire?

Large Electrical Storage Systems

eScooter/Bike Charging Stations

www.AVDFIRE.com

THERMAL RUNAWAY

- Overcharging
- Overheating
- Penetration
- Crushing
- Short Circuit

Examples of typical consumer goods and industrial products that may pose a fire risk:

- **Mobile phones and portable computing equipment**
- **Children's toys**
- **Electric bikes and scooters**
- **Radio controlled vehicles**
- **Power tools**
- **Radio communication equipment**
- **Health service and hospital monitoring and test equipment**

The batteries in these devices can be damaged and pose a fire risk. When there is a short circuit, the cells are overcharged or they are overheated by an external heat source then the electrolyte can start to overheat in a manner which can result in a self-sustaining exothermic reaction.

When the cell generates heat from this chemical reaction at a rate which is significantly greater than the rate at which it can dissipate the heat to the surroundings then the cell may go into a state known as thermal runaway, an uncontrolled self-heating process.

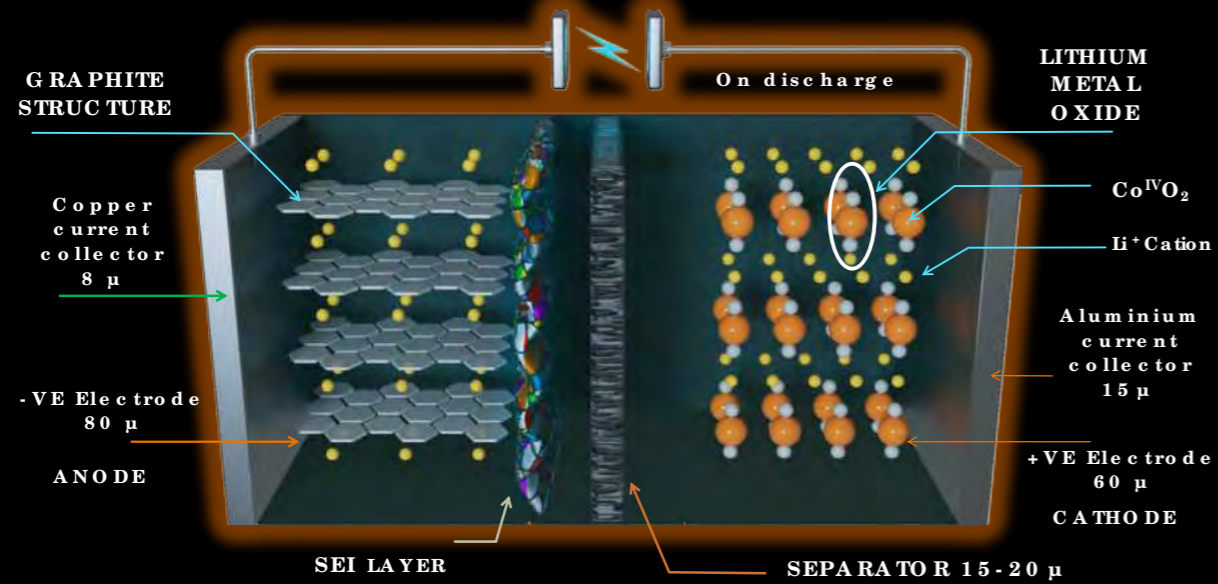
This process can propagate throughout the battery pack resulting in the complete destruction of the cells and a fire or an explosion

Testing has shown that typical water, powder and foam extinguishing agents are not effective in tackling these fires as they frequently re-ignite.

