Pyrophobic® Systems Ltd.

YOUR TRUSTED FIRE SAFETY PARTNER

AUTOMOTIVE CASE STUDY

Seven Months to Safer EV Batteries

Thermal Runaway Arcing Protection

How Pyrophobic Systems helped an electric vehicle manufacturer replace an engineered polypropylene component, reduce arcing risk, and accelerate the path from development to production.

5 months

From discovery to first parts on vehicles

7 months

From discovery to production parts, November 2022

SPE Automotive Innovation Award

Safety category winner, plus Supplier of the Year recognition

THE CHALLENGE

When fire isn't the only danger inside a battery pack

When thermal runaway occurs inside a lithium-ion battery pack, heat and fire are only part of the danger. Electrical arcing, conductive gases, and the ignition of flammable off-gases can create additional failure pathways that accelerate an already critical event.

In April 2022, an automotive company approached Pyrophobic Systems with this challenge. Its existing polypropylene components were not providing the required protection during battery fire events. The company needed more than a replacement material. It needed a solution that could withstand extreme thermal and electrical conditions, support complex component designs, meet automotive requirements, and reach vehicles and production quickly.

Pyrophobic worked closely with the customer's technical team to develop, test, qualify, and manufacture a customized LithiumPrevent solution. The program moved from material selection to first parts on vehicles in approximately five months, and to production parts in approximately seven.

Project Overview

AT A GLANCE

SECTOR	Electric vehicles and lithium-ion batteries
APPLICATION	Terminal caps, busbar protection, and internal battery barriers
PRIMARY CHALLENGE	Electrical arcing caused by material degradation during thermal runaway
EXISTING MATERIAL	Polypropylene-based material
PYROPHOBIC SOLUTION	A customized flexible and intumescent LithiumPrevent material
FIRST VEHICLE PARTS	Approximately five months from discovery to first CNC machined parts on vehicles
PRODUCTION LAUNCH	Approximately seven months from discovery to production parts, November 2022
RECOGNITION	Supplier of the Year recognition and SPE Automotive Innovation Award, Safety category

THE SCENARIO

When the insulation became part of the problem

The customer was experiencing electrical arcing inside a high-voltage electric vehicle battery pack during thermal runaway events.

The existing terminal protection components were manufactured from a polypropylene-based material. Under normal operating conditions, the material performed its basic touch protection function. During a fire event, however, the material began to degrade.

As the polypropylene decomposed, it released gases that were both flammable and electrically conductive. Instead of helping isolate the affected area, the degraded material created additional pathways for electrical arcing.

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THIS INTRODUCED SEVERAL INTERCONNECTED RISKS

01 Additional arcing between energized battery components.

02 Potential ignition of gases released during material degradation.

03 Increased risk of fire spreading from one battery module to another.

04 Greater uncertainty regarding battery pack behaviour during a thermal runaway event.

The customer needed a material that could continue providing electrical isolation under high-temperature and high-voltage conditions while remaining suitable for terminal caps, busbar barriers, and other complex components inside an EV battery system.

Speed was also a major requirement, so the development path had to support rapid vehicle implementation without waiting for a conventional full tooling cycle.

THE SOLUTION

A customized LithiumPrevent formulation

Following the discovery meeting, engineers from Pyrophobic and the customer reviewed the application, failure conditions, electrical risks, component geometries, and automotive production requirements.

Pyrophobic recommended replacing the polypropylene material with a customized version of LithiumPrevent, its engineered intumescent material for lithium-ion battery safety applications. For this project, Pyrophobic developed an exclusive formulation engineered to combine high dielectric strength, controlled intumescent response, and injection moldability.

High dielectric strength **Controlled intumescent response** **Injection moldability**

1

Maintaining electrical insulation during extreme conditions

The customized LithiumPrevent material was engineered to maintain high dielectric strength during high-temperature and high-voltage events. This was important because the original problem was not simply combustion. Material degradation was contributing to new electrical arcing pathways. By maintaining insulating performance for longer, LithiumPrevent helped reduce the risk of arcing between battery terminals, busbars, and other energized components.

2

Creating a protective char barrier

When exposed to intense heat, the material reacts and forms a structured intumescent char. The char creates an additional protective barrier around the component, helping isolate the affected area and reduce movement of heat and fire toward neighbouring modules. The material therefore supports both electrical isolation and physical fire containment during a thermal event.

3

Supporting complex automotive component designs

The formulation was suitable for injection molding into terminal caps, busbar covers, and internal battery barriers. It could also be CNC-machined during development, which later proved decisive for the program schedule.

THE PROGRAM

From concept to vehicle parts

Materialselection was onlythebeginning. Pyrophobic alsohadtodemonstrate that the proposed solution would work within the customer's battery system and manufacturing process. The development program included:

- Material sample evaluation and preliminary performance testing.
- Prototype design, delivery, and customer testing.
- Final component design and CNC machining of finished vehicle parts.
- Automotive qualification and documentation.
- IMDS material registration.
- Injection molding tooling and production preparation.

The customer's automotive team also visited Pyrophobic during development, allowing the technical teams to review the application, testing, manufacturing plan, and final component designs together.

Accelerating the route to production

The key acceleration decision was to run development and manufacturing activities in parallel. By September 2022, approximately five months after the April discovery meeting, component designs had been finalized but injection molding tooling was still being manufactured.

