ENGINEERED SILICONE SOLUTIONS FOR BATTERY APPLICATIONS

WEVO-CHEMIE GmbH, Battery Show Europe 2023, Stuttgart, 24.05.2023 | Sven Schepers, Sales Manager

AGENDA

1. Company introduction
2. Thermal management for battery applications
3. Mitigating thermal runaway
4. Summary

01

COMPANY INTRODUCTION

WEVO-CHEMIE

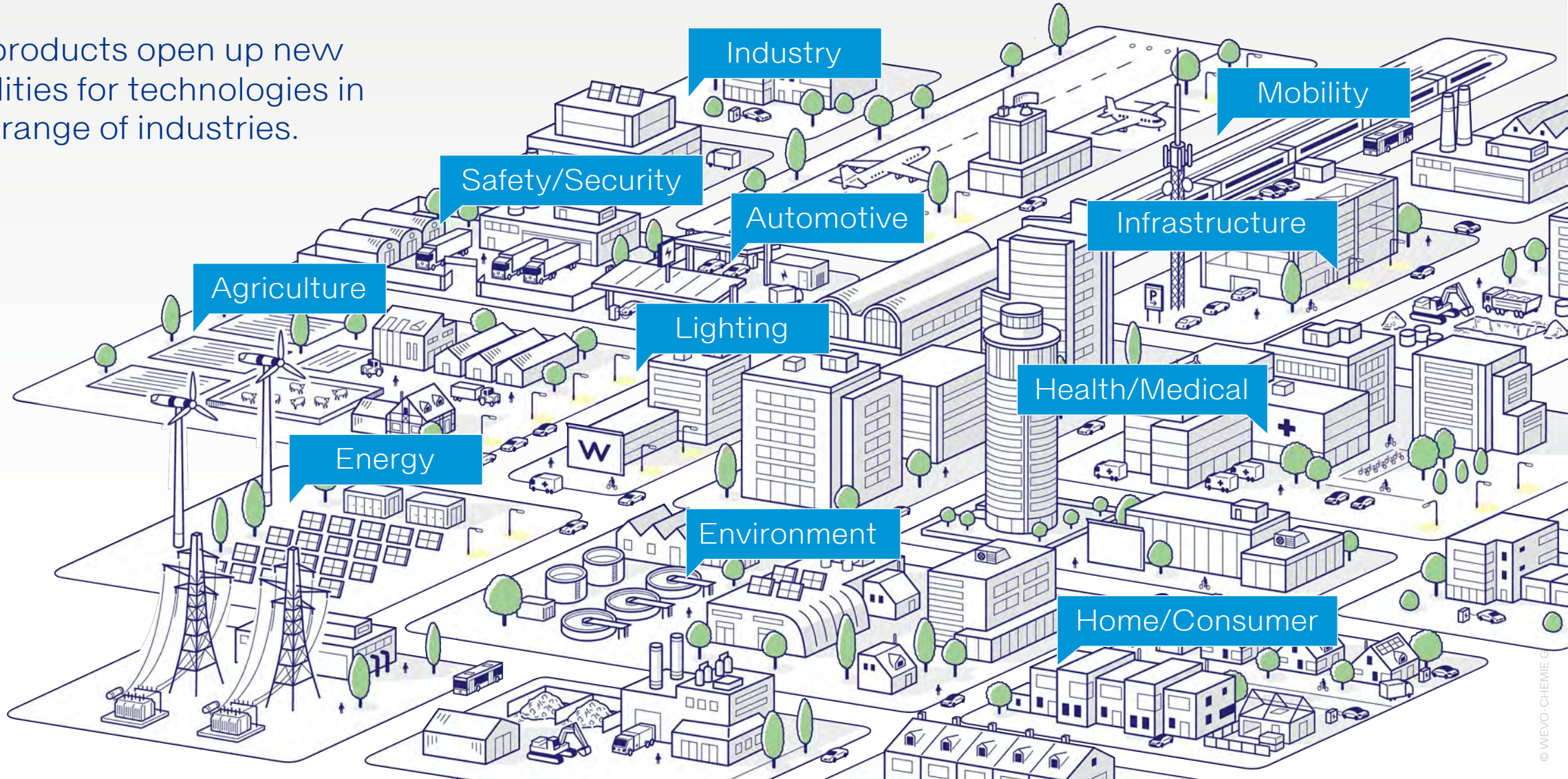
AN INDEPENDENT FAMILY-OWNED COMPANY WITH AN INTERNATIONAL PRESENCE

We are the experts for all encapsulation applications and for special-purpose bonding and sealing applications.

