

November
2020

Reprint

English

FAPU

EUROPEAN POLYURETHANE JOURNAL



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FAPU

FACHMAGAZIN FÜR DIE POLYURETHANINDUSTRIE

KP VERLAG
ISSN 1867-3503

Technical Articles

Sustainable Foams for the Mobility of Tomorrow

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Resource saving polyurethane based decorative foams for modern vehicle interiors proven through optimized functionality and processing properties

Increased demands on materials in the automotive sector

Demand for sustainable products is growing steadily as consumers increasingly consider health and environmental aspects in their purchasing decisions. This applies to many consumer goods and, of course, also to the purchase of vehicles. At the same time, as regulations become more strict worldwide, the automotive industry is constantly looking for the latest material innovations for the components of its next vehicle models.

As a leading supplier to the automotive industry, along the entire value chain, FoamPartner understands the needs of OEMs, Tier 1 and Tier 2, and knows how to translate customer and consumer requirements into the right product properties of its polyurethane foams. Table 1 provides an overview of the most important requirements for modern decorative foams for vehicle interiors.

Trends and needs of the automotive industry	Requirements for polyurethane foams for use in vehicle interiors
Sustainability as a purchase criterion for consumer decisions	<ul style="list-style-type: none"> • Conservation of resources by using sustainable raw materials, saving energy and by providing higher material efficiency and longer service life
Healthier vehicle interior climate	<ul style="list-style-type: none"> • Low emission (very low content of VOC, FOG, aldehyde), no odor, no pollutants
Optimized functionality and durability of components in the vehicle interior	<ul style="list-style-type: none"> • Excellent mechanical properties and hydrolytic stability with simultaneous reduced material usage (thinner foam layers)
Efficient production to save operating costs	<ul style="list-style-type: none"> • Excellent flame laminating capability and faster laminating speeds with reduced burn off material loss and improved adhesion

Tab. 1: Trends and requirements for materials for vehicle interiors

Decorative foams currently used in vehicle interiors

Polyurethane foams based on polyester or polyether polyols are currently used for vehicle interiors. Techni-

cally speaking, polyether and polyester polyols are very different materials, especially with regard to viscosity.

Polyether polyols are low viscous materials used in more than 90 % of all flexible polyurethane foams produced worldwide. Polyether foams are easy to produce, are extremely stable and offer good aging properties. They are also characterized by a low emission content.

Polyester foams are rather special foams, but have excellent mechanical properties and are generally well suited for flame lamination. They are also popular because of their homogenous cell structure and can be produced without defects such as pinholes (air entrapments).

In general, it can be said that both foam technologies have advantages and disadvantages. Table 2 summarizes the main characteristics of both foam types. In principle, sustainable raw materials – especially polyols based on renewable, recycled sources or CO₂-components can be used to produce both types, although they have a significant influence on the product properties just described.

FoamPartner therefore strived to develop a new foam technology with the most suitable sustainable raw material that combines all positive physical, mechanical, and application related properties in one material.

New foam technology based on sustainable raw materials

For use in modern vehicle interiors with the highest quality requirements, FoamPartner has developed a new generation of foam products that combine various sustainability aspects with superior functionality. The new products were recently launched on the market under the family name OBoNature. The portfolio currently includes three product types that meet the specific ap-

Characteristic	Polyurethane foams based on polyester polyols	Polyurethane foams based on polyether polyols
Mechanical properties	😊	😞
Fine and homogeneous pore structure	😊	😞
Low emissions	😞	😊
Hydrolysis stability	😞	😊
Flame lamination capability	😊	😞

Tab. 2: Characteristics of conventional decorative foams



plication requirements for headliners, car seats, as well as door panels and armrests.

Following the guiding principle of upcycling, sustainable raw materials are used in the production of these foams. The best foaming and application results were achieved with CO₂ based polyols. CO₂ is obtained as a by-product from chemical processes. As a result, 20 % less petrochemical precursors are needed for polyol production. The sustainable proportion in the foam is calculated to be > 13 %.

The VOC (volatile organic compound) and fogging values of the new foam products are far below the limits required today for a healthier indoor climate. They meet the emission and odour test of the stringent Daimler standard DBL 5450 according to measurement methods VDA 278 and VDA 270.

The use of halogen free flame-retardant additives not only ensures that the fire protection standard FMVSS 302 is met to guarantee passenger safety, but attention was also paid to a particularly low pollutant product composition.

In addition to a sustainable product profile, functionality and performance during processing and application are of course also important. All three foams have an extremely homogeneous cell structure and exhibit excellent hydrolytic stability. They are characterized by very good mechanical properties. Their elastic behaviour, thanks to optimized elongation at break and tensile strength, ensures excellent recovery after thermo-compression. Table 3 shows a representative description of the product OBoSky 3540 T of the OBoNature foam family based on relevant technical data. This product is especially recommended for use in headliners.

