

# Huntsman Battery Materials

NAATBATT 2023

## Our Solutions Drive Significant Emission Reductions

**~750M tons**

of lifetime **emissions avoided** each year by our product solutions

Source: Management estimates assured by a third-party review



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# Huntsman Corporation

is a publicly-traded global manufacturer and marketer of differentiated and specialty chemicals. Our products number in the thousands and are sold worldwide to manufacturers serving a broad and diverse range of consumer and industrial end markets.

- ~ 9,000 Associates
- ~ 70 Locations in 30 Countries
- Headquarters and R&D in Houston, Texas
- 2021 Revenue of USD 8.5 billion
- Listed on NYSE in 2005



**Huntsman  
Businesses**

**Polyurethanes**

\$5.0B Revenue

**Performance Products**

\$1.5B Revenue

**Advanced Materials**

\$1.2B Revenue

# HUNTSMAN BATTERY MATERIALS

**ULTRAPURE®** Carbonates  
Electrolyte solvents

**JEFFAMINE®** Amine  
Solid Electrolytes

**ARALDITE®**  
Adhesives for The  
Battery Box

**EUREMELT®**  
Thermoplastic  
Polyamides  
for The Battery Box

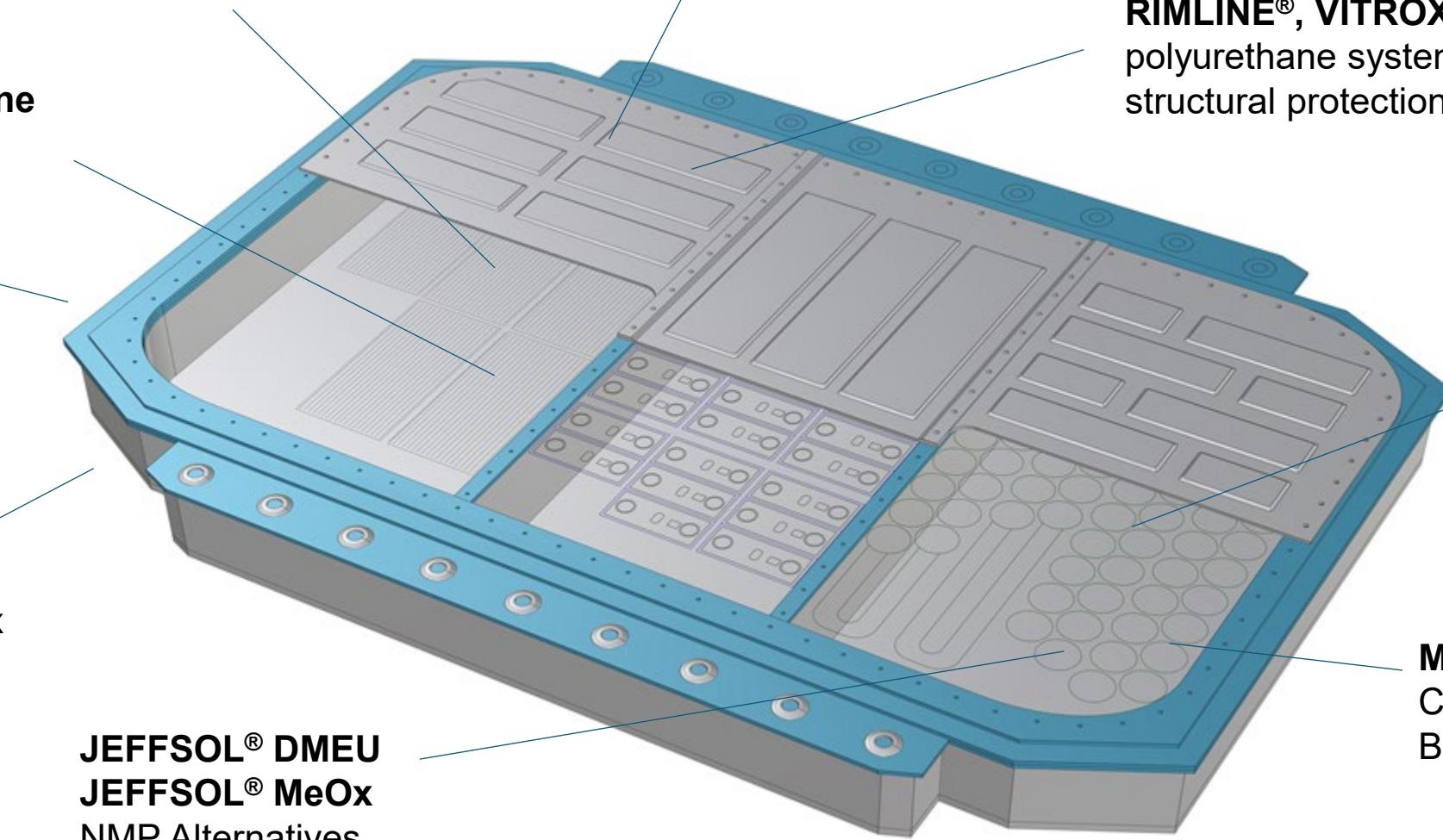
**JEFFSOL® DMEU**  
**JEFFSOL® MeOx**  
NMP Alternatives