Our customised resin systems are mainly used in electrical and electronic components.

SHAPING THE FUTURE

Wevo products open up new possibilities for technologies in a wide range of industries.

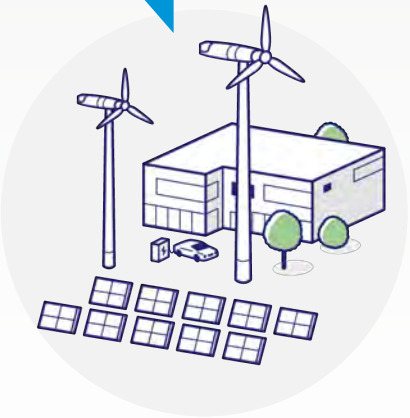


WEVO SOLUTIONS FOR YOUR INDUSTRY

Automotive Mobility

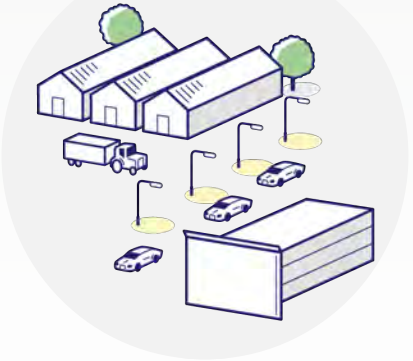
Wevo gets things moving

Energy · Industry Safety/Security



Wevo for secure systems

Lighting

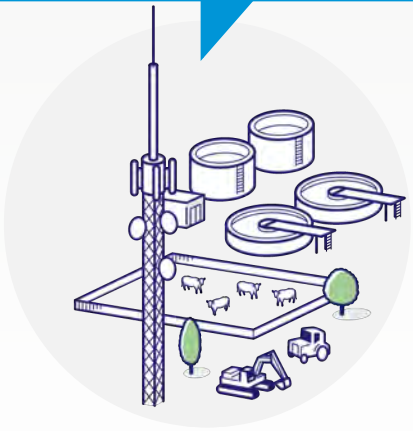


Wevo provides light

Home/Consumer Health/Medical

Wevo is home

Infrastructure Environment · Agriculture



Wevo stands for reliability

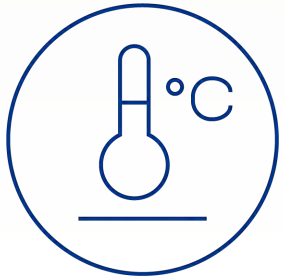
COMPREHENSIVE PROTECTION

RESIN SOLUTIONS FROM WEVO PROTECT SENSITIVE COMPONENTS AGAINST:

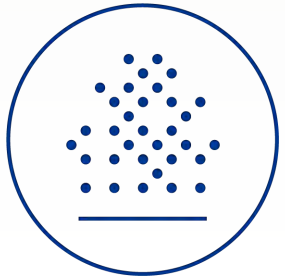
Chemicals

Vibrations

Particles



Temperature



Dust

Humidity

CUSTOMISED PRODUCTS AND SERVICES

Product tailoring

Testing and application support

Aftersales service

Flexible logistics

CERTIFICATIONS AND PRODUCT APROVALS

Wevo-Chemie is committed to supplying innovative products and services that comply with regulations and standards on chemicals and their safe use.

REACH SVHC

UL 94

RTI

DIN EN 60216-1

IATF 16949

RoHS

ExPlast

HWI / HAI

DIN EN 45545-2

ISO 14001

ISO 45001

WEVO IN FIGURES

1st

ISO/TS 16949 certified (since 2017: IATF 16949) supplier in our sector

>50

export countries served by Wevo

>75

years of experience in product development and application technology

>500

Wevo resin formulations available worldwide

1250

customers use our systems

>2 bn

components casted, bonded or sealed with Wevo products every year

PRODUCT PORTFOLIO

THREE PRODUCT CHEMISTRIES FOR CUSTOMISED SOLUTIONS – FOR EVERY REQUIREMENT

WEVOPUR

Balanced systems with
highly configurable profile

WEVOPOX

High-strength systems with
high thermal stability

WEVOSIL

High-elasticity systems with
high thermal stability

02

THERMAL MANAGEMENT FOR BATTERY APPLICATIONS

THERMAL MANAGEMENT FOR BATTERY PACKS

Identified challenges:

