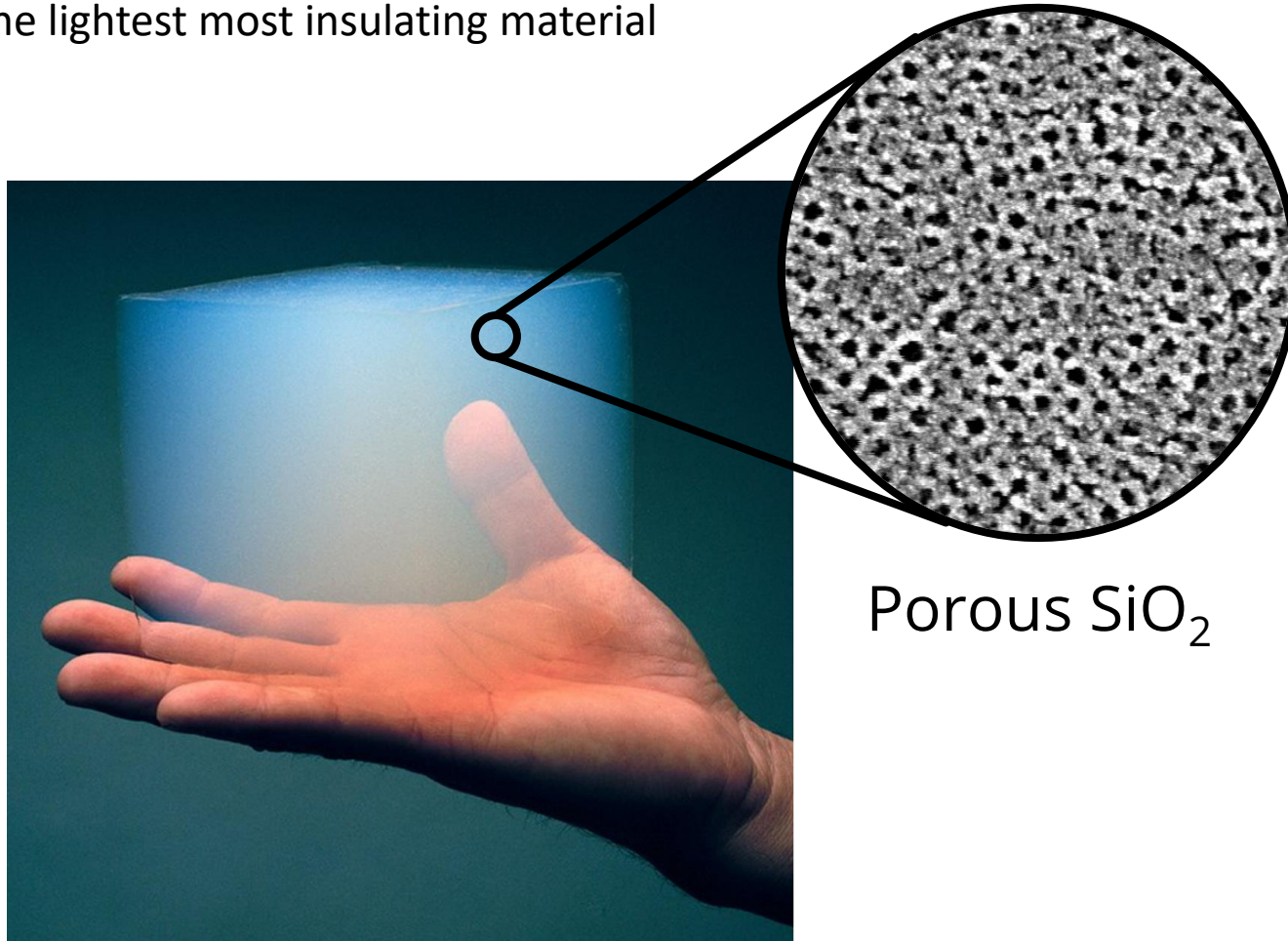


Improvements in Aerogel Barriers for Thermal Management in Electric Vehicles

