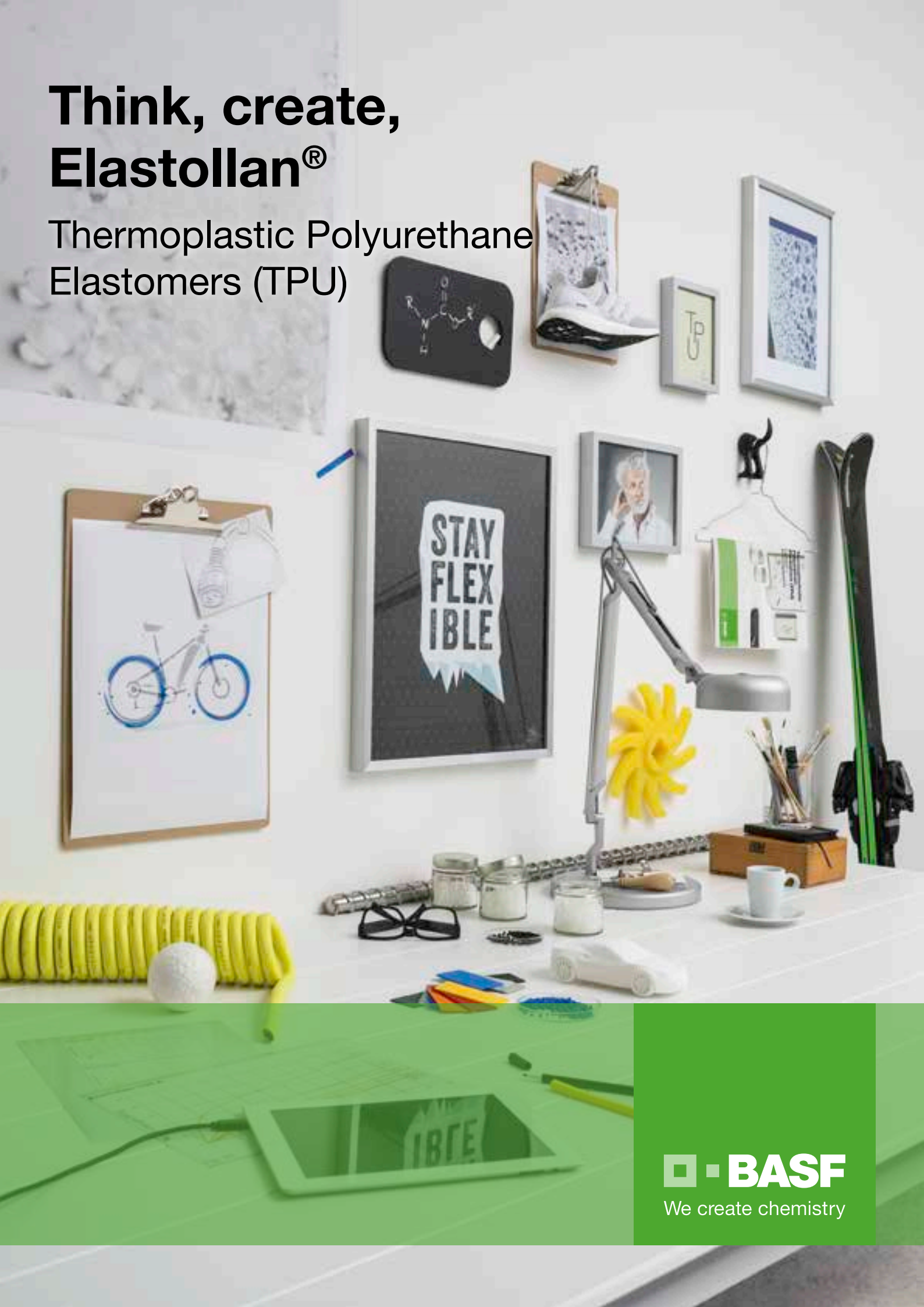
Think, create, Elastollan®

Thermoplastic Polyurethane Elastomers (TPU)



BASF
We create chemistry

Elastollan®

Elastollan® is the brand name for thermoplastic polyurethane (TPU) from BASF. It stands for maximum reliability, consistent product quality and cost efficiency. Elastollan® can be extruded into hoses, cable sheathing, belts, films and profiles, and can also be processed using blow molding and injection molding technologies. Over the last few decades, the numerous benefits of Elastollan® in all its forms – aromatic or aliphatic, very soft or glass fiber-reinforced, flame retardant or highly transparent – have been clearly demonstrated across every sector of industry.

