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BASF – We create chemistry for a sustainable future

BASF Company Introduction

87.3 b€ (USD 92Bn) **2022** sales	Our chemistry is used in almost **all** industries	**6** Verbund sites and 239 other production sites	**82,000** customers from various sectors globally	**111,481** **employees**

01 We are committed to **reduce our absolute CO2 emissions by 25% by 2030** and **aim net zero emissions by 2050**.

02 We started and will continue to invest into our **battery material business**.

03 Our goal is to become **the most sustainable CAM producer** with the **best-in-class CO2 footprint** globally.

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BASF offering

BASF solutions for e-mobility applications

Thermal management

Car body
- NIR-reflective pigments
- NIR-reflective coatings
- Insulation materials

Interior parts
- NIR-reflective pigments

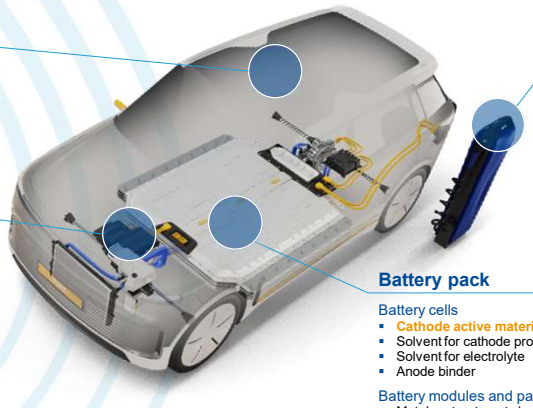
Electric powertrain

Power electronics
- Coolants (Glysantin®)
- Media-resistant plastics
- Thermally conductive plastics
- Flame-retardant plastics
- EMI shielding for engineering plastics

Electric motor
- Metal pretreatment chemicals
- Components for lubricants
- Coolants (Glysantin®)
- Media-resistant plastics
- Motor mounts (Cellasto®)
- Subframe mounts (Cellasto®)
- Motor cover for NVH

Driveline
- Axle and gear lubricants
- Components for lubricants

Fuel cell
- Coolants (Glysantin®)
- Coolant pipes
- End plate & media distribution plate



Charging infrastructure

Housing and structural parts
- Metal pretreatment chemicals
- Anti-corrosive coatings
- Flame-retardant plastics

Cable and connectors
- Cable jacketing
- Flame-retardant plastics

Thermal management
- Media-resistant plastics
- Thermally conductive plastics

Battery pack

Battery cells
- Cathode active materials (CAM)
- Solvent for cathode production
- Solvent for electrolyte
- Anode binder

Battery modules and packs
- Metal pretreatment chemicals
- Anti-corrosive coatings
- Flame-retardant plastics
- EMI shielding for engineering plastics
- Battery mounts (Cellasto®)

Thermal management & power supply
- Coolants (Glysantin®)
- Media-resistant plastics
- Thermally conductive plastics
- High performance thermal insulation

BASF's innovations advance e-mobility applications

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BASF's leading position in battery value chain

An integrated Battery Materials & Recycling solution

Mining | Base Metal Refinery | **BASF Battery Materials** | Systems and applications

Ni/Co/Mn ores | Ni/Co/Mn salts | **PCAM** | **CAM** | Cells/Batteries | OEMs

Precipitation | Calcination | Post-Treatment

$MeSO_4 \xrightarrow[NH_3]{NaOH} Me(OH)_2 \xrightarrow[O_2]{LiOH} Li_{1+x}Me_{1-x}O_2$

Ni, Co, Mn, Li, (Cu) | Base Metal Refinery | Black mass processing | Dismantling / discharging | Battery pack collection

Purification | Solvent Extraction | Pyrolysis | Crushing/Sorting

BASF Battery Materials Recycling

BASF with Partners

CAM: Cathode active material
PCAM: precursor of CAM
Me: Metal like Ni, Co, Mn, Al...

Full service along the battery value chain with tailor-made solutions for our customers

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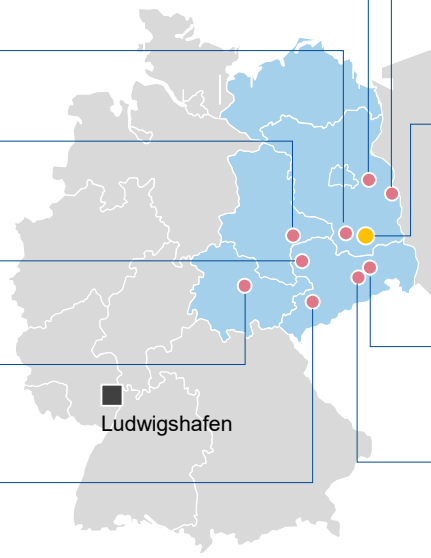
Location of Schwarzheide
Electromobility Cluster