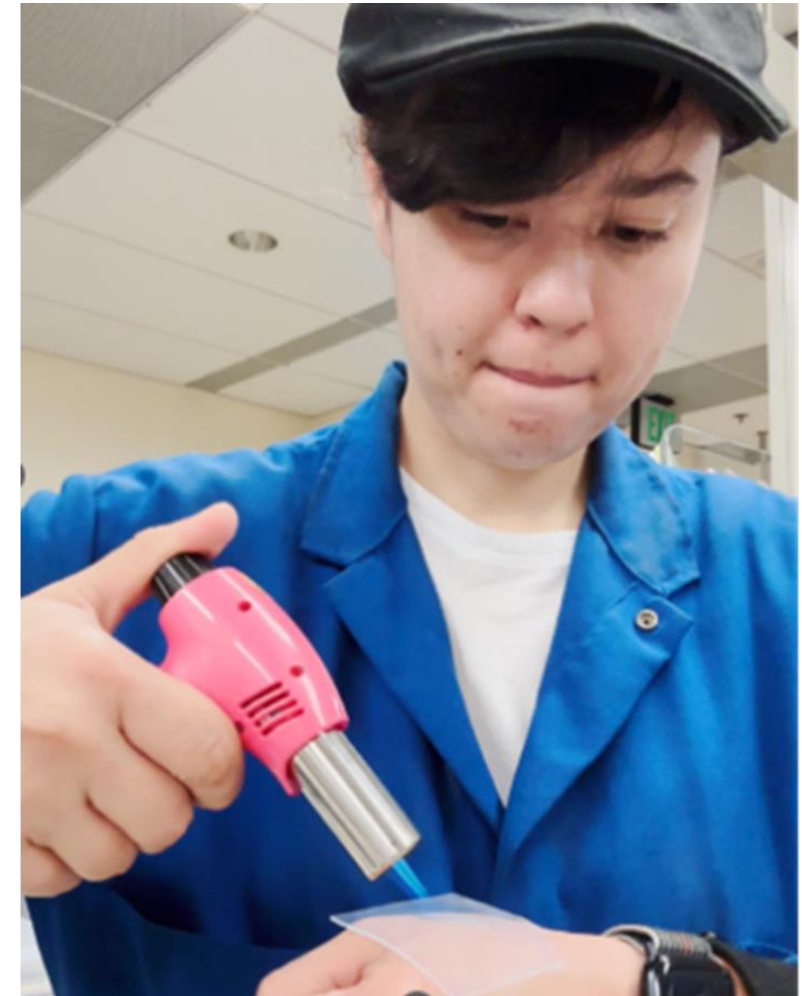
# What is aerogel?

An extremely porous ceramic (>90% empty space)

