



Plastics in automotive engineering

In the field of tension between new drive concepts and sustainability

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BASF SE

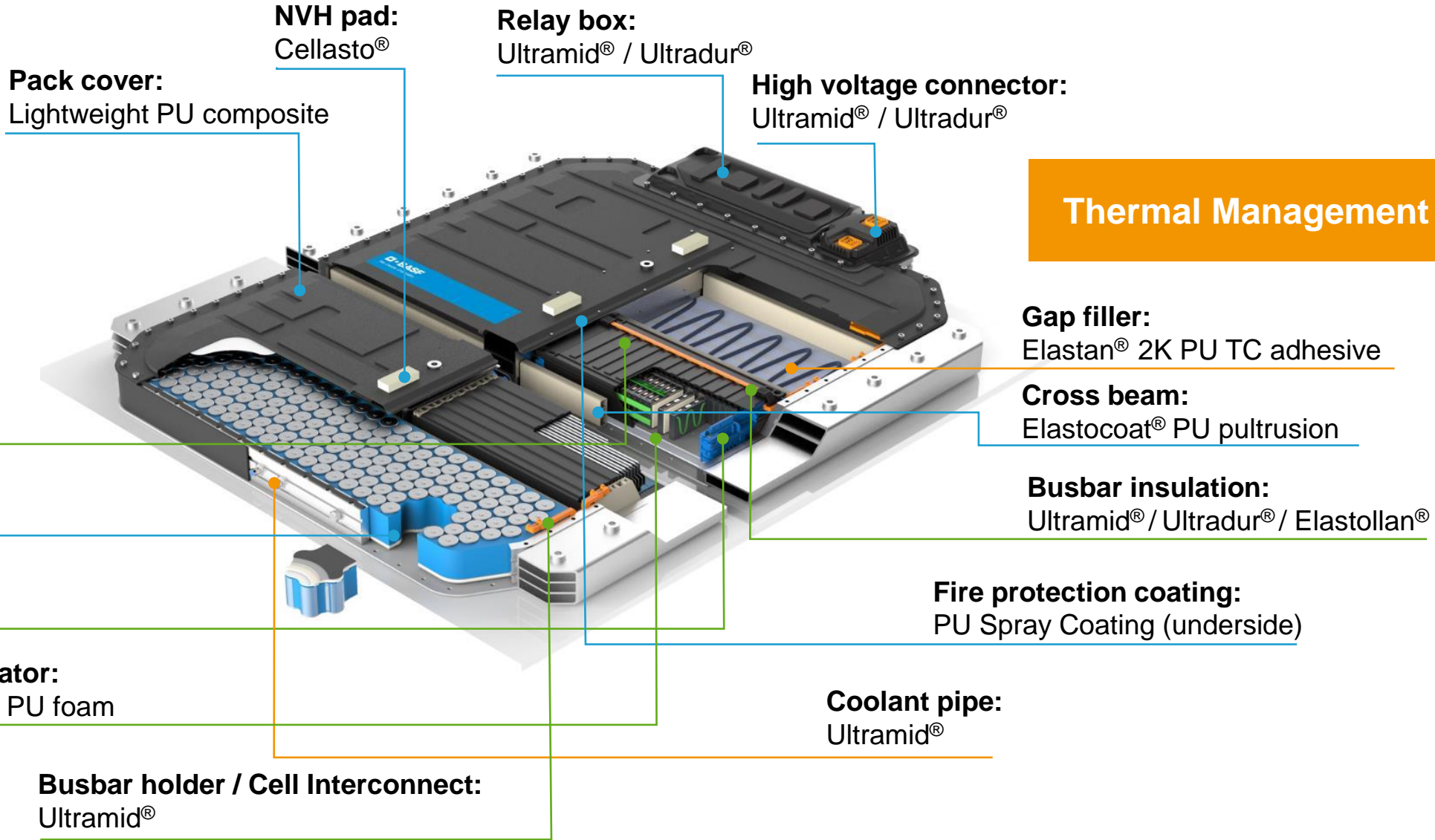
Car Symposium Bochum, 03.05.2023

**BASF**
We create chemistry

BASF Performance Materials: Polymer solutions for HV batteries

Battery Pack

Battery Module



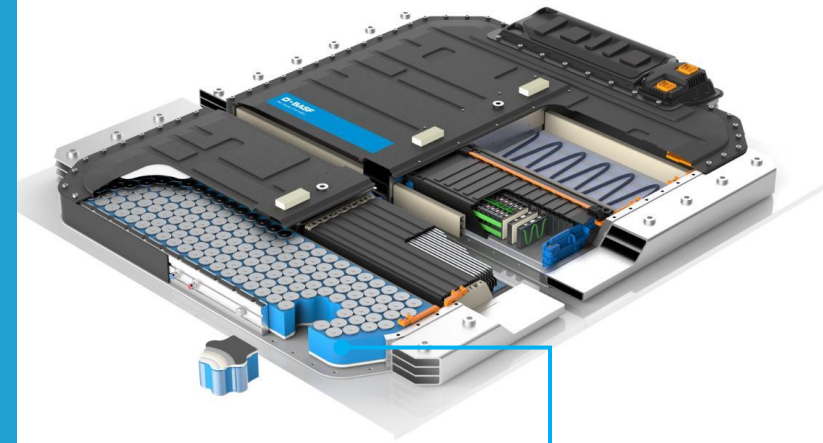
BASF PU potting solutions for Cell-to-pack / cell-to-body design

Key properties & features

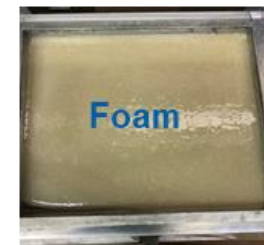
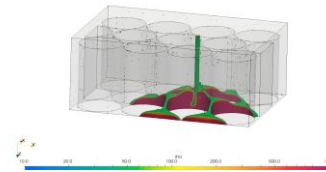
- Broad density range, foam or compact
- High bonding capacity and stiffness
- Fully customized reaction behavior for optimized industrial production processes
- Thermal conductivity combined with electric insulation with optional flame retardance

Customer benefits

- Fast-track development of individualized formulations
- Process related knowledge on flowability and viscosity supported by inhouse foaming and crash simulations
- Studies of bonding on variable substrates, thermal and electrical properties



t=5s



Thermal Conductive Adhesives

2C Polyurethane solution for thermal interface management in battery packs

Key properties & features

- Thermally conductivity up to **2W/m•K**
- High adhesion performances to multiple surfaces
- **Low squeeze flow** (low compression force) to avoid deformation of the cooling plate during **battery assembly**
- **Customizable open time** for various assembly models

Customer benefits

- Optimized filler concept with **improved cooling performance** and low abrasion characteristics
- High dispensing rate up to 60cc/sec and low application time to improve productivity
- **Silicon free** system to avoid painting functionality issue