Lauchhammer
SVOLT

Bitterfeld
FARASIS
Farasis Energy (Germany) GmbH

Leipzig
BMW AG (i3, i8, iX mod.)
Porsche Leipzig GmbH

Erfurt
CATL
CATL GmbH

Zwickau
VW Sachsen GmbH (ID3 & ID4)
Audi (Q4 e-tron)
Audi

Ludwigshafen

Grünheide

Guben
RockTech Lithium

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BASF Schwarzheide GmbH

GOVECS GROUP
Wroclaw
Govecs Poland (e-Schwalbe)

ACCUMOTIVE
Ein Unternehmen der Daimler AG
Kamenz
Accumotive GmbH & Co. KG
(Batteries for Smart & EQC)

Dresden
Volkswagen Sachsen GmbH
Gläserne Manufaktur (ID3)

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EBMI-CAM 1.0 Schwarzheide

- **Block field G500**: Two Production Buildings, with each:
  - Building: 5,625 square meters, with the highest point reaching 48 meters
  - ≥ 700 pieces of equipment
  - ~ 1300 Pipes (> 28 km)
- **Construction start** August 2020
- **Inauguration** June 2023

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New EU regulatory framework for batteries

Key specific provisions for EV lithium-ion batteries[1]

	Today	2025	2026	2027	2028	2031	2032	2036
Battery Collection & Treatment	No loss policy; all collected waste batteries to enter a recycling operation							
Recycling Efficiency of LIB	50%		65%			70%		
Metal Specific Recovery Rates					Nickel, Cobalt, Copper 90% Lithium 50%		Nickel, Cobalt, Copper 95% Lithium 80%	
Recycled Content (+ from production scrap)					Recycled content declaration	Cobalt 16%, Nickel 6% Lithium 6%		Cobalt 26% Nickel 15% Lithium 12%
CO_2 Footprint		Carbon Footprint (CF) declaration		CF performance classes	Maximum carbon footprint thresholds			
Due Diligence		Responsible raw material sourcing obligations with third-party verification						
Battery Passport				Electronic record (battery passport)				

[1] According to the political agreement on the EU Battery Regulation from Dec 2022. Final adoption of the Regulation expected by end Q2 2023 (with no major changes). All starting points of specific requirements in this presentation are based on the assumption that the Regulation enters into force in June/July 2023.

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We are embarking on an ambitious journey to become a global leading battery recycler

Timeline

2021
- First contract on recycling with major OEM

2022
- BASF offerings through Partner Network
- External pilot trials for refining process development

2023
- BASF build new Battery Recycling Prototype Plant in Schwarzheide, Germany
- Long-term storage for Black Mass
- First activities in NA

2024
- BASF Black Mass Commercial Scale Production plant in Schwarzheide, Germany

2026
- Expansion of Black Mass production capacity by factor ~2

Mid 2020's
- Commercial BMR plant mid decade

Global Footprint being developed in parallel

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Commercial black mass plant, Schwarzheide

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BASF's process is flexible to accommodate for varying feed types of production scrap and EOL batteries

Black mass production | Technology

Production scrap

EOL batteries

→ Mechanical treatment → Thermal treatment → Mechanical treatment → Thermal treatment → Pyrolyzed black mass

Crushing

Performed under inert atmosphere. Crushing is required to liberate material and allow for further processing

Vacuum Drying

Performed to remove the majority of electrolyte otherwise particles will stick together and become difficult to separate.

Safety concern minimized from the removal of flammable components

Sorting and Delamination

Performed to separate plastics, Cu, Al and other fractions

Pyrolysis

Pyrolysis enables the removal of organics components and reduces halogenic content. The pyrolysis process usually takes place at around 500 °C, in the absence of oxygen and is limited by the melting point of Al (660 °C)

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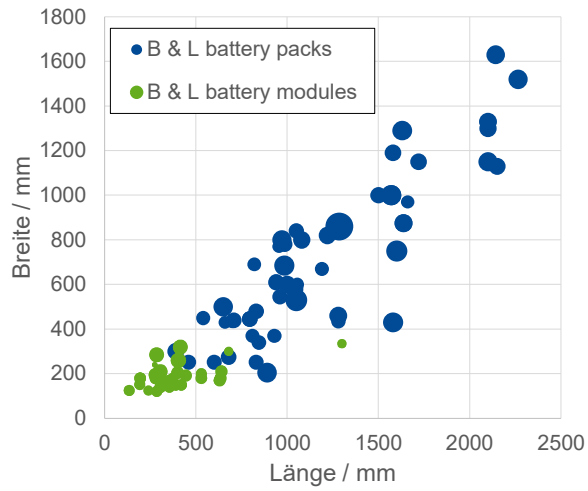
Abmessungen von LIB Systemen vs. LIB Module