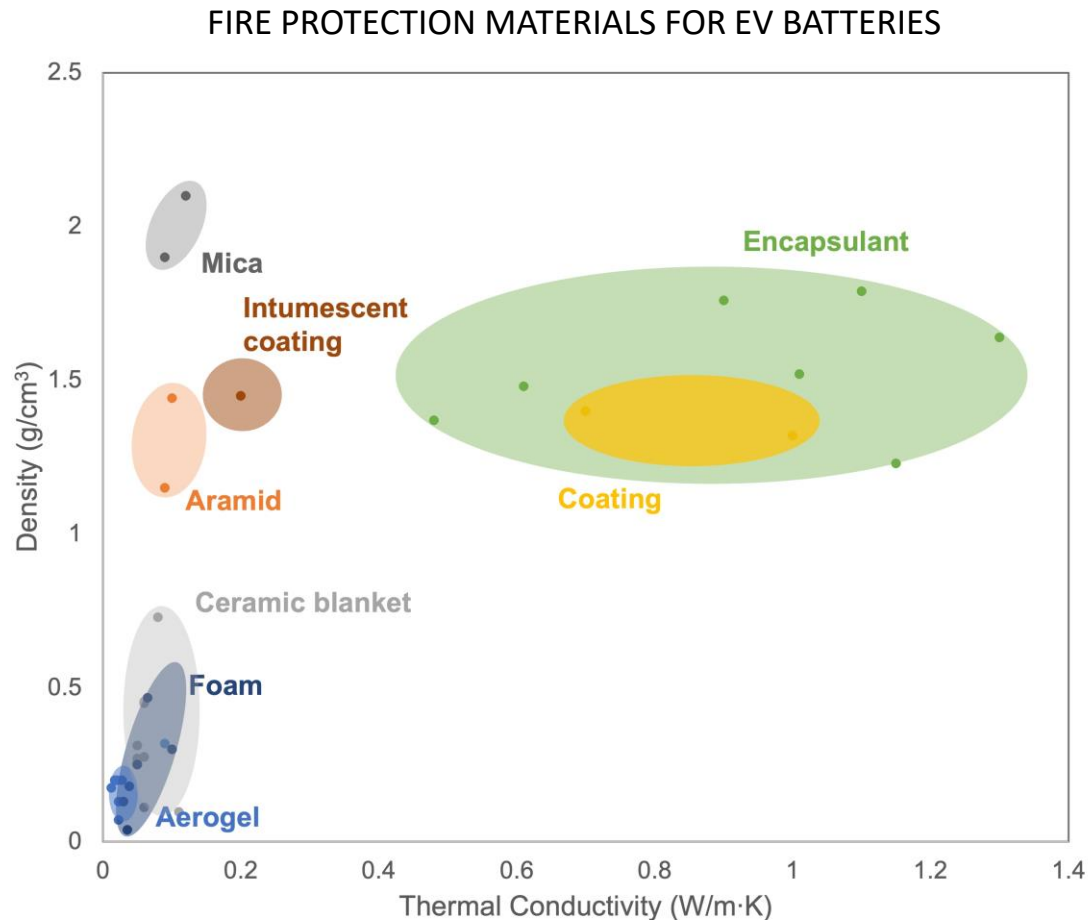
The lightest most insulating material



Porous SiO<sub>2</sub>



Aerogels are ideal for battery insulation but are expensive and challenging to integrate.



### THE ADVANTAGE: [1]

“[Aerogel] aids in keeping cells warm in cold conditions and prevents heat transfer between cells in the event of an overheating cell.”

### THE ISSUE: [2]

“The fragile nature and high-cost processing (in terms of solvent usage and extraction) may compromise its thermal insulation advantage and limit its applications.”

[1] EVs to Dominate Aerogel Applications by 2025, IDTechEx, 2023

[2] Springer Handbook of Aerogels, 2023 (ISBN 978-3-030-27322-4-1)

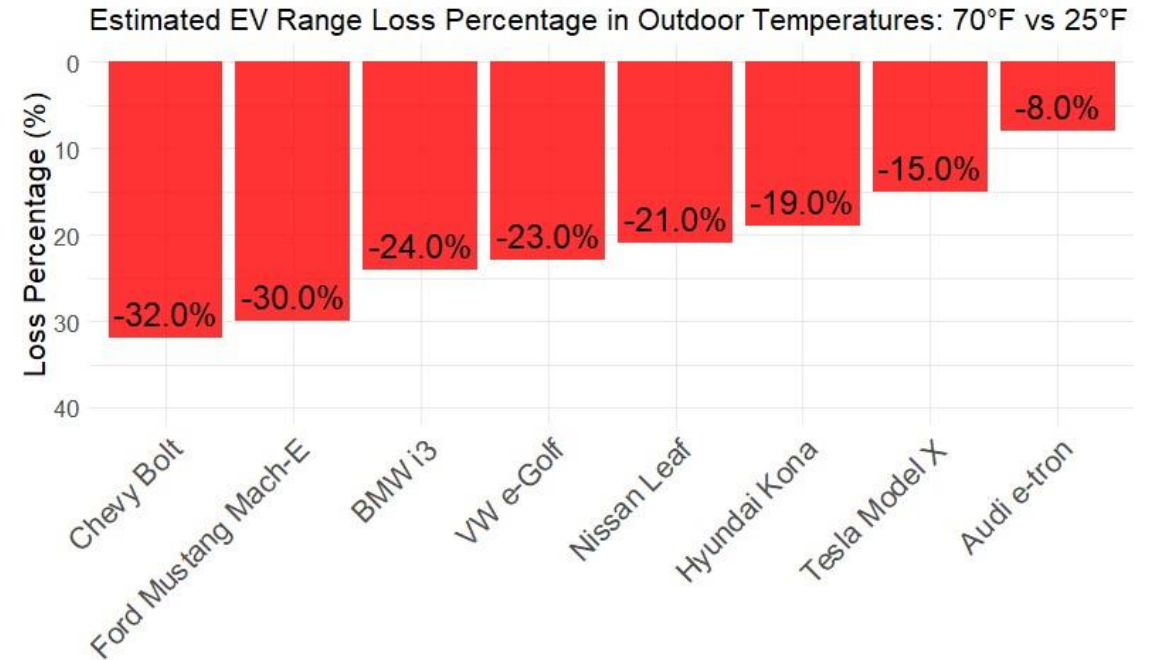
# Our first market will be electric vehicle battery pack protection