Battery Pack

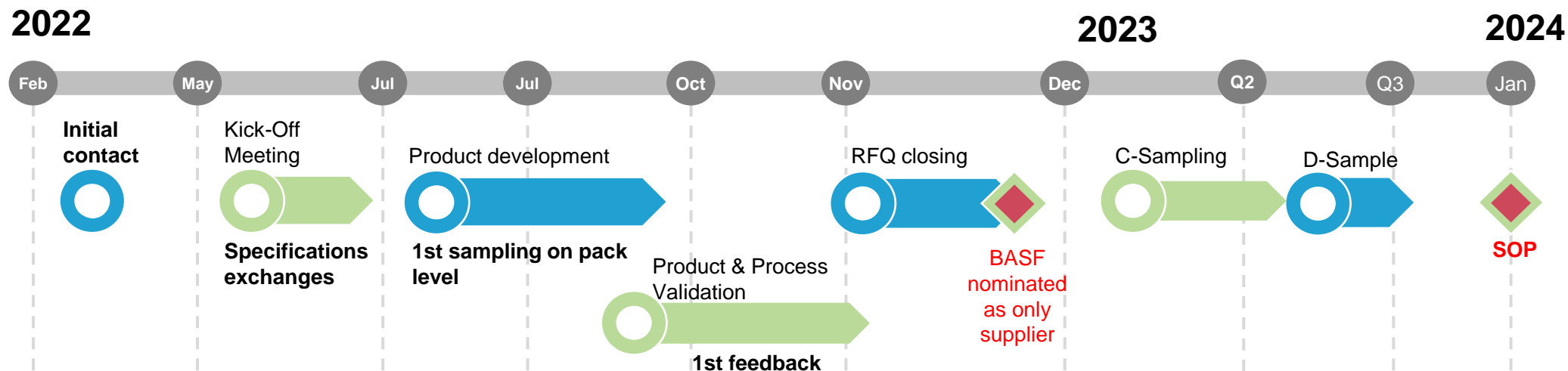
Battery Module

Thermal Management

Agile project management key to achieve OEM timelines

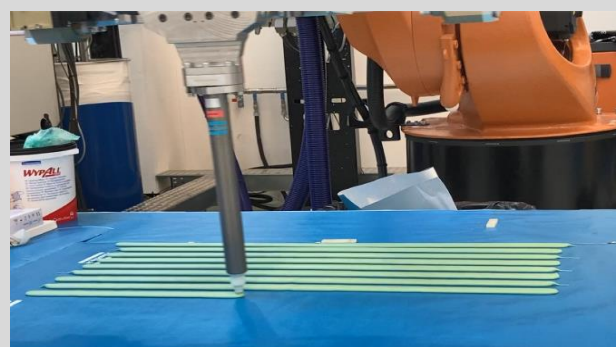
12 months from initial contact to product development & C-sample nomination

Exemplary Project Timeline for a BASF Thermal Conductive Adhesives project



OEM

BASF



Module structural components

Next generation red-Phosphor Ultramid® A3X(PA66) and org-P Ultramid® B3U (PA6)

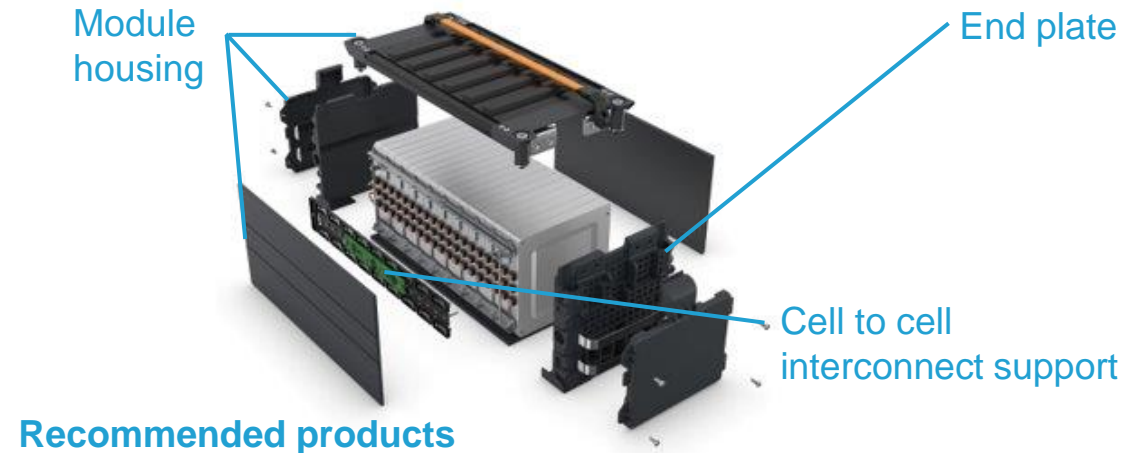
Key properties & features

- Outstanding long-term heat aging and hydrolysis resistance
- High mechanical performance (impact)
- Outstanding FR rating
- Halogen free
- Withstand fire test GB38031 (B3U42)

Customer benefits

- Significantly reduced corrosion and wear in processing unit
- Excellent phosphorus stability for minimum mold deposits