**ARALDITE®**  
Composite Box

**RIMLINE®, VITROX®, SHOKLESS™**  
polyurethane system for thermal and  
structural protection

**ARATHANE®**  
Encapsulation  
Systems

**MIRALON®**  
Carbon Materials for  
Battery Cells



# Enabling the Next-Generation of Cell Technologies

# HUNTSMAN

# Dispersant

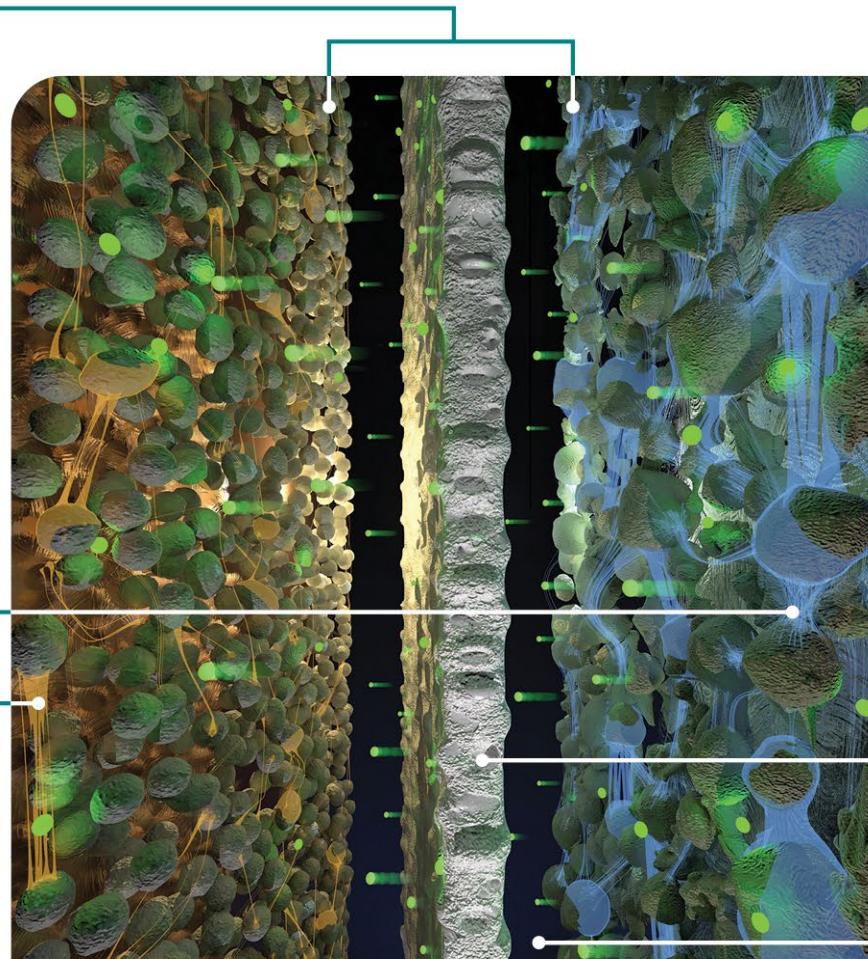
## JEFFSPERSE® Dispersant

## Binders

## JEFFAMINE® Amine Polyurethane Binder

## Conductive Additive

# MIRALON® Carbon Materials



# Separator

## ELASTAMINE® and JEFFAMINE® Amine

## Solvents for Electrolytes

ULTRAPURE® Ethylene Carbonate  
ULTRAPURE® Propylene Carbonate  
JEFFAMINE® Amine for Solid Electrolytes