## Poor management = pack failure



Smol, N. (2023, June 28). The risk of lithium-ion batteries - thermal runaway in EV's. Fire Isolator. <https://fireisolator.com/the-risk-of-lithium-ion-batteries-thermal-runaway-in-evs/>

## Cold climate = lost range



Data collected from: Person. (2022, December 12). *Winter & Cold Weather EV range loss in 7,000 cars.* Study. <https://www.recurrentauto.com/research/winter-ev-range-loss>



## Introducing ZeroTherm: aerogel-based cell-to-cell thermal barrier for EV battery pack protection.

- For use in pouch and prismatic cells.
- Flexible, compressible design allows for custom cutting to shape.
- Scalable, domestic manufacturing ensures reliable supply chains and lower costs.

**Thermal conductivity**  
**20mW/m-K**

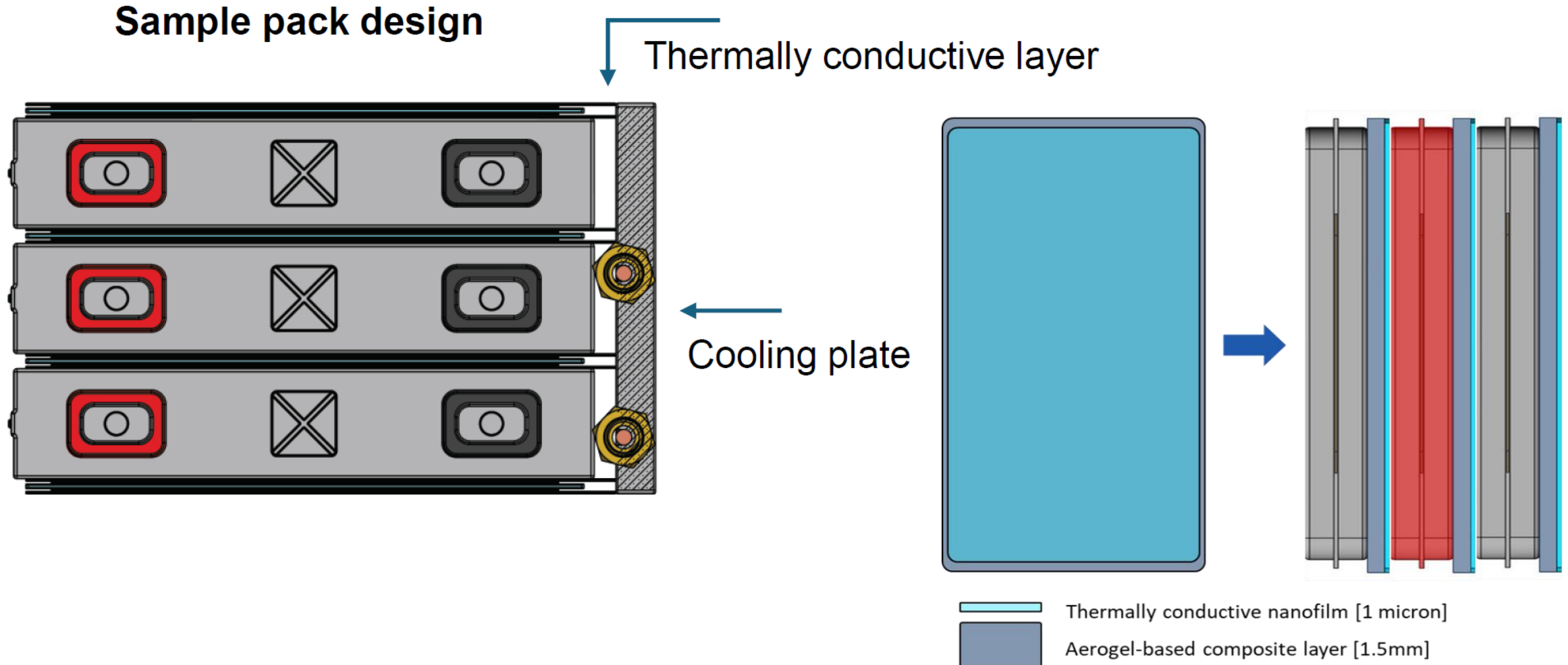
**Thickness**  
**2mm+**

**Max temperature**  
**1200°C**





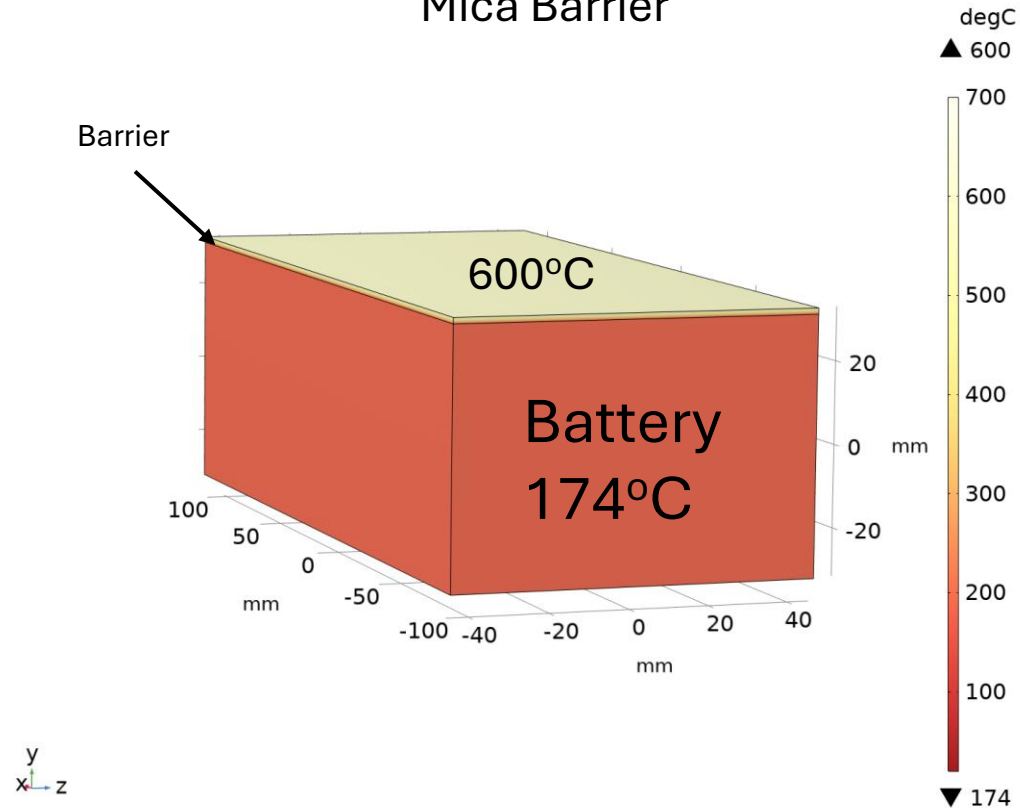
# Aerogel enables simple and effective temperature control designs