Battery Module



Product	Polymer	Product Position	Flammability	CTI
Ultramid® A3X2G5/G7 R02 BK23187	PA66-GF25/35 FR(52)	Standard	V-0 (0.8 mm)	550/600
Ultramid® A3X2G5/G7 R02 BK23288	PA66-GF25/35 FR(52)	High end	V-0 (0.8 mm)	550/600
Ultramid® A3X2G10	PA66-GF50 FR(52)	Standard	V-0 (0.8 mm)	600
Ultramid® B3U42G6/G7	PA6-GF30 FR(40)	High end	V-0 (0.4 mm)	600

Insulation Layer for Busbars

Key function & features

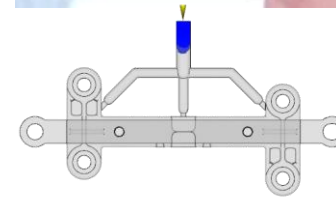
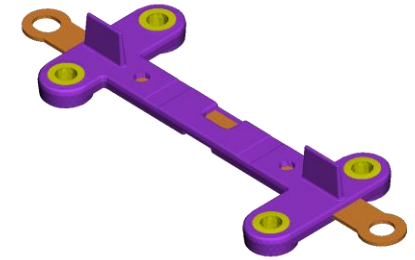
- Electrical insulation for HV busbars
- Stable insulation under **wide temp range** (-40~120deg)
- High resistance against **thermo-mechanical stress**
- **Flame-retardant** solutions based on non-halogen flame retardant additives

Customer benefits

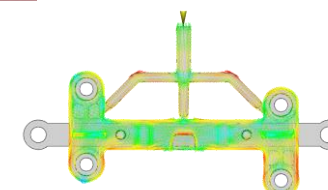
- High knowledge and understanding of thermo-shock failure and right **material selection** for **customer specific parts**
- **Simulation** support for the design of your busbar geometry
- Avoidance of critical geometry elements in an early project stage



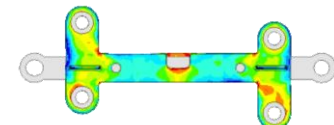
Battery Module



Flow analysis



Fiber orientation



Thermal stress analysis

Recommended products

Product	Polymer	Flammability	CTI
Ultramid® A3U44G6* DC	PA66-GF30 FR(40)	V-0 (0.4 mm)	600
Ultramid® Adv N3U42G6*	PA9T-GF30 FR(40)	V-0 (0.4 mm)	600
Ultramid® B3U42G6	PA6-GF30 FR(40)	V-0 (0.4 mm)	600
Ultradur® B4450 G5 HR*	PBT-GF25 FR(53)	V-0 (1.5 mm)	600
Ultramid® C3U*	PA6-FR(30)	V-0 (0.4 mm)	600
Elastollan® R 2600 FHF	TPU-GF15-FR	V-0 (3.0 mm)	600



