

## advances in performance material solutions and PU recycling

By: Nick Palmen

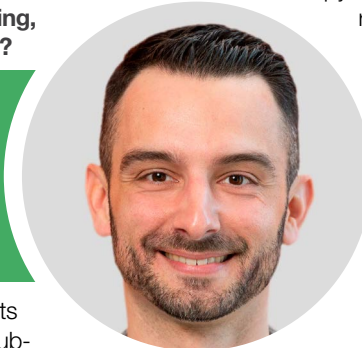
**With up to 75% of the energy produced by a vehicle powertrain being expended on moving mass, the industry is striving to develop recyclable lightweighting materials.**

According to BASF, the trend is towards foams which are lightweight, high-strength, resistant to excessive heat and recyclable.

Automotive Industries (AI) spoke to Dr. Mark Staniford – BASF Strategic Marketing & Sustainability Manager PU Flex Foam Solutions, Patrick Hantschk – BASF Head of Business Development eMobility and OEM Account Management, and Patrick Frey, Segment Manager Transportation – Auto E&E and eMobility – Marketing Engineering Plastics. All are with BASF Performance Materials Europe.

**AI: How can BASF next-generation battery demonstrator help customers enhance lightweighting, thermal management, safety, and performance?**

**Patrick Hantschk – BASF Head of Business Development eMobility and OEM Account Management.**



**Hantschk:** Our battery demonstrator highlights how BASF's performance material solutions can substantially enhance the functionality, safety and cost-competitiveness of high-voltage battery packs in battery electric vehicles (BEVs).

For lightweighting and performance, the demonstrator uses polyurethane based potting foam to fix cylindrical cells in a battery pack, combining low density with high mechanical strength.

To accommodate the shift from cell-to-module to cell-to-pack designs, BASF provides polyurethane-based materials such as Elastan® EV (thermal interface materials) and Elastolit® EV (potting systems).

Structural components made with Elastoflex® EV contribute to reducing the overall weight of the battery pack while ensuring structural integrity.

In terms of thermal management, the demonstrator features Elastan® EV TIMs with thermal conductivity up to 2.1 W/m·K. These materials ensure efficient heat dissipation while offering mechanical strength, electrical insulation, and compatibility with large-scale production.

BASF also offers tailor-made formulations to meet customer requirements.

Safety is another key focus. Elastocoat® EV, a polyurethane-based fire protective coating, provides thermal shielding up to 1,200° C and resists solid particle impact during thermal runaway events. A one-step application process using flat stream technology enhances productivity and allows use on complex 3D shapes.

The coating is free of silicone and monomers.

**AI: What new concepts and recycling methods for polyurethanes did you present at K 2025?**

**Staniford:** A range of recycling approaches for polyurethanes, including glycolysis, attribution of ChemCycling® based on pyrolysis oil derived from end of life tires, mechanical recycling, and gasification.

An industry first breakthrough in polyurethane mechanical recycling was also presented.

Chemical recycling is used where mechanical recycling is not suitable. In addition, we are exploring the substitution of fossil-based raw materials with renewable alternatives feedstock to further support circularity.

While some of these methods are already commercially validated, others are in the pilot phase. A range of options is needed because the composition of future waste streams is uncertain.

- **Glycolysis:** Demonstrated via the Liebherr pilot freezer and Hörmann garage doors, both using recycled polyol derived from waste
- **ChemCycling® (Pyrolysis-based):** Showcased with a VW T-Roc headliner, in which the Polyurethane fraction is made entirely from ChemCycling® feedstock
- **Mechanical Recycling:** Illustrated by steering wheels containing content from post industrial waste
- **Gasification:** Steering wheel as demonstrator for gasification pilot.

**AI: How does BASF's new PU flexible foam contribute to the circular economy?**

**Staniford:** BASF's meltable PU flexible foams are designed for full recyclability. They retain their mechanical properties across multiple recycling loops and can be reprocessed into new foams without compromising performance.

Recyclable PU foams offer significant potential to support design-for-recycling strategies in the automotive sector. On

average, up to 25 kg of PU can be found in a car, in seats, doors, instrument panels and steering wheels.

Currently, the components with the highest PU material weight in vehicles are seats and acoustic insulation parts. These are ideal candidates for replacement with our meltable foams.

We see strong potential in reducing material complexity in components like dashboard panels, armrest door panels and acoustic systems, which is beneficial for recovery at end-of-life.