# ULTRAPURE® Ethylene Carbonate

## Huntsman's Advantage

- Huntsman is the only North American producer of alkylene carbonates, including ULTRAPURE® Ethylene Carbonate and ULTRAPURE® Propylene Carbonate
- Innovating around core strengths in carbonate and amine technology

## Investment

**1974** Conroe Ethylene Carbonate plant

**1999** ULTRAPURE® introduced

**2012** Conroe, TX production of ULTRAPURE®

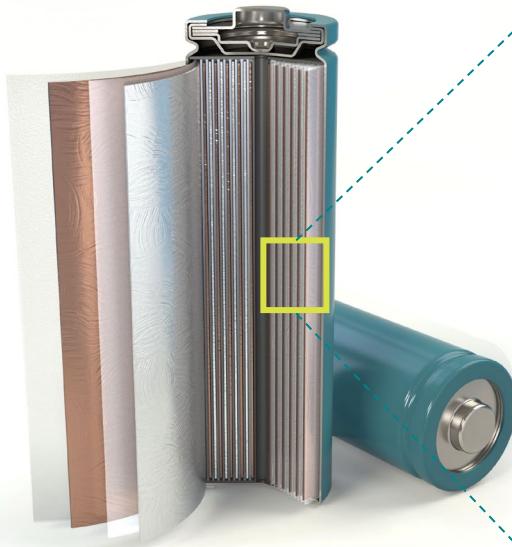
**2013** Introduced EV grade specifically tailored for Electric Vehicles

**2023** Major expansion in USA

**FUTURE** Possible additional expansions in US and Europe



# Building Blocks for Batteries



**JEFFSOL® MeOX** is an alternative to NMP. It is under development as solvent to PVDF for electrode casting. Samples are available to evaluate.

**JEFFAMINE®** polyether amine are versatile and efficient building blocks for high-performance batteries: gel and solid electrolyte components, crosslinkers for binders, and as surface modifiers for high nickel cathode active materials, the tunable EO and PO chains impart rigidity and hydrophobicity

**JEFFSPERSE®** dispersants can be tuned with different EO/PO ratios to provide different HLB-values, Wide Molecular Weight range, Flexible Polyether Backbone, and Amine Functionality for further modification

