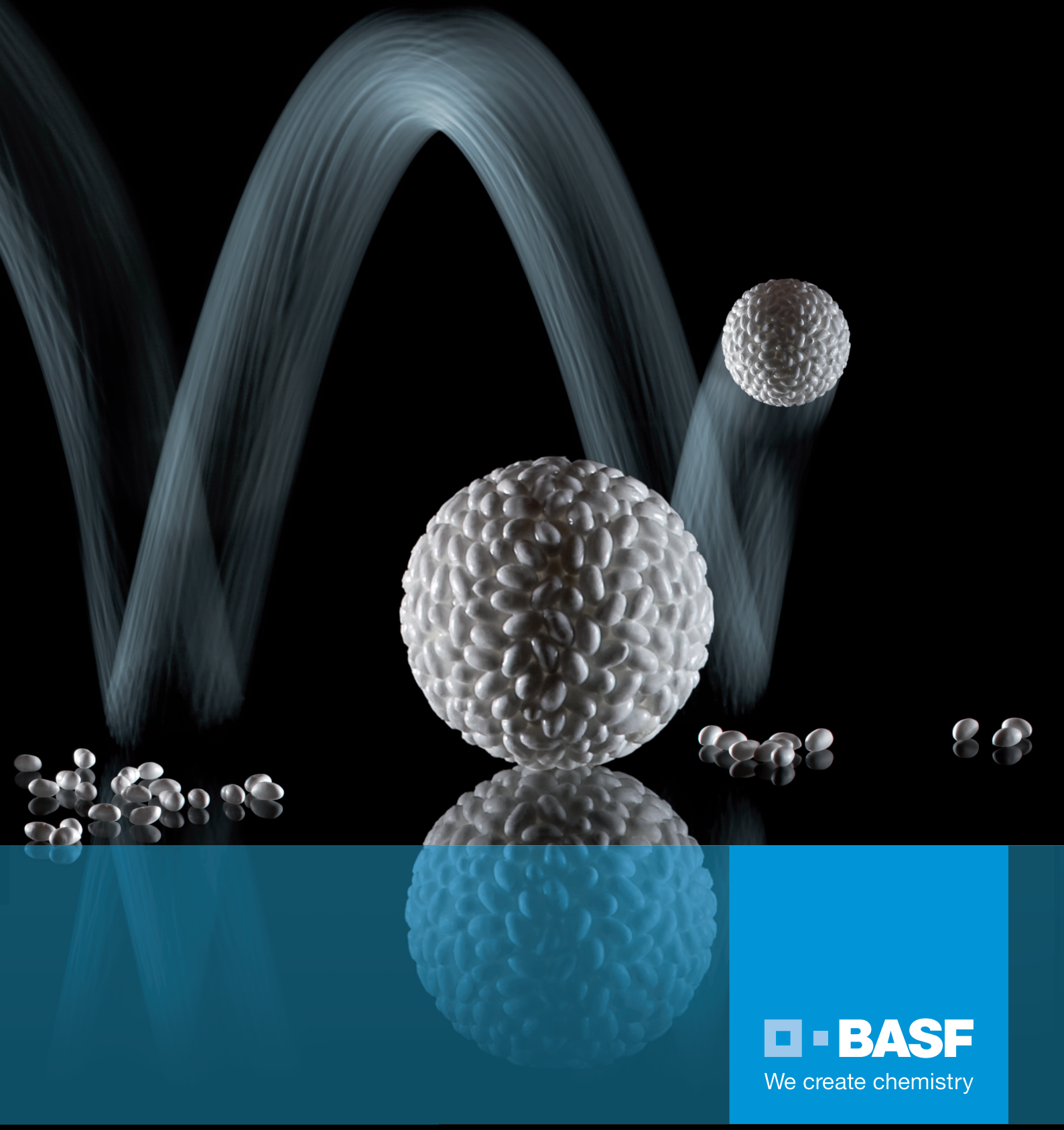
Infinergy®

The first expanded TPU –
As elastic as rubber but lighter



BASF
We create chemistry

Infinergy®

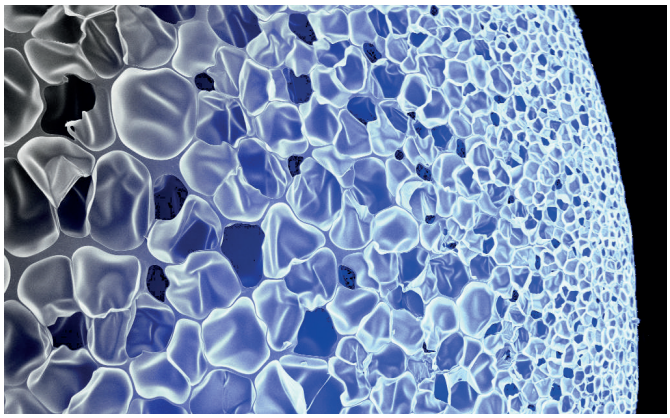
The first expanded TPU – As elastic as rubber but lighter