# COMSOL 6.2 heat flow model

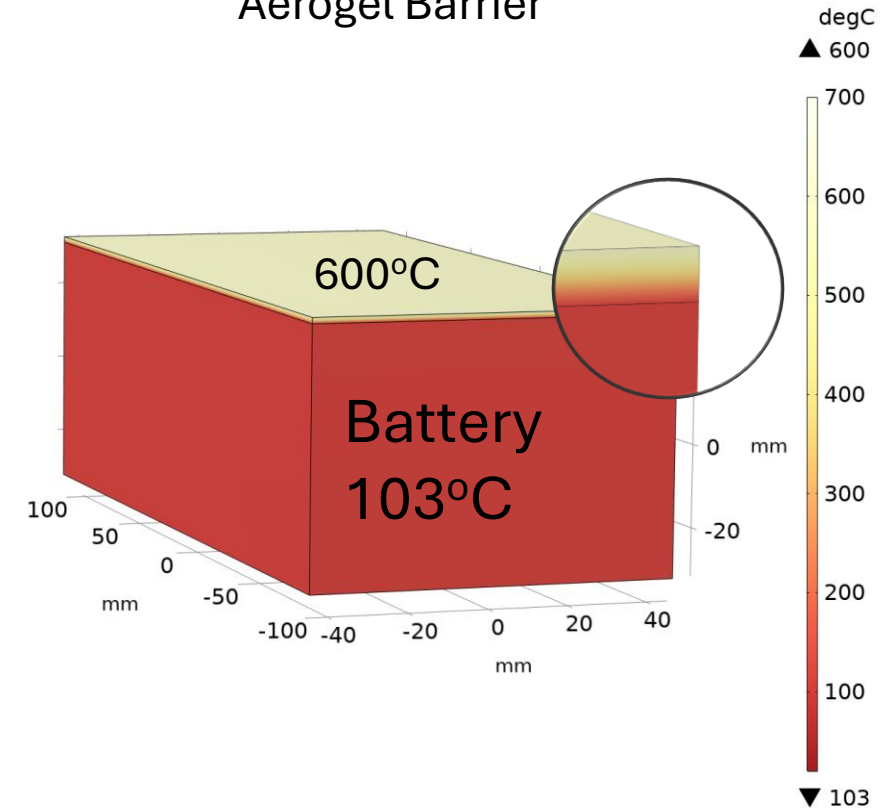
Time=15 min

Mica Barrier



Time=15 min

Aerogel Barrier



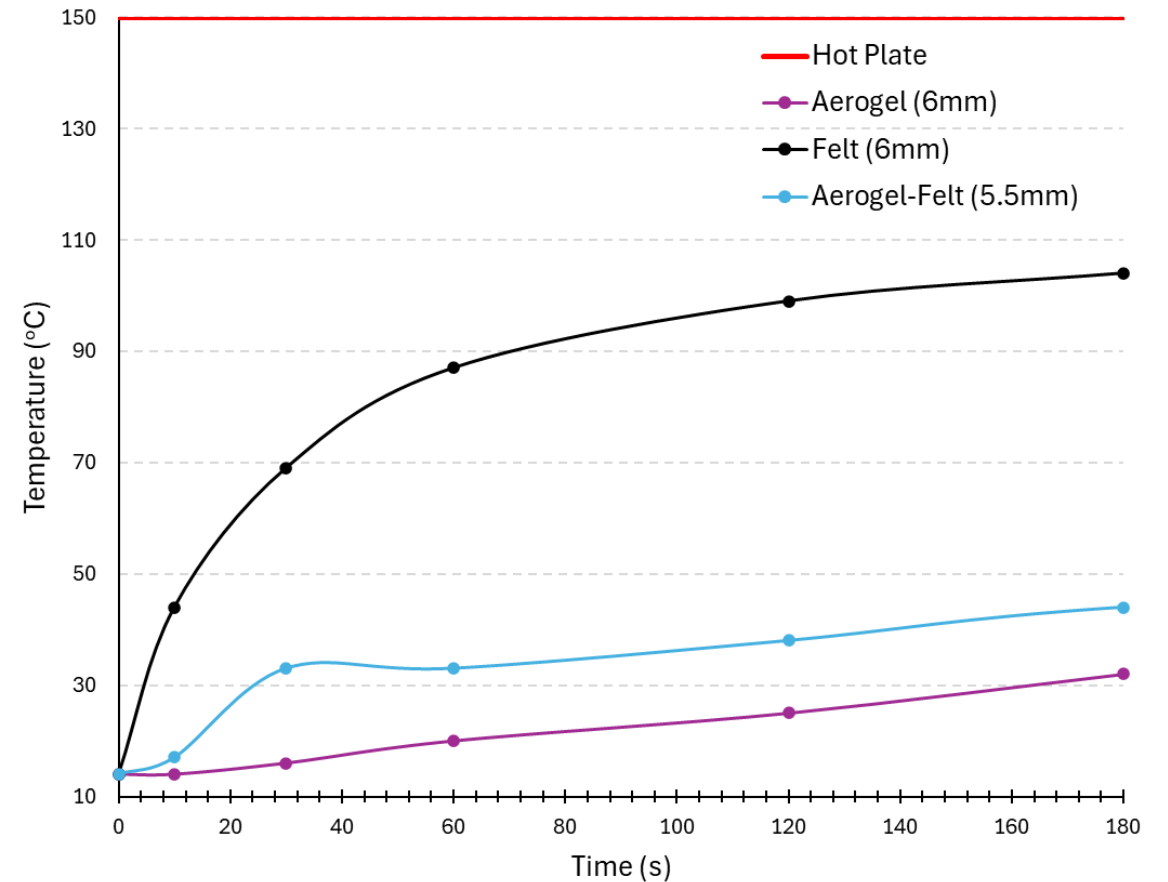
Mica is a common thermal barrier used in EV battery pack design, despite having 10x the density compared to aerogel. In thermal simulation with a heat source at 600°C for 15 mins (reasonable thermal runaway conditions) the battery using a Mica barrier is above 150°C which is the onset of thermal runaway in common Li-ion cells. Aerogel keeps the battery below thermal runaway conditions with sufficient time to respond to the single cell failure and prevent full system failure.