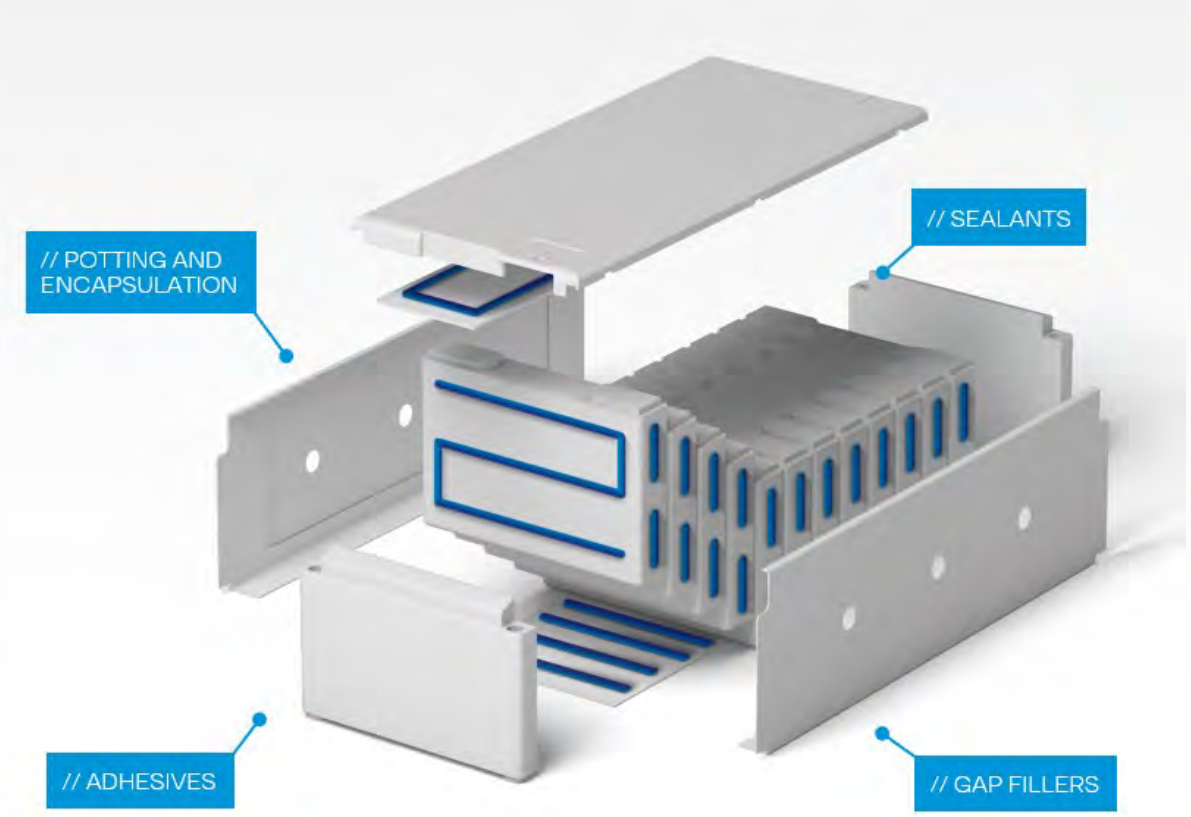
Thermal management solutions using potting or gap fill materials with high thermal conductivity

- For prismatic, round or pouch cells
- For automotive applications or energy storage at home

BATTERY PACK AND MODULE ASSEMBLY FOR ENERGY STORAGE/1

The exponential growth of e-mobility and stationary energy storage results in the need for efficient and fully automated production lines for battery packs and modules.

Wevo's tailor-made thermally conductive and highly engineered WEVOSIL potting compounds and adhesives are used to fix and encapsulate the individual cells in packs and modules and help to dissipate the heat.