# MIRALON® Carbon Materials

## Market Applications & Scale-Up Plan

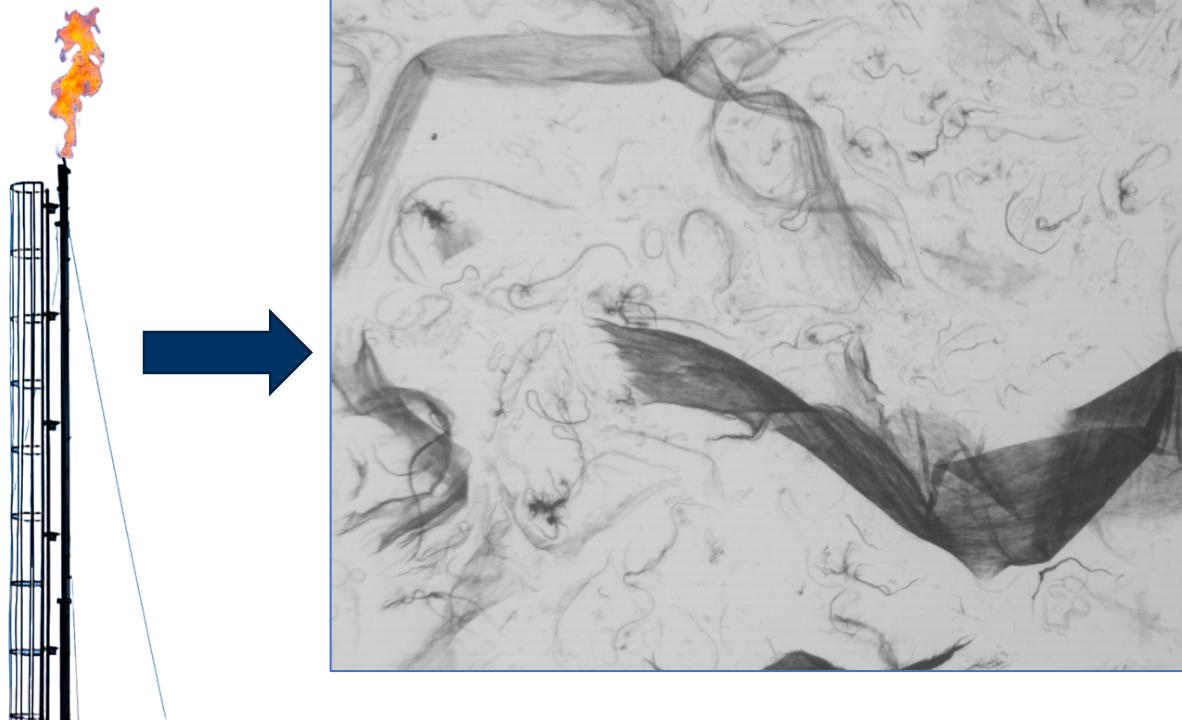
**HUNTSMAN**

Enriching lives through innovation

### Problem

Oil & Gas industry flares natural gas:

- Methane has 28x more global warming potential than CO<sub>2</sub>



**Mirakon®**

**2010**

Technology development

**2015**

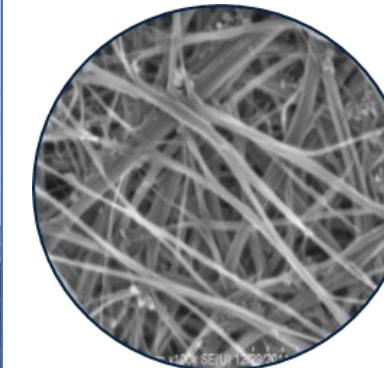
Lab scale & experimental sales

**2019**

Micro plant & experimental sales

**2021**

Mini plant & experimental sales



**2022**

Pilot Plant & commercial sales

**2023**

1st Commercial scale plant 30 tones/year  
Step change in unit cost

**2024+**

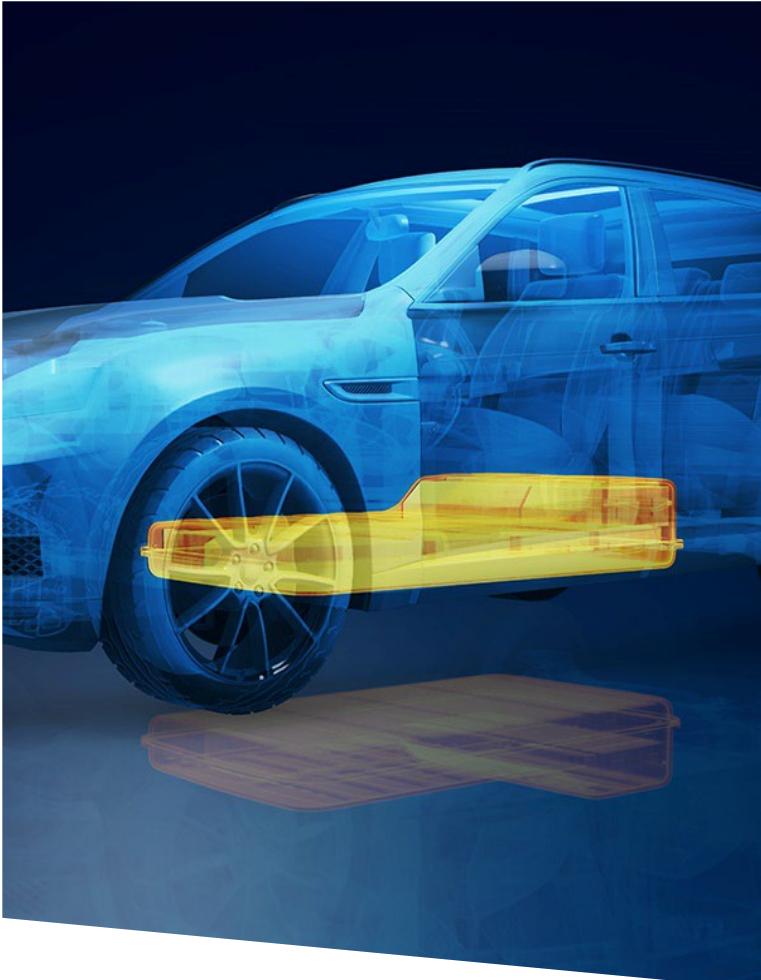
Replicate, scale & improve

# ARALDITE® Resin Systems

for Composite Battery Housings can save up to 40% weight

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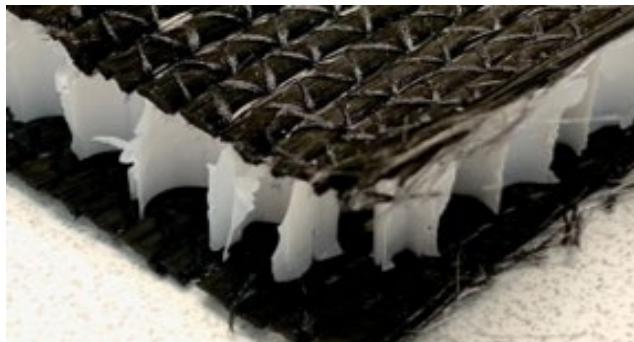
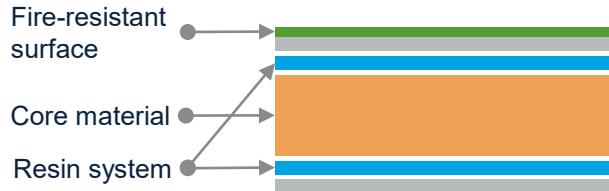
**ARALDITE®** epoxy systems enable composite battery housings to meet GB/T 31467.3-2020, UL94 or GB/T 2408 certification goals, impart EMI shielding, and at mass production scale

**ARATHANE®** polyurethane resins enable battery cell encapsulation with well-balanced adhesion and heat dissipation properties with UL 94 V0 flame retardancy rating

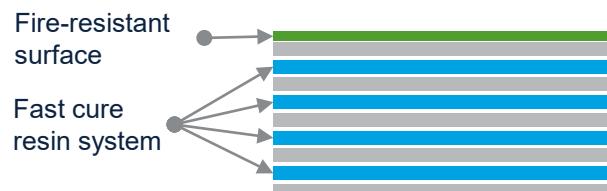
**EUREMELT®** enables encapsulation of electronic devices in a single step of low-pressure molding with advantages of sustainable materials based on renewable resources (up to 90 w% depending on grade), no solvent needed, curing reversible by melting, and safe due to low tox profile

# Polyurethanes – concepts of composite systems

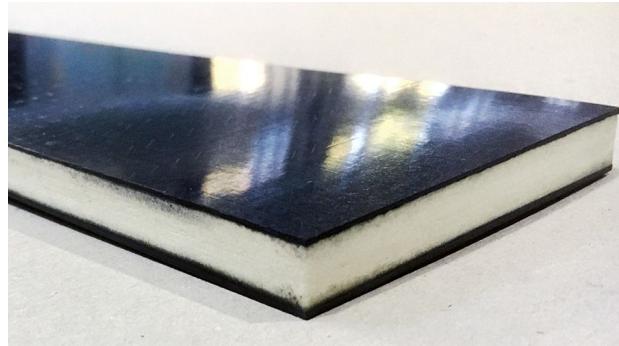
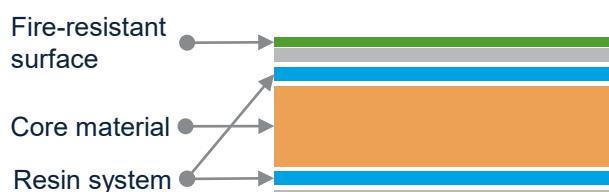
Sandwich panel design with lightweight core material



Mass production resin system with addition of intumescent function on the surface



Sandwich panel design with lightweight core material



## VITROX® HC Advanced CSM system

- Resin on glass or carbon fiber reinforcement over a polycarbonate honeycomb core
- High stiffness-to-weight ratios, tunable resin reactivity, broad processability
- High part integration capability, complex geometries, low tooling cost and low molding pressure

## VITROX® RTM polyurethane system

- Low viscosity, short cure time, and tunable injection time
- Thermal resistance and strong fiber-matrix adhesion
- Can be used for semi-structural and structural applications

## RIMLINE® FC system for a foam core boards

- Large density range
- Moldable in 3D and ready to Overmold
- Usable in RTM and WCM

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