# Practical Demonstrations

Butane blow torch demo at maximum output



Hot plate testing





# Key challenges for aerogel products

## Cost, cost, cost....

Cause	Effect
Specialized equipment	High capex
Batch processing	Poor economies of scale
Specialized processes	High labor costs
High-temperature drying	High emissions and energy costs

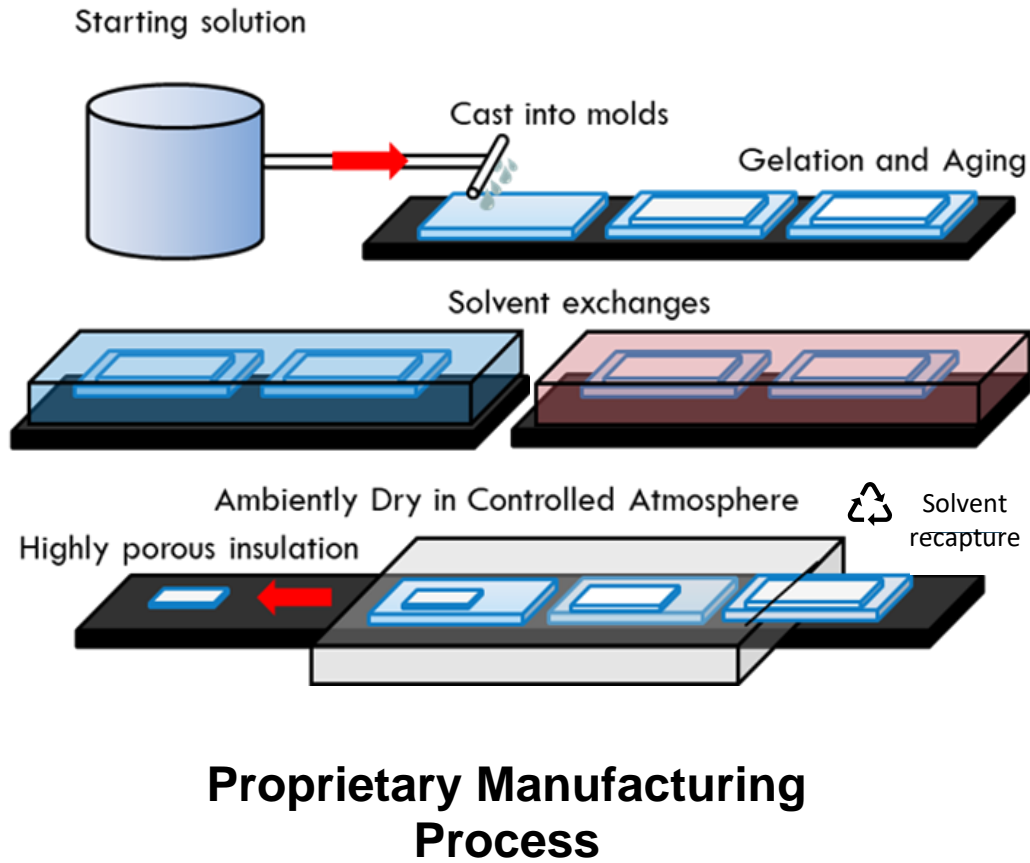
## Product experience....