Infinergy® is the world's first expanded thermoplastic polyurethane (E-TPU). The closed-cell, elastic particle foam combines the properties of TPU with the advantages of foams. The key features are:

- low density
- high elasticity
- outstanding resilience
- high abrasion resistance
- high tensile strength
- good chemical resistance
- good long-term durability in a wide temperature range

Materials expertise Elastollan® (TPU)
\+ **Particle foams know-how** Neopolen®
= **Innovation** Infinergy® (E-TPU)

The individual Infinergy® beads have a size of from 5 to 10 mm and are supplied with a bulk density of approximately 110 kg/m³.



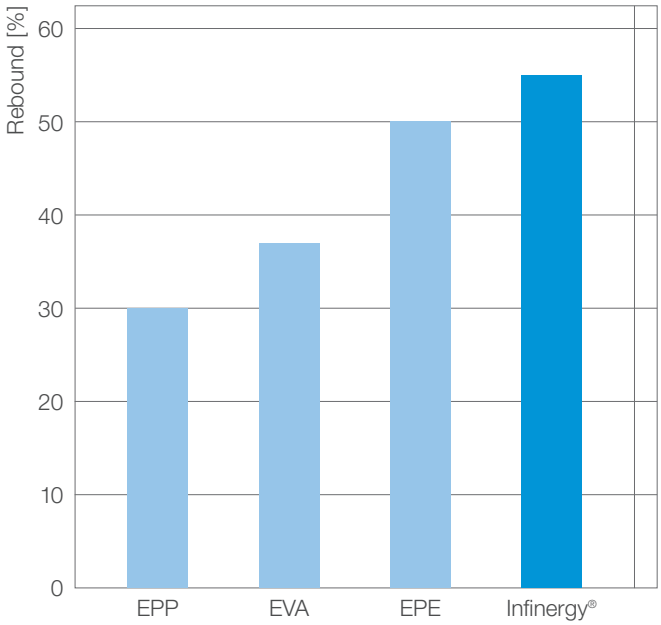
The closed cells inside an Infinergy® bead can be seen on the scan taken with the scanning electron microscope.