BATTERY PACK AND MODULE ASSEMBLY FOR ENERGY STORAGE/2

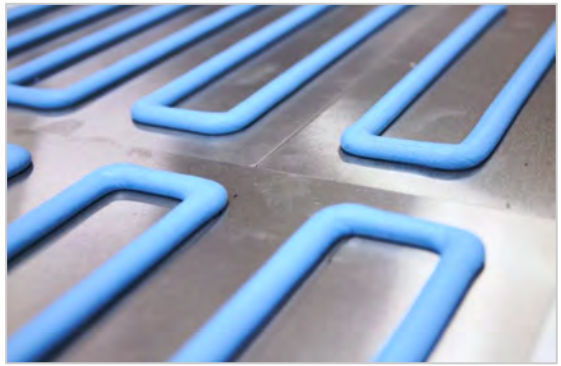
Gap filler:

WEVOSIL 26010 FL “low density”

- 3 W/m·K (ASTM)
- 2.20 g/cm³
- UL 94 V-0 (1 mm)
- BLT < 150 µm

WEVOSIL 26020 FL

- 4 W/m·K (ASTM)
- 3.10 g/cm³
- UL 94 V-0 (2 mm)
- BLT < 100 µm



- Bead application WEVOSIL 26010 FL A/B – WEVOSIL 262020 FL A/B
- Dosing rate: > 5 ml/sec
- Very good anti-settling properties over 12 weeks (no stirring required)

BATTERY PACK AND MODULE ASSEMBLY FOR ENERGY STORAGE/3

Potting materials:

WEVOSIL 22007 FL – low density

- 2 W/m·K (ASTM)
- 2.30 g/cm³
- UL 94 V-0 (1 mm)
- < 15,000 mPa·s

WEVOSIL 22008 FL – low viscosity

- 2.8 W/m·K (ASTM)
- 2.82 g/cm³
- UL 94 V-0 (4 mm)
- < 6,000 mPa·s

03

MITIGATING THERMAL RUNAWAY

SUPPRESSING THERMAL RUNAWAY PROPAGATION/1

Identified challenges:

Thermal runaway of cells as the worst-case scenario

- Spot fire
- Heat spreading
- (Toxic) hot burning gases/particles
- Carbon produced as residue (Connectors/busbars → Short circuit)
  - For prismatic, round or pouch cells
  - For automotive applications or energy storage at home

SUPPRESSING THERMAL RUNAWAY PROPAGATION/2

Methods actually tested/used:

Phase change materials (PCMs)

Organic PCMs:

Pro	Con
Endothermic reaction	Endothermic reaction limited?
Cheap	Carbon producer
	Repairability?

Inorganic PCMs:

Pro	Con
Endothermic reaction	Endothermic reaction limited?
Cheap	Corrosive!
	Repairability?
	High density
	Processability?

SUPPRESSING THERMAL RUNAWAY PROPAGATION/3

Methods actually tested/used:

Mica compounds

Pro	Con
Best heat shield performance	Limited flexibility
Best fire protection	Ready-to-use inserts
	Repairability?
	High density
	Processability?

SUPPRESSING THERMAL RUNAWAY PROPAGATION/4

Methods actually tested/used:

Foam systems

PU foams:

Pro	Con
Very good heat shield	Toxic burning gases
Low density	Carbon as residue
	Repairability?

Silicone foams:

Pro	Con
Very good heat shield	Release of H_2 during curing: 10–20 l/1 kg foam
Low density	Corrosive!
	Repairability?

THERMAL MITIGATION/1

Coating on cells, connectors and busbars:

WEVOSIL 27001 FL A/B

- Creates a silica protective layer
- Can be applied as a coating or encapsulant and in cured form as thin pads on battery cells/assemblies and cell heads or busbars
- Acts as a thermal barrier and allows single fracture/opening to guide venting gases away from adjacent battery cells
- Sticky and soft for self-adhesion properties and to compensate for swelling of cells without delamination
- Easily repairable and refilling
- Does not produce carbon, which could cause short-circuits
- Not corrosive

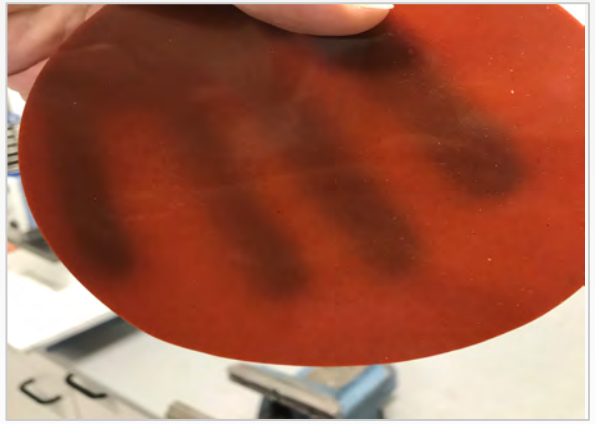
WEVOSIL 27001 FL after 5 min burning @ app. 1000 °C