- Brittle mechanical properties
- Extremely dusty



Conventional supercritical drying chamber

# Key enabler: scalable, low-cost aerogel production



- Manufacturing breakthrough dries aerogels in a dehumidification process that resembles paper drying.
- Continuous, highly repeatable process drastically increases throughput.
- No need for specialized equipment, leading to low capital expenditure.
- Up to 90% cost and 98% emissions reduction through efficient ambient drying.

# How to turn aerogel into next-generation products:

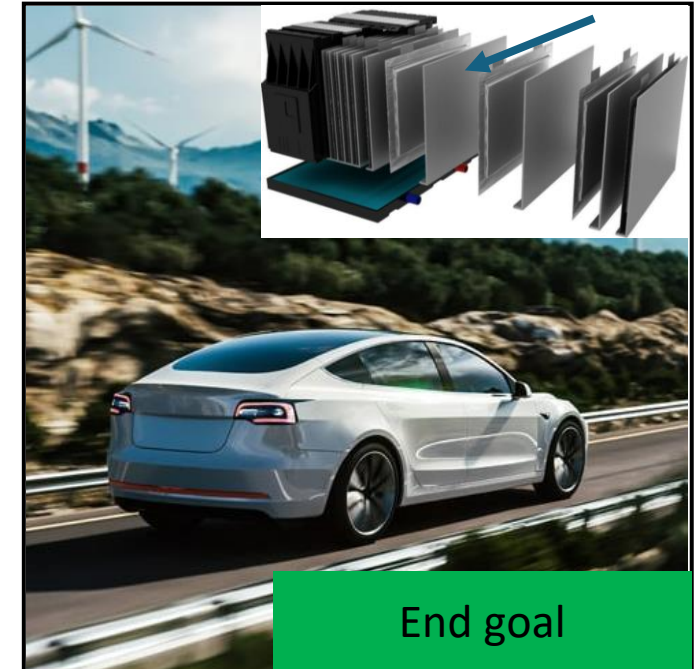
Step 1: scalably and sustainably produce insulating aerogel particles



Step 2: integrate aerogel particles into composite production



Step 3: install aerogel-based composite for superior insulation performance



ZER❄️THERM®

# ZeroTherm performance and safety advantages

**Reduce overall warranty costs:** better thermal management means fewer failures, increased reliability and extended lifecycles.

**Regulatory compliance:** ZeroTherm is being designed to satisfy global EV battery safety guidelines and regulations, including GTR-20 and 38031-2020.

**Expand fleet and consumer adoption:** ZeroTherm helps create an isothermal pack environment in extreme temperatures that improves EV range and reliability.

**Reduce material costs:** lighter material and better thermal management can reduce reliance on bulky, heavy thermal management equipment.



# Team:



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Chief Executive Officer



Daniel Farzannekou  
Chief Operating Officer  
**UCLA**



Dr. Oscar Huang



Justin Wong



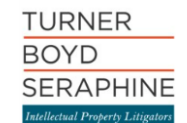
Dr. Bruce Dunn



DC Palter



Fred Hadidi





# Acknowledgments:

## Research Partners



## Funding Partners



## Government Partners





“Westwood Aerogel has validated and has expert knowledge in an ambient drying process for aerogel insulation in a lab environment and is ready for the next phase process scale-up.”

Chung Bothwell, MBA, JD, LLM  
Strategic Partnerships  
Lawrence Livermore National Laboratory



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