Properties

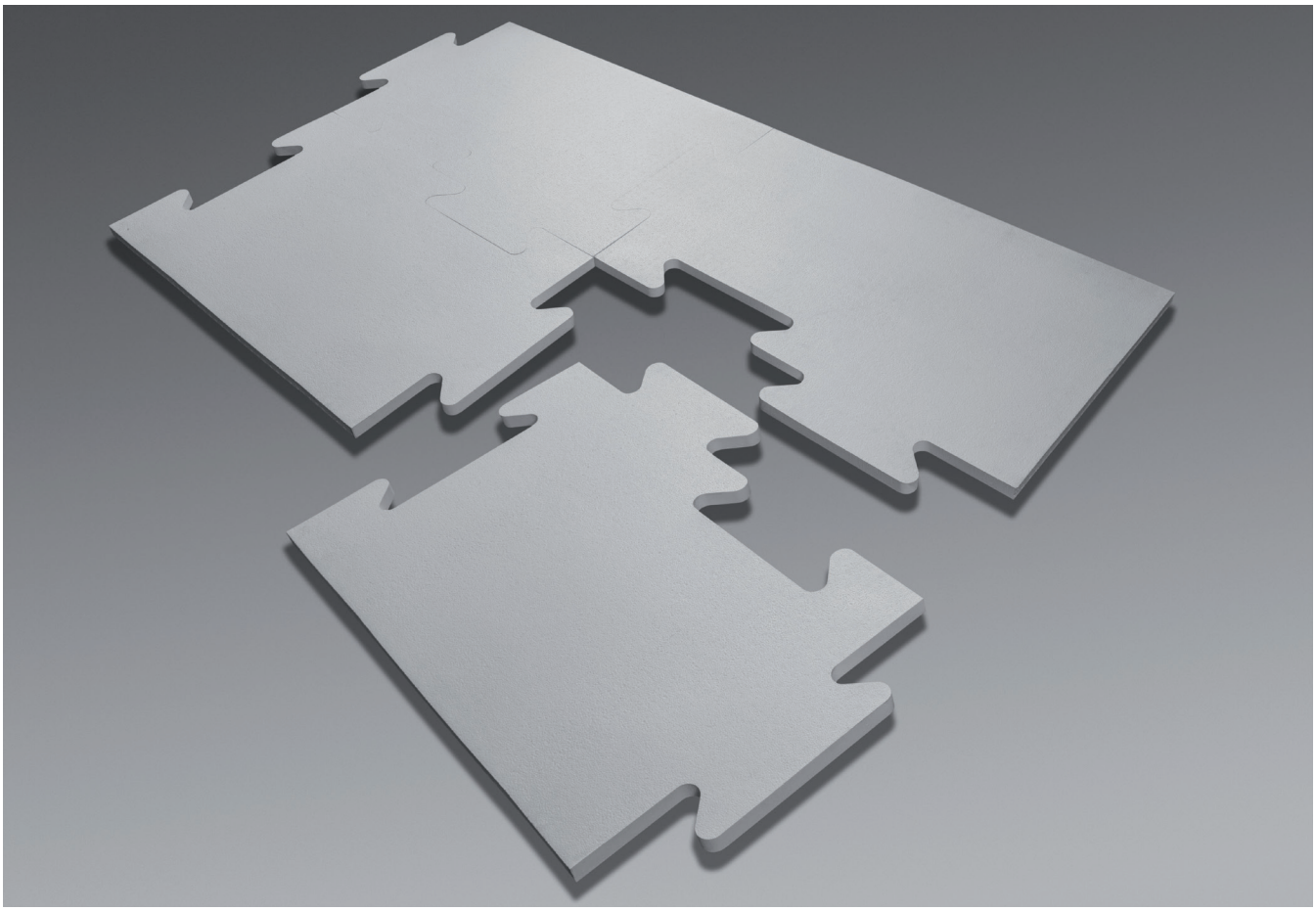
Like its starting material TPU, Infinergy® is noted for having high elongation at break, tensile strength and abrasion resistance as well as good chemical resistance. In addition, the innovative particle foam remains highly elastic and soft over a wide temperature range.

The feature of Infinergy® that is particularly striking is its high resilience. Tests of the resilience elasticity under ISO 8307 (the ball rebound test) and under DIN 53512 (using a defined pendulum hammer) show that Infinergy® achieves a rebound of over 55 %. This is therefore significantly higher than comparable particle foams such as expanded polypropylene (EPP) at 30 %, ethylene vinyl acetate (EVA) at 37 % or expanded polyethylene (EPE) at 50 %. Infinergy® does not lose its excellent resilience even under a continuous load.

Dynamic mechanical analysis has shown that, even at extremely low temperatures of -20 °C (-4 °F), Infinergy® still has a low dynamic modulus, is very soft and stretchy and thus does not go stiff.



Comparison of the rebound of different foams
[Molding density: 30 kg/m³ and 265 kg/m³ (Infinergy®)]



Panels made from Infinergy® can be processed on conventional splitting machines, punches and water jet cutting machines.

Applications

Infinergy® can be used anywhere where a combination of low weight, excellent mechanical properties and good long-term durability is required.

Possible areas of application for this durable material are:

- In the Sports and leisure sector (floor coverings, e. g. for playgrounds or running tracks, bicycle tires)
- In vehicle construction (e. g. for vibration decoupling)
- In mechanical engineering (e. g. as cushioning elements and buffers in industrial linkages)
- Reusable dunnage trays in the logistics sector
- In the shoe industry

Infinergy® in the “Energy Boost” from adidas

The German sports equipment manufacturer adidas uses Infinergy® in its innovative “Energy Boost” running shoe. As the material used in the midsole, Infinergy® makes the shoe comfortable to wear and delivers excellent running properties. The sole springs back into its original shape immediately after impact: thanks to this high rebound effect resulting from the resilience of the material, runners use up less energy than they did before.

As Infinergy® withstands temperatures of between -20 °C (-4 °F) and over +40 °C (+104 °F) without changing its functional properties, the adidas shoe can be used at any temperature – whether in winter or in summer. Another advantage highlighted by the shoe manufacturer is the great long-term durability of the material which, just like the other properties, is significantly better than that of conventional midsole materials.