- Höhe LIB-Systeme
  - Min: 160 mm
  - Max: 760 mm
- Höhe LIB-Module
  - Min: 20 mm
  - Max: 216 mm

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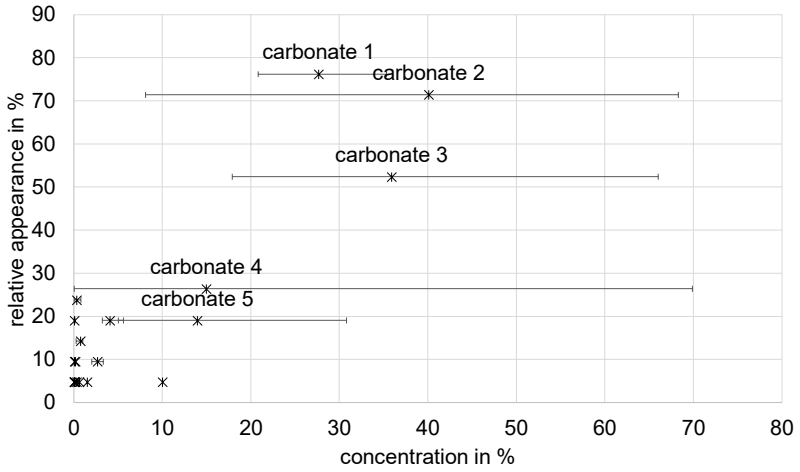
Electrolytes in LIB (frequency of occurrance)

- diethyl carbonate
- dimethyl carbonate
- ethylene carbonate
- ethyl-methyl carbonate
- propylene carbonate
- others

data base: automotive battery cells



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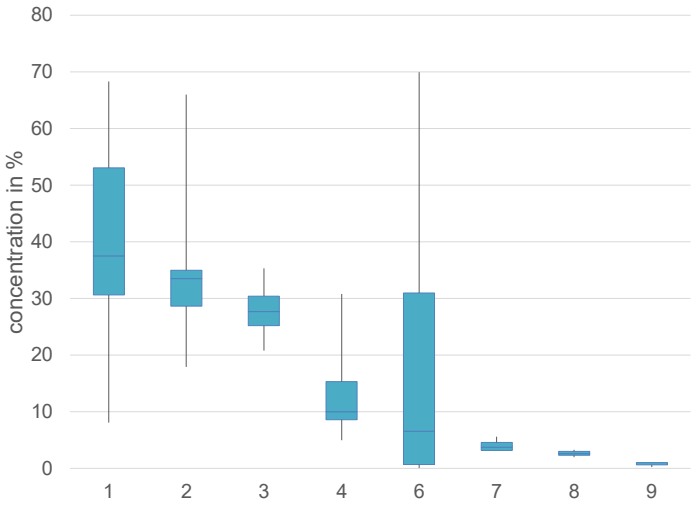
Electrolytes in LIB (concentration)

- 1,3-propane sultone
- cyclohexyl benzene
- diethyl carbonate
- dimethyl carbonate
- ethylene carbonate
- ethyl-methyl carbonate
- methylphenyl carbonate
- propylene carbonate
- others (not shown: relevant for less than 5 % of cells OR with a $c_{75\,\%}$ below 1 %)



data base: automotive battery cells

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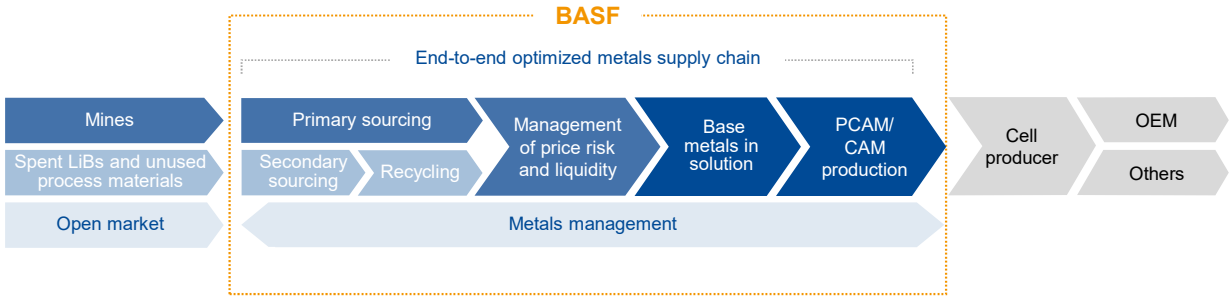
We combine metal sourcing, trading and recycling globally, to reduce supply risk and ensure EHS compliance

Metals Management



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