THERMAL MITIGATION/2

Potting of the whole battery pack with the low-viscous version:

WEVOSIL 22027 FL A/B

- Creates a silica protective layer
- Endothermic reaction (boosted by special additives inside)
- Release of water and CO_2, to dilute and cool down the gases
- Easily repairable and refilling
- Sticky for self-adhesion properties and to compensate for swelling of cells without delamination
- Does not produce carbon, which could cause short-circuits
- Not corrosive



WEVOSIL 27001 FL / 22027 FL

	WEVOSIL 27001 FL A/B, Coating	WEVOSIL 22027 FL A/B, Potting
Type	2-component addition-curing silicone	2-component addition-curing silicone
Operating temperature [°C]	–60 to +250	–60 to +180
Mixed viscosity @ 23 °C [mPa·s]	4,000–8,000	700–1,300
Pot life @ 23 °C [min]	50–70 (adjustable)	50–70 (adjustable)
Curing	Room temperature, can be accelerated by heat or IR	Room temperature, can be accelerated by heat or IR
Shore hardness A	25–35	25–35
Elongation at break [%]	100	100
Melting point [°C]	< –45	< –45
Water absorption 30 d@ 23 °C [%]	< 0.2	< 0.5

04

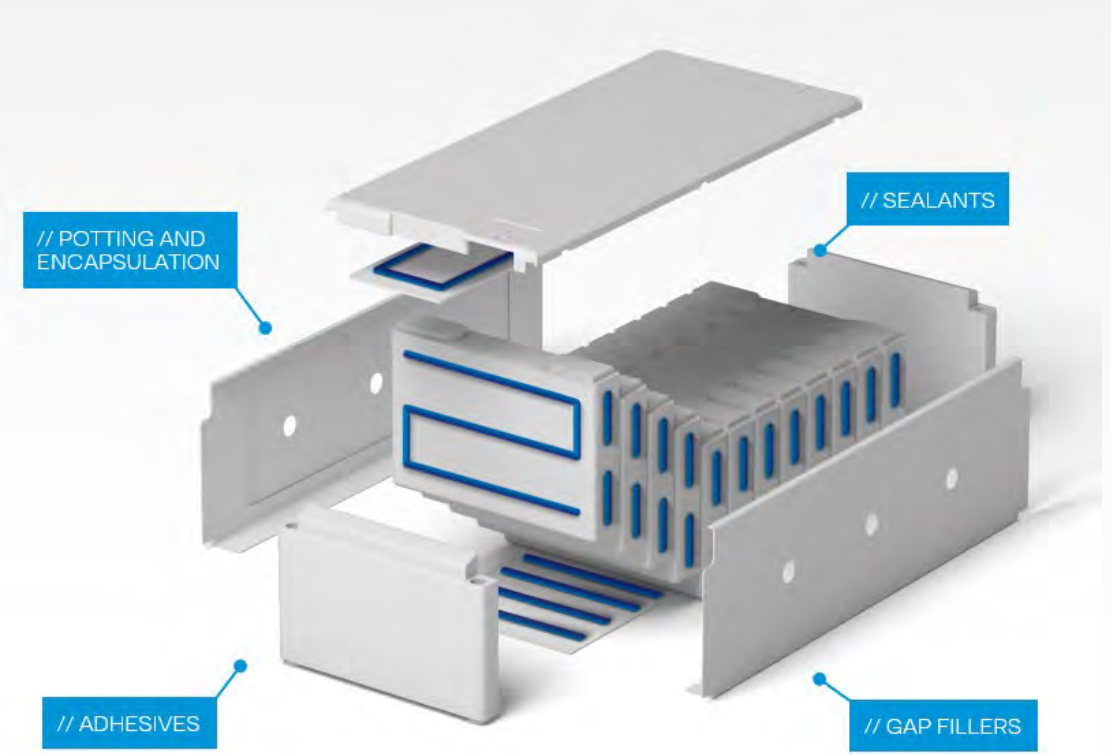
SUMMARY

SUMMARY

Thermal management:
Silicone gap filler and potting materials, also low-density versions, for thermal management of battery systems.

Thermal mitigation:
Silicone potting and coating materials to suppress or prevent the propagation of thermal runaway in all kinds of battery cells.

Very good compromise of all required parameters.



THANK YOU FOR YOUR ATTENTION!
ANY QUESTIONS?

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