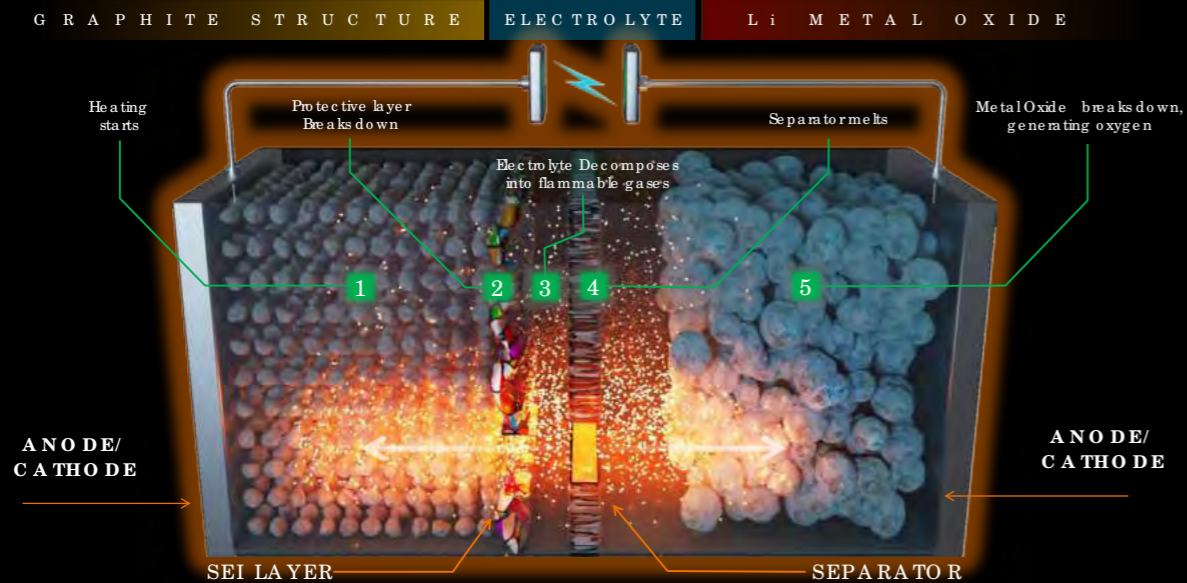
Third Party testing has shown Lith-Ex to be effective in suppressing and extinguishing lithium battery fires. This testing has also shown that Lith-Ex prevents re-ignition by forming an encapsulating barrier over the battery cells..



EXPANDED VIEW OF A LITHIUM-ION BATTERY ASSEMBLY



THERMAL RUNAWAY IN A LITHIUM-ION BATTERY



HOW DOES AVD WORK?

The vermiculite particles within the mist are deposited on the surface of the burning cells to create a film isolating the fuel source. The film instantly dries and, because the high aspect ratio platelet particles overlap and bind together, a non-flammable oxygen barrier is created between the fuel source and the atmosphere.

The water droplets in the AVD not only knock down the flames but also have a cooling effect on the adjacent cells. As this water evaporates the vermiculite platelets begin to build up and the barrier film is created as the fire is brought under control.



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



As the water is driven off, AVD forms film over the cells, and functions in three ways:

- To isolate the fuel source
- To reduce the amount of thermal propagation
- To act as an oxygen barrier

AVD has passed the 35 kV dielectric test

LITH EX



Are you prepared for a lithium-ion battery fire at sea?

PRODUCTS:

Gaseous Suppression



Inert Gas (IG-01, IG-55, IG-100, IG-541)
Novec 1230™ Fluid (FK-5-1-12)
FM-200® (HFC-227ea.)
Carbon Dioxide (CO₂)
Hybrid Systems (N₂ / Water)
Pressure Relief Vents
Enclosure Integrity Testing Equipment
Pipe & Fittings

Water Suppression



Water Mist - High Pressure
Water Mist - Intermediate Pressure
Water Mist - Low Pressure
Hybrid Systems (Water / N₂)
Monitors & Delivery Systems
High Speed Deluge

Foam Suppression



Foam Concentrates
Foam Proportioning
Foam Delivery Systems
Compressed Air Foam
Foam Concentrate Testing

Explosion Protection



Explosion Suppression
Explosion Isolation
Explosion Vents & Pressure Relief
Spark Suppression
Explosibility Testing

Fire Detection



Linear Heat Detection - Digital
Linear Heat Detection - Fibre Optic
Linear Heat Detection - Micro Chip
Flame Detection
Video Imaging Detection
Spark Detection
Control & Indicating Equipment
Thermal Imaging Detection
Aspirating Smoke Detection

Military & Defence



Military Vehicles
Naval Vessels

Special Applications



Micro Environment
Oxygen Reduction
Kitchen Protection Systems
Dry Chemical
Vehicle Systems
Marine & Offshore
Vapour Mitigation
Li-Ion Fire Systems

Support Services



Design / Engineering
Technical Support
Services & Testing

Australia

Head Office

Unit 1, 251 Ferntree Gully Road
Mt Waverley VIC 3149
Australia

Brisbane Office

Unit 7, 93 Rivergate Place
Murarrie QLD 4172
Australia

Perth Office

18 – 20 Ledgar Road
Balcatta WA 6021
Australia

Sydney Office

Unit 5, 11 Reliance drive Tuggerah
NSW 2259
Australia

1300 742 296

www.fire-protection.com.au
enquiries@fire-protection.com.au

New Zealand

Auckland Office

Unit 2, 13 Airborne Road
Albany North Shore 0632
New Zealand

0011 64 9415 5488

www.fire-protection.net.nz

South East Asia

www.fire-protection.com.sg



'Every solution for your special hazard problems'