MatWerkz

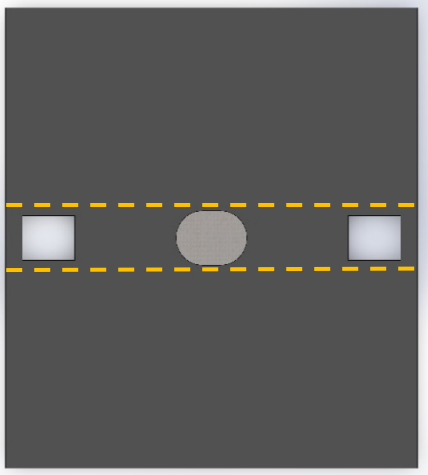
PYROWERKZ

How it Works

Matwerkz Pyrowerkz is a lightweight fire-resistant jacket that can be used to stop the propagation of fire. Its excellent thermal insulation performance prevents heat from protection against the spread of fire and heat during thermal. Exposure to high temperatures will rapidly transform Pyrowerkz into a rigid thermal barrier with exceptionally low thermal conductivity, ensuring the protection of valuable assets.

Pyrowerkz can be die-cut and customized with integrated seams to support folding and simplified installation across various prismatic battery cell formats.

Matwerkz Pyrowerkz can be customized with integrated seams to enable folding and simplify installation.



Key Features

- Thermally insulative (< 0.1 W/m.K) below 70 ^{o}C
- Enhanced thermal insulation (< 0.1 W/m.K) above 200 ^{o}C
- Non-flammable
- Able to withstand temperatures of up to 1000 ^{o}C
- Modular and Lightweight

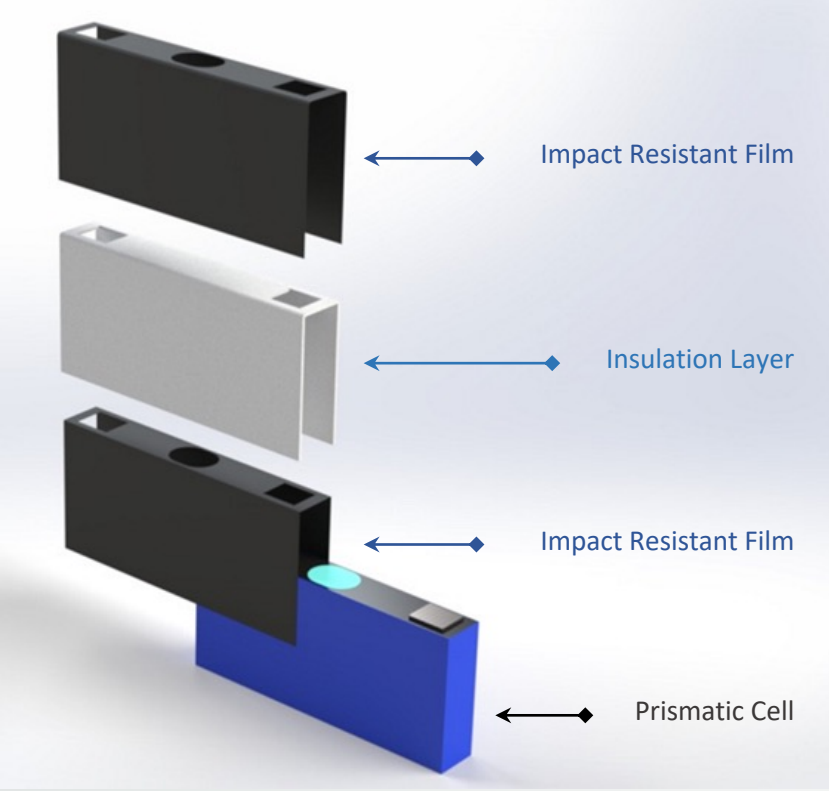
Technical Feasibility

Material Principles

Pyrowerkz employs a tailored material architecture to limit heat transfer and is combined with polymer-based frameworks to form flexible sheets. The resulting structure integrates waterproofing, flame resistance, thermal insulation, and electrical insulation in a single solution suitable for battery system applications.

Structural Features

Pyrowerkz features a sandwich construction comprising a central insulation layer bonded between two impact-resistant structural layers. The black outer film is designed to provide mechanical integrity during thermal runaway events, allowing the structure to withstand forces generated by a trigger cell. The white section is strategically positioned above the cell safety valve to facilitate controlled venting of gases and pressure release during thermal runaway. When deployed to protect adjacent cells, Pyrowerkz effectively shields surrounding cells from direct flame and excessive heat exposure.