* Available in orange color



Ultramid® Expand

Polyamide based particle foam with unique properties

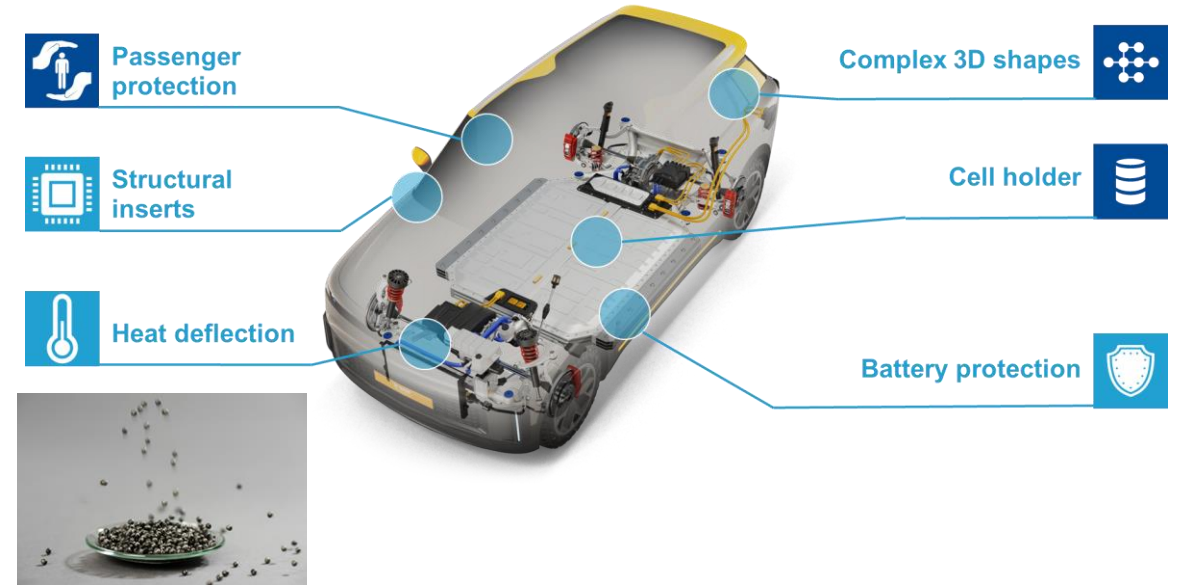
Key function & features

- High heat deflection temperature
- **High temperature resistance**
- Excellent mechanical properties at temperature >130 °C
- **Chemical resistance against automotive liquids**
- Drop-in solution in EPP tooling (steam chest molding)
- Simulation models available

Customer benefits

- **Recyclability** due to thermoplastic nature of the material
- **Simulation support** for the design of your part geometry
- Suitability for cathodic dip coating

Potential applications



Recommended products

Product	Polymer	Bead size	Bulk density
Ultramid® Expand D4S2925 UN	PA6	2.5 mm	290 g/L
Ultramid® Expand D4H2925 BK23381	PA6 Heat Stabilized, black	2.5 mm	350 g/L
Ultramid® Expand Experimental D4H3510 BK23381	PA6 Heat Stabilized, black	1.0 mm	350 g/L

The triangle of sustainability



Mercedes-Benz

Auf dem Weg zur Kreislaufwirtschaft



40% recycled Material in 2030



Carbon Neutrality 2045.

Hyundai is in progress to achieve carbon neutrality by 2045

By neutralizing CO2 emissions at all stages of production and operation.



A net-zero automotive parts supply chain.

A significant focus of Hyundai's commitment to the electric vehicle sector is our network of sustainable parts suppliers. Hyundai will continue to monitor and support all parts suppliers from their carbon neutrality journey, providing guidance, education and training, a responsible program for our entire supply chain, including our suppliers.

Hyundai

European Green Deal



Reduction of GHG Emissions



Recycled Content



Recyclability End-of-Life



STELLANTIS



*with single digit percentage compensation of the remaining emissions



Way to Zero VW

-40%

CO₂ emissions by 2030

= 17 tons of CO₂ per vehicle (in Europe)

E-Mobility

Decarbonisation Production and Supply Chain

Wind and Solar power

Recycling



VOLKSWAGEN

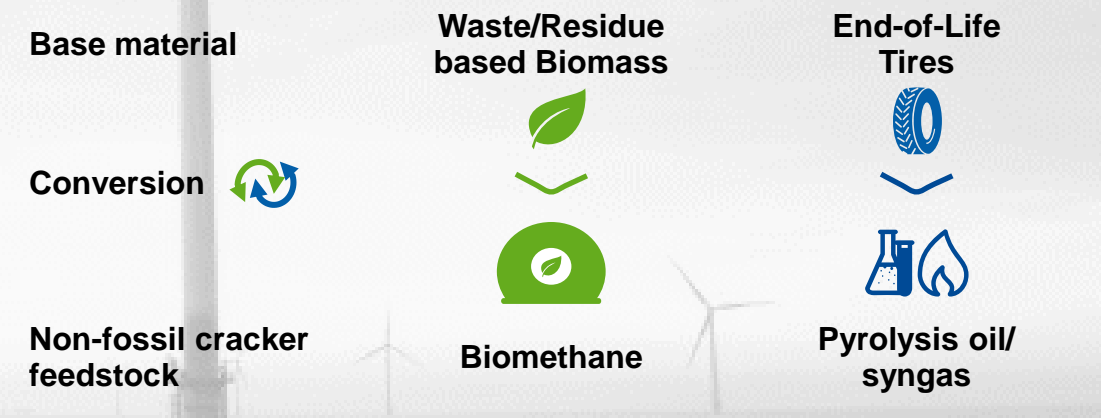
Group standard
 Class No.: 97000, 97410
 Descriptors: environmental standard, recyclability, recycling, recycling requirements, use of recycled material, vehicle
Environmental Standard for Vehicles
 Recycling Requirements, Use of Recycled Material, Recyclability Type Approval
 VW 91102
 Issue 2022-02