This extensive product portfolio, which makes use of a variety of raw materials and formulations, is the starting point for successfully bringing innovation to customers.

We thrive on creative ideas and complex challenges – come and talk to us!

Elastollan®

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Competent.
Cooperative.
Focused.

Elastollan® Means More.

We know how to pool competencies. Working in partnership with our customers, we create synergy – the basic ingredient for cost effectiveness and innovation!

As the world's leading provider of thermoplastic polyurethanes, we can draw on many years of experience and considerable resources. Our team from sales, marketing and application development are equipped to tackle the most demanding technical problems, providing knowledgeable advice and consistent customer focus. We are able to simulate and test many different production and application conditions with our customers at the BASF Technical Center.

All physical and chemical standard tests are performed in our own laboratories. If special tests need to be carried out, we will also take care of the entire process, working with external laboratories and institutes within our extensive BASF network.

BASF's global research and development team are also constantly working on ways to optimize existing Elastollan® product ranges and develop innovative products in line with market needs.

Elastollan® means variety. Elastollan® has the potential to improve many products. It's all about spotting opportunities, thinking creatively and finding smart ways to combine its strengths.

With its own TPU production plants around the world, regional research and development centers and local sales, marketing and application development teams, BASF is ideally positioned for putting flexible, customer-focused supply concepts into action and providing local customer service.

That's how we can make sure that Elastollan® will continue to be a symbol of variety, quality and innovation in the future.