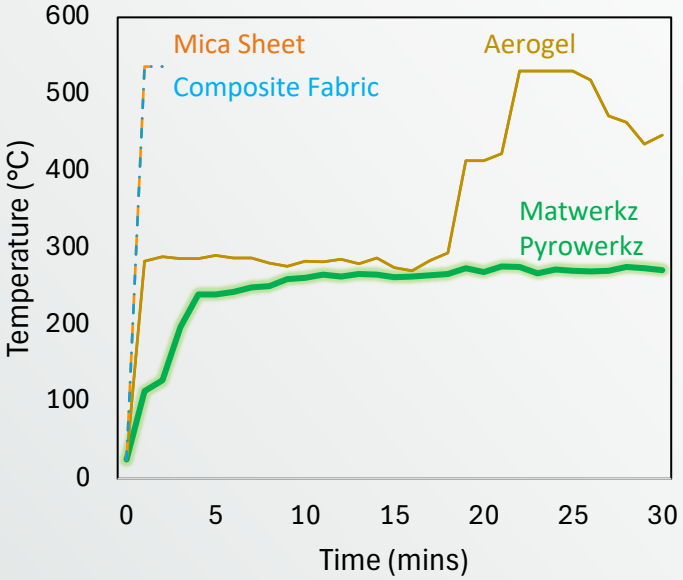


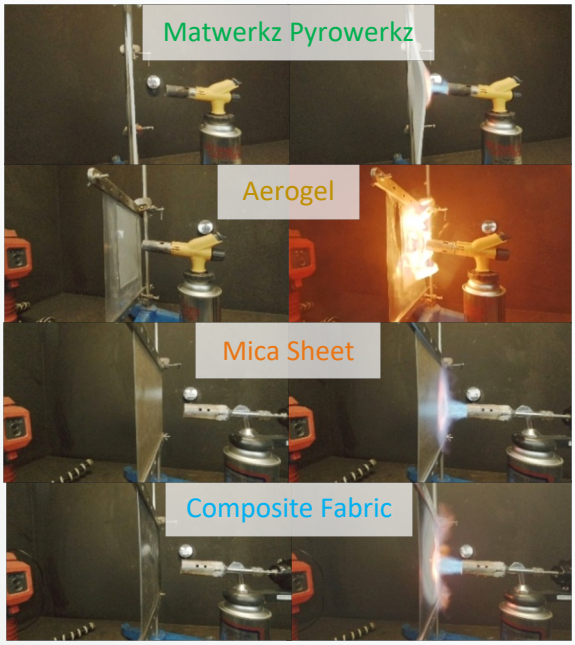
Applications

Designed for integration within EV prismatic battery modules and packs, Pyrowerkz is supplied in sheet form and provides lightweight, modular fire and thermal protection. Its thin profile supports efficient space utilization, weight control, and design flexibility in battery system layouts.

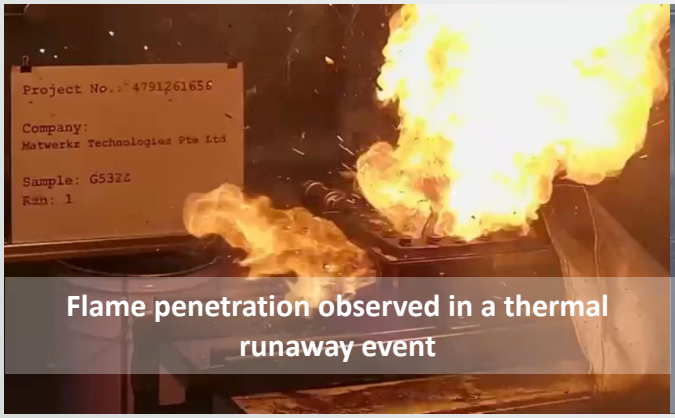
Pyrowerkz provides scalable, high-performance insulation that meets the safety, and efficiency demands of both traditional and emerging technologies.