Product features	Test method	OBoSky Nature 3540 T
Sustainable share in foam [%]		13
Net density [kg/m ³]	ISO 845	35
Tensile strength [kPa]	ISO 1798	> 110
Elongation at break [%]	ISO 1798	> 200
Compression set [%]	ISO 1856	< 6
Pore structure		very fine
Thermo-compression properties		excellent
Flame lamination capability		✓
Hydrolysis stability		✓
Low emission content	VDA 278	✓
Flame protection	FMVSS 302	✓

Tab. 3: Product properties of OBoSky Nature 3540 T, recommended for headliners

Material efficient manufacturing with faster lamination processes

The new foams offer excellent laminating properties compared to conventional flame laminable polyether based polyurethane foams with comparable material density. Application tests in practice have shown that OBoNature products can be processed at a lamination speed that is approximately 14 % faster (40 m/min instead of 35 m/min), while at the same time the material loss caused by flame lamination is approxi-

mately 11 % lower, with comparable results in adhesion performance.

Figure 1 shows the results of the application test regarding the laminating performance. The OBoNature foam and a premium ether foam of comparable density were laminated with the same textile at different lamination speeds. The results were then compared with the nominal value, i.e. the laminator's specifications regarding the thickness of the laminated foam.

In summary, the new foams can be used with a reduced foam thickness and still achieve excellent lamination results. Thus, both material and manufacturing costs can be saved. A similar process behaviour in terms of speed and burn off with comparable adhesion results was also achieved with polyester foams.

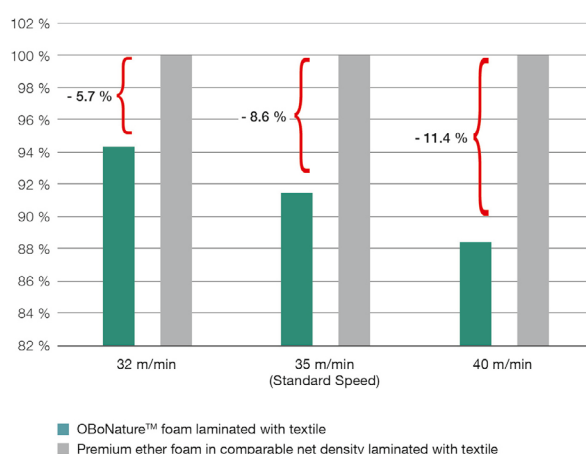


Fig. 1: Material savings of laminated OBoNature foam compared to laminated premium ether foam at different lamination speeds

Summary – sustainability meets performance

Anyone who wants to help shape the future must think in terms of conserving resources and act in a socially responsible manner. Sustainable solutions are required that provide answers to social, regulatory and ecological needs. FoamPartner meets these challenges and, as one of the leading foam manufacturers, develops products with particularly sustainable and economic added value.

The new OBoNature foam technology, which is based on sustainable raw materials, has produced trend setting solutions for the automotive sector and especially for vehicle interiors that demonstrate the consistent implementation of the company's sustainability strategy. The product benefits can be summarized as follows:

- **Conservation of resources:** Responsible manufacturing through the use of sustainable raw materials obtained from by-products of the chemical industry; as a result, 20 % less petrochemical precursors are required in raw material production. The sustainable proportion of finished foam is > 13 %.
- **Material efficiency:** Longer service life thanks to excellent hydrolytic stability and material durability. FoamPartner's unique 120 m long block technology minimizes adhesive seams by 50 %. In addition, the material thickness of OBoNature foams can be reduced by approximately 11 % with the same lamination performance.
- **Health protection:** Low emission properties according to VDA 278 and VDA 270. Use of halogen free flame-retardant additives to ensure passenger safety according to FMVSS 302.
- **Efficient production:** Easier processing thanks to good thermoformability and excellent laminating behavior with up to 14 % faster laminating processes, which contributes to savings in operating costs.

The OBoNature product family was awarded with the company's proprietary Ecovative label. The label stands for FoamPartner's promise 'Best in Foam – Sustainable through Innovation' and identifies product solutions with special sustainable and economic value.





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Publishing house and editorship:

KP Verlag, Owner: Birgit Harreither
Christine-Teusch-Str. 34, 22846 Norderstedt, Germany
Phone +49 40 432717-78, Fax +49 40 432717-79
E-Mail: info@fapu.de, www.fapu.de

Management/Publisher:

Birgit Harreither

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ISSN:

ISSN 1867-3505

Subscription Details:

Single copy (as PDF): EUR 20.00

Yearly subscription (5 issues as PDF): EUR 95.00

Subscription for students (5 issues as PDF): EUR 70.00

Test subscription (3 issues as PDF): EUR 50.00

Super subscription

(more information available at www.fapu.de): EUR 155.00

FAPUweb-subscription: EUR 95.00

Layout and Production:

GSBXMEDIA – Gestaltung, Satz, Beratung, Crossmedia

Königstr. 17, 41564 Kaarst, Germany

Phone +49 2131 525153-0, Fax +49 2131 525153-60

E-Mail: gsb@gsbxmedia.com

Internet: <https://www.gsbxmedia.com>

FAPU – European Polyurethane Journal is published 5 times a year.

If the magazine can not be delivered by reasons that are outside of our control, there is no right to claim later delivery or reimbursement of subscription fees already paid in advance.

Minimum subscription period is one year. Subscription is automatically renewed if it is not cancelled in writing 8 weeks before the end of subscription period.

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Cover Photos: BBG, Huntsman, Teknos