The white midsole of the adidas shoe “Energy Boost” is made from Infinergy®

(Photo: adidas AG)

There are lots of conceivable applications for Infinergy®: for example in “unflattable” bicycle tires ...

... in boat fenders and cushioning elements ...

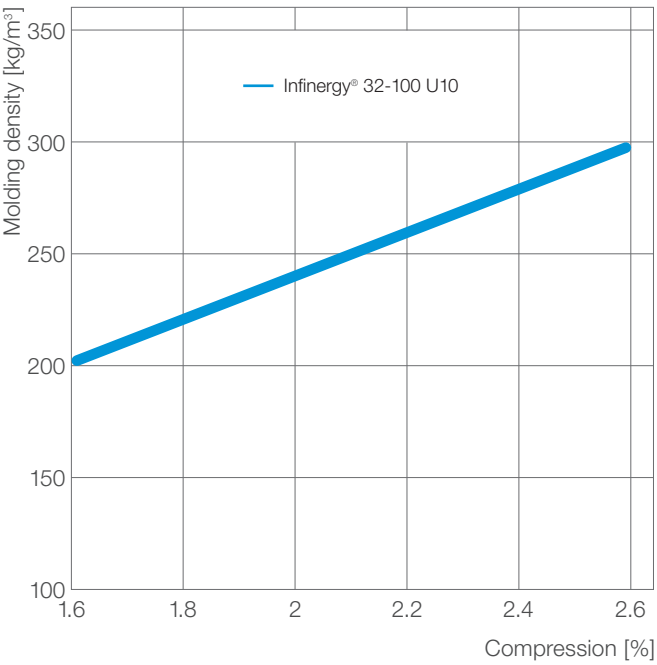
... or in floor coverings in the sports or leisure sector.

Processing

In principle, Infinergy® can be processed on the same molding machines which are designed for processing of expanded polypropylene (EPP). A steam chamber pressure of at least 5 bar is necessary. During processing, the steam pressures are usually in the range of 1.6 to 2.2 bar, depending on the geometry and density of the molding. Both crack splitting and pressure filling are possible methods that can be applied here. Appropriate injection systems should be used.

In addition, because polyurethane binders adhere so well to Infinergy®, there are other processing techniques such as gluing and foam sealing of the beads. This procedure enables large-scale processing of Infinergy®.

Converters can process panels made from Infinergy® on conventional splitting machines, punches and water jet cutting machines.



Environment and Recycling

Infinergy® is compliant with the RoHS directive and does not have to be labeled under dangerous goods regulations. Information on other regulations, e. g. GADSL, will be provided on request. Infinergy® is also recyclable.

Physical properties of moldings made from Infinergy® 32-100 U10

Property	Test specification	Unit	Material density (MD) according to ISO 845 [kg/m³] (Core density)		
			200	250	300
Tensile strength	DIN EN ISO 1798	kPa	600	600	600
Elongation at break	DIN EN ISO 1798	%	150	125	100
Compressive stress at 10 % strain at 25 % strain at 50 % strain	According to ISO 844	kPa	 40 100 200	 55 130 275	 70 160 350
Rebound	DIN EN ISO 8307	%	55	55	55
Compression set (50 %, 22 h, 23 °C) 24 h after stress release	DIN EN ISO 1856 (Method C)	%	< 6	< 5	< 4
Dimensional stability under heat (Linear change in size after 4 days) 60 °C 110 °C	According to ISO 2796	%	 < 1 < 10	 < 1 < 10	 < 1 < 10
Water absorption (1 day)	According to DIN 53428	Vol.-%	< 2	< 2	< 2
Flammability Sample thickness: 13 mm	FMVSS 302		← Satisfied from MD 280 [kg/m3] →		

PMSI 1301 FE

Note

The data contained in this publication are based on our current knowledge and experience. In view of the many factors that may affect processing and application of our product, these data do not relieve processors from carrying out own investigations and tests; neither do these data imply any guarantee of certain properties, nor the suitability of the product for a specific purpose. Any descriptions, drawings, photographs, data, proportions, weights etc. given herein may change without prior information and do not constitute the agreed contractual quality of the product. It is the responsibility of the recipient of our products to ensure that any proprietary rights and existing laws and legislation are observed. (September 2015)