Thermal Insulation Performance

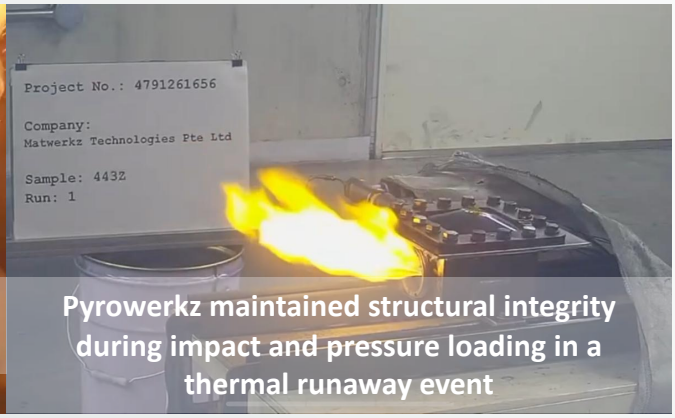




UL2596 Battery Enclosure Material Safety Test



Battery pack with plastic lid only



Battery pack with Pyrowerkz adhered plastic lid

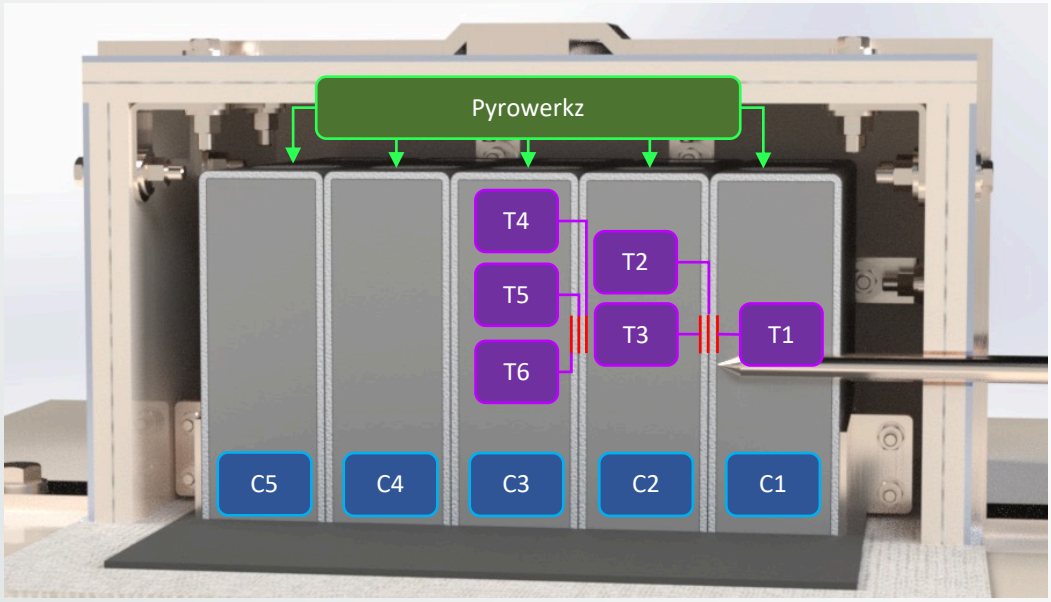
Engineered for high-performance protection, Pyrowerkz limits heat transfer and flame spread during UL2596 testing. By acting as an advanced thermal barrier, it enhances system safety and supports the reliability of next-generation energy storage and mobility applications.

Nail Penetration Test

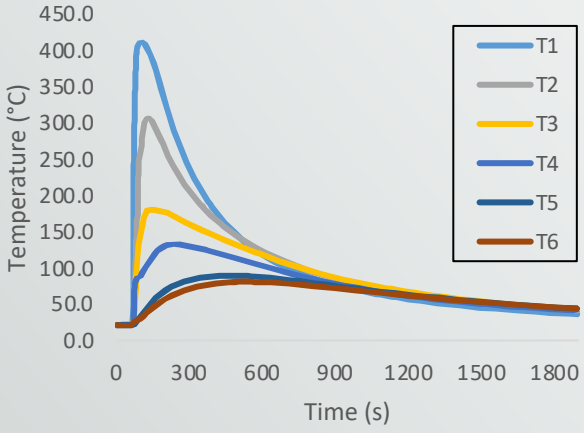
Nail penetration testing using an 8 mm nail was conducted on a five-cell 117 Ah NMC prismatic battery configuration protected with Pyrowerkz. Temperature measurements were obtained using thermocouples placed between the cells and Pyrowerkz to evaluate thermal insulation performance under abuse conditions.

SCAN FOR TEST REPORT

SCAN FOR TEST VIDEO



Nail Penetration Test Setup Schematics



Cells	Voltage (V)	Internal Resistance
C1	0	0.5549 GΩ
C2	3.854	0.6717 mΩ
C3	3.878	0.7363 mΩ
C4	3.877	0.9936 mΩ
C5	3.880	0.4759 mΩ

Post-Test Battery Properties

Nail penetration test was conducted with reference to GB/T 38031 under representative abuse conditions. Pyrowerkz provided effective thermal isolation of the trigger cell, with no functional degradation observed in adjacent cells (C2 – C5) after testing.

General Specifications

Properties	Unit	
Specific density	[g/cm^3]	0.7 – 0.75
Thermal conductivity (20-70 ^{o}C)	[W/m·K]	0.052
Thermal conductivity (>200 ^{o}C)	[W/m.K]	0.046
Electrical conductivity	[MΩ/cm]	100V: 110 500V: 5500 1000V: 5500
Compatible substrate	[-]	Most metals and plastics
Hydrophobicity (24h at 80% RH, weight gain)	[%]	≥ 3.5
Product thickness	[mm]	2.2 – 2.4
Available sizes	[mm]	600 x 600
Phase transformation temperature (from thermally conductive to insulative)	[^{o}C]	125 ^{o}C
Expansion ratio after phase transformation	[%]	ca. 45
Flame retardancy	[-]	UL94 V0
Application method	[-]	Designed for adhesives-free installation
RoHS	[-]	Meets RoHS requirements Does not contain prohibited substances

MatWerkz

ABOUT MATWERKZ TECHNOLOGIES

Founded as an A*STAR spin-off in 2020, Matwerkz Technologies is a Singapore-based deep-tech organization specialized in developing unique **thermal management solutions** catered to emerging and rapidly expanding industries such as transport, logistics, telecommunications and construction.

Our goal is to create materials that would **enhance safety, reliability and sustainability** of products and structures through effective temperature regulation. Hence, we offer a wide range of **thermal regulation, thermal resistant and fire retardant materials** for various industrial applications.

As materials designers, we are committed to ensure that all our materials are not just designed to be highly durable during the product lifetime but also that our customers understand ways to deal with such materials at the end-of-life of their products.

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