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Up 70% lower product CO₂ footprint with BASF sustainable plastics solutions

Criteria	 Biomass Balance	 ChemCycled
	Maturity	Commercial
Available products	PA & PU & other chemical products	PA & other chemical products
Available area	EU & AP	EU, NA soon
Product performance	Same as fossil base / virgin material	Same as fossil base / virgin material



Combined Mass Balance Approach for circular content and reduced product carbon footprint

Mass Balance Approach

- Substitution of fossil feedstock by **circular and renewable** raw materials in the chemical production.
- Attribution of the alternative feedstocks to mass balanced products that work as **drop-in solution** with prime quality specs.
- Certification of mass balanced products according to the REDCert2 scheme.

ChemCycling™

- Conversion of **end-of-life tires** to oil by a pyrolysis process.
- Circular material content by substitution of fossil feedstock through **pyrolysis oil**.

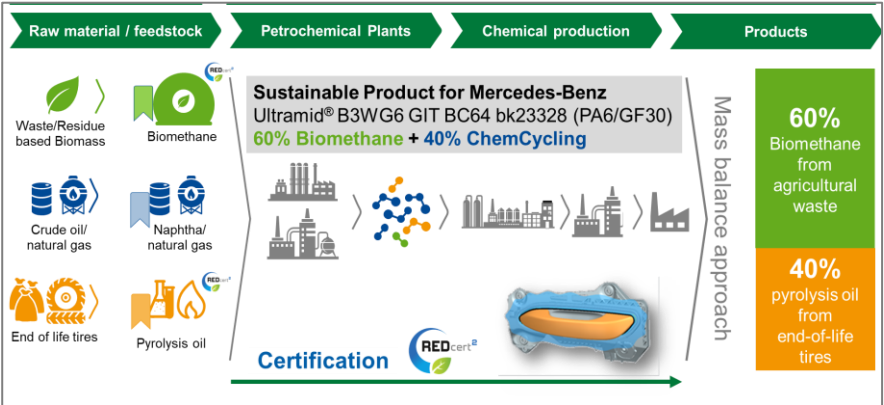
Biomass Balance

- Waste based **Biomethane** as replacement for fossil feedstock to achieve reduced product carbon footprint.

Closing the loop



Combining ChemCycling and Biomethane



Interactive animation - Experiencing the mass balance approach

© BASF

Save fossil Resources & reduce CO₂ Emission with Mass Balance Approach

Design your sustainable product

1 Choose your resources
(Two are always active)

Pyrolysis Oil Biomethane Fossil Feedstock

2 Combine your resources

Pyrolysis Oil	40 %
Biomethane	60 %

3 Your Sustainability Impact

Secondary Raw Material Share*

CO₂ saving (Cut-off)**

*referring to organic portion of the product according to mass balance

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Choose Calculation Scheme for CO₂ savings
Upstream System Expansion Cut-off

https://plastics-rubber.basf.com/emea/en/performance_polymers/industries/pp_automotive/transportation_sustainability/mass_balance_animation.html

Catena-X

The first collaborative, open data ecosystem for the automotive industry of the future

"We are proud to join the Automotive Alliance as a member of the first hour. Building on our broad and deep industry know-how, we are committed to drive forward the collaboration towards a more efficient and sustainable automotive value chain."