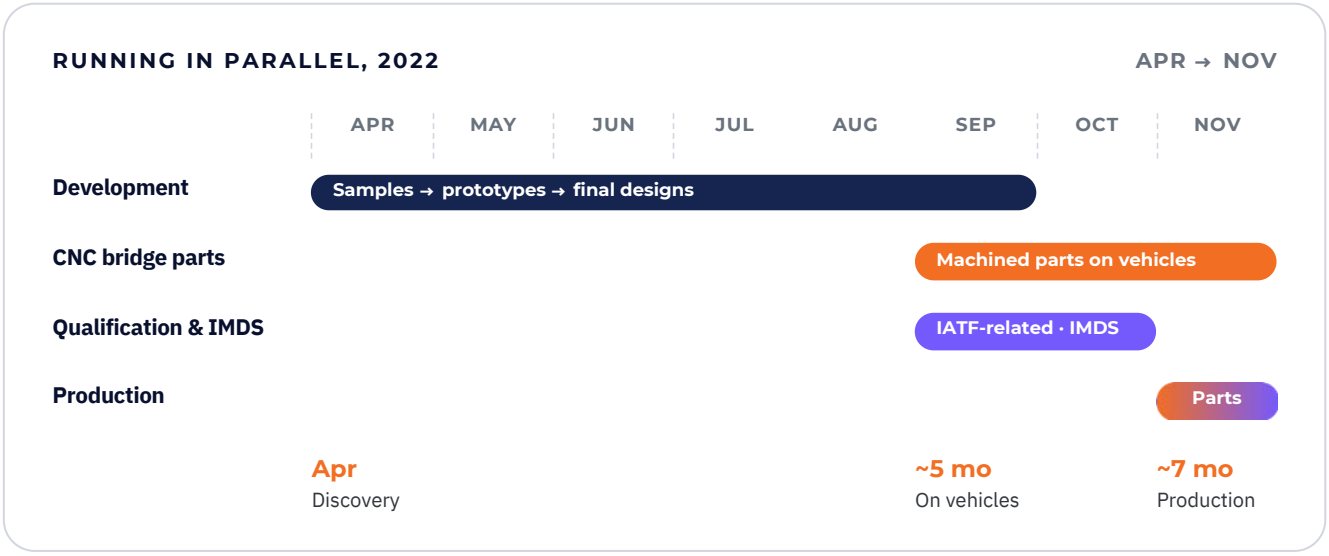
Rather than wait for tooling to be completed, Pyrophobic CNC machined the first finished components from LithiumPrevent material and supplied them for installation on vehicles.

This bridging approach let the customer move forward with vehicle parts while the permanent production process was being completed, without changing the final injection molded design.

In parallel, Pyrophobic completed the required automotive quality and material documentation, including applicable IATF-related qualification requirements and IMDS registration. The IMDS listing was received in October 2022. Rapid tooling followed, and production parts began in early November, approximately seven months after discovery.

PROJECT TIMELINE

Discovery to award, milestone by milestone



2022

April — Discovery meeting with the customer's technical team.

May — Sample materials evaluated and preliminary testing completed.

July — Updated prototypes designed, delivered, and tested.

August — Customer technical visit to review the solution and development program.

September ≈ 5 months — **Designs finalized and first CNC machined parts placed on vehicles, approximately five months after discovery.**

October — Automotive qualification activities completed and IMDS listing received.

November ≈ 7 months — **Injection molding tooling completed and production parts began, approximately seven months after discovery.**

2023

March — Supplier of the Year recognition presented through the customer's annual supplier awards program.

September — Project nominated for the SPE Automotive Innovation Award.

November — **Intumescent terminal protection solution won the SPE Automotive Innovation Award in the Safety category.**

THE OUTCOME

Five months to vehicles, seven to production

5 months

Discovery to first parts on vehicles

7 months

Discovery to production parts

The program reached first vehicle parts in approximately five months and production parts in approximately seven months. A project of this complexity would normally require more than a year, which makes those two milestones the clearest measure of what the parallel development approach delivered.

Production-ready implementation

The program progressed beyond material evaluation and prototyping. It included final component designs, automotive qualification, IMDS registration, injection molding tooling, and serial production preparation. The customer therefore received a scalable manufacturing solution rather than a temporary laboratory concept.

Independent recognition

The collaboration later received Supplier of the Year recognition through the customer's annual supplier awards program. The project was then nominated for the SPE Automotive Innovation Award in September 2023 and won the Safety category in November 2023, providing independent industry validation of the program's innovation and contribution to EV battery safety.

About Pyrophobic LithiumPrevent

LithiumPrevent is a patented intumescent thermoplastic material designed to expand with heat and help prevent and contain thermal runaway in lithium-ion batteries at the cell and module levels. It can be molded into three-dimensional formats for integrated cell holders, spacers, terminal protection, and barriers between modules. **Learn more about LithiumPrevent →**

Facing a similar battery safety challenge?

Contact thePyrophobicspecialists'team todiscuss thermal runaway mitigation or request a sample of LithiumPrevent.

Contact Pyrophobic →

EMAIL salesmkt@pyrophobic.com

PHONE +1 (365) 275-8526

WEB pyrophobic.com