**AI: How does BASF's innovative PU technology enable waste-free production and reduce CO2 emissions?**

**Staniford:** Our meltable foam systems are designed to support waste-free production and lower carbon emissions through:

- Closed-loop manufacturing: Segregated recycling processes allow for the reuse of production waste
- Reduction of incineration of post-industrial PU waste
- Energy-efficient processing: The recycling technologies employed are optimized for low energy consumption.

**AI: What are the key features of BASF's new generation of flexible PU foams?**

**Staniford:** The material can be 100% recycled and used as raw material for new foams using an energy-efficient recycling process developed by BASF.

Prototypes already incorporate production waste into new components, enabling waste-free production. There is no compromise on performance, and they are processed using conventional PU technology.

**AI: What are the challenges?**

**Staniford:** Our recycling process is already effective for processing post-industrial waste of our meltable PU foam.

However, accessing post-consumer waste remains a challenge, particularly in the automotive sector, where vehicles in Western Europe typically remain in use for decades.

In the meantime, we are evaluating the compatibility of our recycling technology with post-consumer PU waste to ensure future scalability and circularity.

**AI: What solutions does BASF offers for busbars and cell connectors?**

**Frey:** For busbar and cell connect systems we offer several PA and PBT based compounds. Whether they are assembled, overmolded or extruded, they need to exhibit good thermal shock behavior (mechanical requirements at low temperatures), high elongation at break,

electrical isolation, and high comparative tracking index.

Durable orange color as well as flame retardancy are required in some cases.

BASF offers a broad portfolio covering PA, PBT and PPA in different technologies. With our simulation tool Ultrasim® we offer simulation service for designing busbars e.g., process-, mechanical- and thermostress-analysis.

**AI: Does Ultradur (PBT) for high voltage applications offer non-halogenated flame retardancy while providing highest electrical insulation?**

**Frey:** We offer a wide range of non-halogenated PBT based Ultradur materials. With our Ultradur B4450 G5 HR we have an Ultradur with V0 at 1.5 mm wall thickness and Comparative Tracking index (CTI) of 600. According to IEC 60112, this is the highest value.

**AI: What are the key properties and features of Ultradur® and Ultramid® for HV applications?**

**Frey:** High voltage applications in the vehicle are typically used to switch and protect the 400/800-volt components and the battery.



**Dr. Mark Staniford – BASF Strategic Marketing & Sustainability Manager PU Flex Foam Solutions.**



**Patrick Frey, Segment Manager Transportation – Auto E&E and eMobility – Marketing Engineering Plastics.**

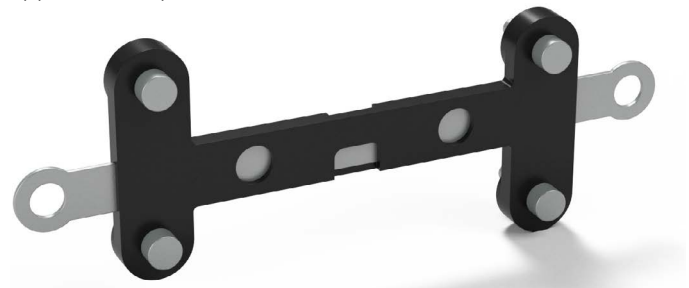
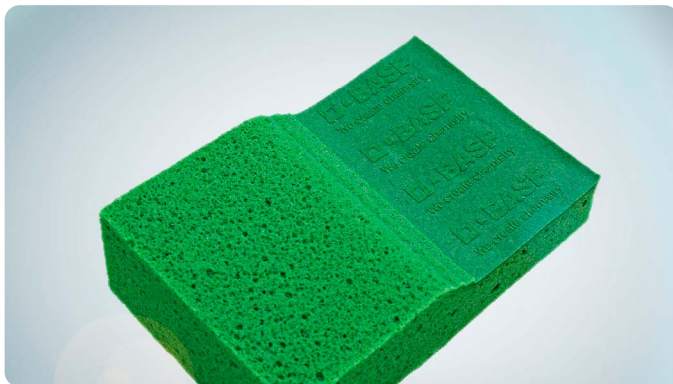
One classic design criterion is the Comparative Tracking Index (CTI). CTI 600 is according to IEC 60112 the highest value you can achieve.

For the protection of high voltage applications, flame retardancy is also a key requirement. UL94 meets regulatory requirements in HB, V2 and

V0 performance. We offer materials for all three performance levels.

HV connectors are sealed with liquid-silicone-rubber.

Additionally, general requirements like high mechanical strength and high elongation at break are required to fulfill application requirements. **AI**



**TOP: The Ultrasim® simulation tool assists with busbar design. LEFT: BASF's meltable PU flexible foams are designed for full recyclability.**