

FyreWrap® LiB G2 Coating

Introduction

FyreWrap® LiB (Lithium-ion Battery) Coating from Unifrax is a high-temperature, lightweight flame barrier and electrically insulating material designed to increase safety in lithium-ion battery packs. FyreWrap LiB G2 Coating utilizes the same core technologies as the FyreWrap LiB Films. The coating is easily applied at room temperature in atmospheric conditions.

FyreWrap LiB G2 Coating Features

- Fire resistant, flame barrier
- Electrically insulating
- Proprietary fire blocking technology protects structures and substrates
- Variable thickness depending on the application
- Application via spraying or various types of roll coating
- High emissivity allows for greater heat dissipation

Coating Capabilities

- Thermal runaway propagation prevention
- Short circuit prevention and electrical protection
- Cascading fire prevention
- Thermal isolation and containment

Applications

- Cells (external to cell)
- Battery module
- Battery packs
- Packaging for transportation

Markets

- E-Mobility
- Grid Storage
- Energy Storage Systems (ESS)
- Military
- Aerospace
- Consumer Electronics
- Medical
- Transportation packaging



Material Properties

- Resistant to temperatures in excess of 1100°C
- Dielectric Strength (ASTM D149): 20 (kV/mm)*
- UL94 V-0*
- Thermal Conductivity (ASTM E1461) 0.199 W/m-K @ 25°C
- Thickness: 0.05 mm to 0.5 mm thickness
- Basis Weight: 100 g/m² per 0.1 mm thickness
- Coverage Rate: 7.5 m²/Gallon @ 100 g/m²

Ultimate Protection with FyreWrap LiB Performance Materials

Unifrax's purpose is based on a commitment to produce high-quality specialty products that help our customers save energy, reduce pollution and improve fire safety. Supporting and exemplifying the purpose statement, Unifrax is committed to delivering optimal solutions for fire, thermal and electrical safety within the lithium-ion battery pack. Please contact us to learn more about FyreWrap LiB Performance Materials.

FyreWrap LiB Capabilities

- Thermal runaway propagation prevention
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- Thermal isolation and containment

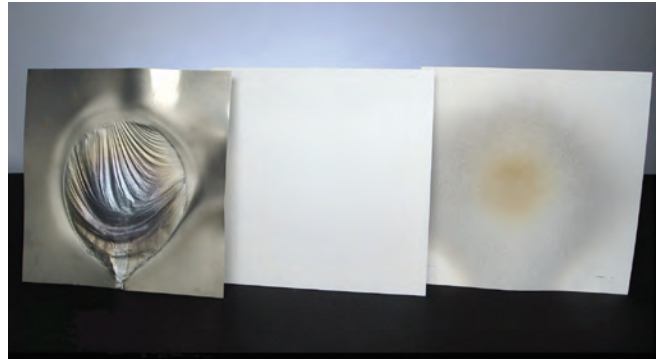
FyreWrap LiB Coating Application Study

FyreWrap LiB Coating was applied at a thickness of 0.1 mm on an aluminum panel that is 1 mm thick. The panel is pictured below on the right. The FyreWrap LiB Coated panel was exposed to a flame that was greater than 1000°C for 30 seconds. The aluminum panel showed no signs of deformation due to the flame protection provided by the coating technology. The same set-up shown below on the left, demonstrates the effects of not having the coating present on the panel. The flame melted the aluminum, causing a hole to form within seconds. The coating technology helps to maintain the structural integrity of the material while providing electrical protection in high temperature environments.

Based on recent testing, it is believed that the coating can withstand direct flame impingement in excess of five minutes**. To learn more about FyreWrap LiB coating technologies or to discuss your application, please contact us at 716-768-6472.

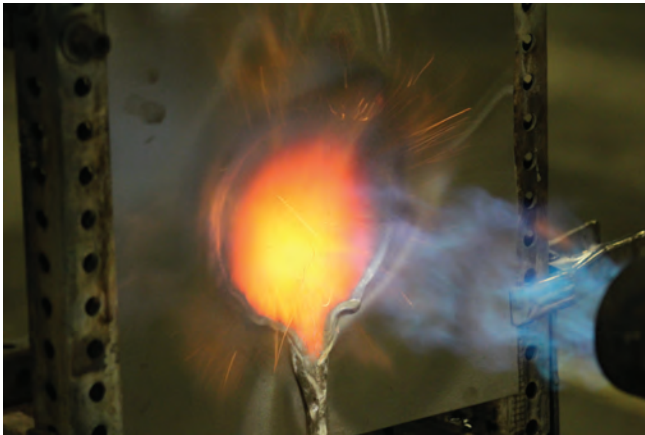
*Testing was performed on coating applied to an aluminum panel.

**Duration of the prevention of flame penetration is dependent on many factors, including substrate thickness and type, coating thickness, velocity and temperature of flame, etc.



Pictured above from left to right: Aluminum panel exposed to > 1000°C flame impingement, aluminum panel coated with 0.1mm FyreWrap LiB coating (no flame impingement), aluminum panel coated with 0.1 mm FyreWrap LiB coating after being impinged by a flame > 1000°C. Test set-up shown in greater detail in picture below.

Bare Aluminum Panel heated above 1000°C



Coated Aluminum Panel heated above 1000°C



Please contact Unifrax for more information on FyreWrap LiB films and coatings along with any specific design requirements.

FyreWrap®

The following is a registered trademark of Unifrax: FyreWrap.

The test data shown are average results of tests conducted under standard procedures and are subject to variation. Results should not be used for specification purposes.

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