Markus Kamieth
Member of the Board of BASF SE




Motivation: Collaborative, must win-battles



SUPPLY RESILIENCY

„Plan and ensure **material flow** and availability across **multiple value chain steps**“








SUSTAINABILITY

„Put targets into action by working with **real PCF data** to de-carbonize the value chain“

and „**close the loops** for circularity“

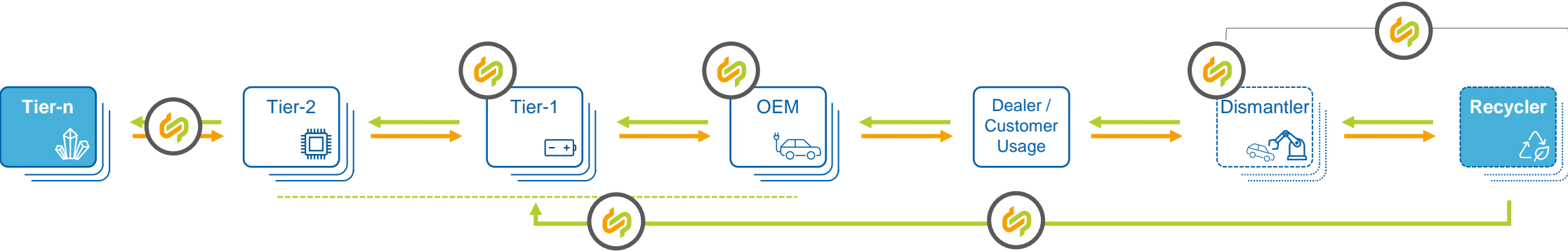
Solution: One shared global data space



	275.000+ legal entities		x # business processes
	x # production sites		x # business users
	x # digital Twins		

How can Catena-X support our business?

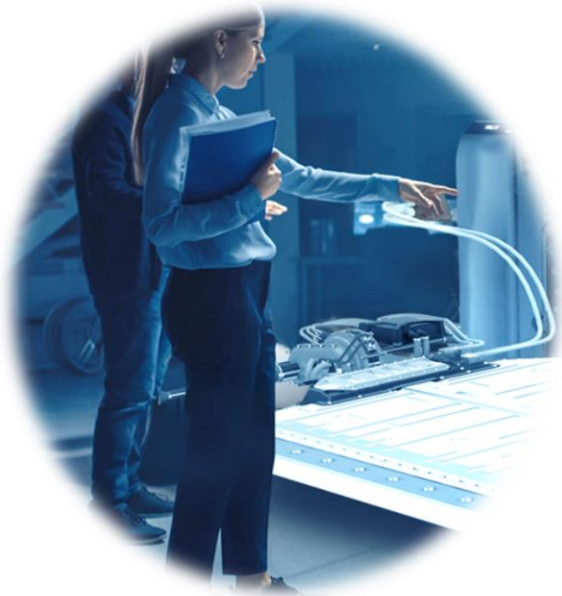
Catena-X is a key technological lever to help closing-the-loop and enable true circularity for **BASF**



Examples of how Catena-X can support our business

<p>Part Traceability</p> <p>We can jointly shape the foundational standards to achieve a harmonized approach throughout the whole value chain</p>	<p>Sustainability</p> <p>Together, we can leverage the sustainability efforts as a key driver for real CO2 footprint transparency and PCF reduction</p>	<p>Circular Economy</p> <p>We can be the frontrunners of Digital Material Passports, being the foundation for true material transparency</p>	<p>Business Partner Data Management</p> <p>Together we can profit from driving efficiency through redundancy-free business partner master data and services</p>	<p>Demand & Capacity Management</p> <p>We can jointly work on increasing value chain transparency, leading to improved utilization and a more resilient supply chain</p>
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Creating sustainable mobility



Plastics in eMobility offers numerous advantages like **strength and flexibility**, **design freedom** in complex geometries and **good processability**



Sustainability ever-increases in importance and can be addressed with tools like **Chemcycling** and **Biomass balance**



Catena X as one shared global data space is strengthening the **supply chain resilience** and enables **decarbonization** by working with real PCF data that put targets into action

Join into the collaborative approach to make sustainable mobility real

A long journey, but possibilities are endless



Thank you for your attention



We create chemistry