Injection molding machinery

Multilayer flat-film extruder

Analytics

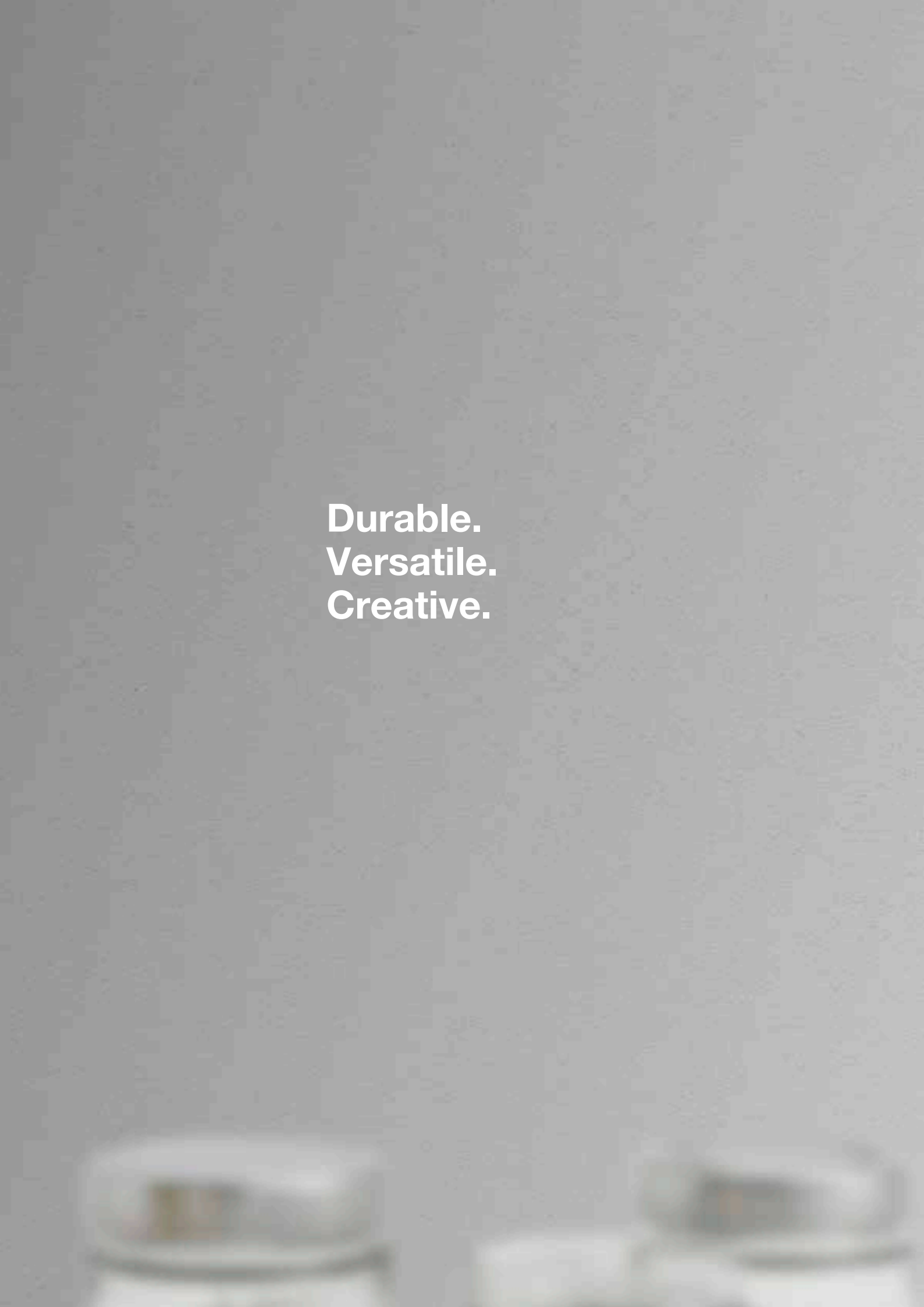
Extrusion lines

Portfolio

An overview of existing Elastollan® grades with lots of typical applications. More detailed information concerning technical properties can be found in the following brochure: Elastollan® - Product Range.

Product Line	Chemistry	Injection Molding	Extrusion	Shore Hardness Range
11	Ether	Yes	Yes	70 A - 75 D
11 FHF	Ether flame retardant	Yes	Yes	75 A - 54 D
12	Ether	Yes	Yes	85 A - 83 D
12 FHF	Ether flame retardant	Yes	Yes	70 D - 80 D
13	Ether	No	Yes	85 A - 90 A
C	Ester	Yes	Partly	80 A - 75 D
B	Ester	Yes	Yes	80 A - 65 D
S	Ester	Yes	Partly	70 A - 65 D
500	Ester	Yes	Partly	85 A - 65 D
600	Ester	Yes	Yes	70 A - 50 D
700	Ester	Yes	Partly	70 A - 65 D
800	Ester	Partly	Yes	75 A - 95 A
A	Ether or ester aliphatic	Yes	Partly	65 A - 55 D
L	Ether or ester aliphatic	No	Yes	75 A - 80 D
Supersoft	Ester or ether	Yes	Partly	35 A - 65 A
HPM	Ester	Yes	Partly	60 A - 55 D
HFFR	Ether flame retardant	Yes	Yes	85 A - 92 A
CS	Ester	Yes	No	70 A - 65 D
R	Ester-reinforced	Yes	No	E-modulus 1000 - 17000 MPa
Food Contact (FC)	Ester or ether	Yes	Yes	70 A - 75 D
Hotbond	Ester	No	Yes	See tech. product information
Bondura	Ester	No	Yes	See tech. product information

	Range Properties	Example of Applications
	Excellent hydrolysis resistance, cold flexibility, resistance to microorganisms	Cable sheathing, films and coatings, conveyor belts, elevator belts, profiles, hoses, rail pads, animal ID tags
	Non-halogen-based flame retardant, outstanding mechanical properties, excellent hydrolysis resistance, resistance to microorganisms	Cable sheathing, connectors and bushings, films and coatings, hoses
	Highly transparent, excellent hydrolysis resistance, cold flexibility, resistance to microorganisms	Ski boots, films and coatings
	Non-halogen-based flame retardant, outstanding mechanical properties, high rigidity, excellent hydrolysis resistance, resistance to microorganisms	Connectors and bushings, cable sheathing
	Water-vapor permeable, good tear propagation strength, very good mechanical properties	Functional membranes, films and coatings
	Excellent mechanical properties, very good damping behavior, good rebound, very good wear resistance	Pneumatic hoses, films and coatings, profiles, seals, damping elements, automotive injection molding
	Very good mechanical properties, good cold flexibility, good wear resistance	Conveyor belts, films and coatings, footwear, wheels and rollers, profiles, compounding, nonwovens
	Good mechanical properties, good wear resistance, good damping behavior and rebound	Hoses, profiles, footwear, wheels and rollers, animal ID tags
	Good mechanical properties, good abrasion resistance	Wheels and rollers, animal ID tags, rail pads, conveying and pneumatic hoses, profiles
	Transparent, good damping behavior and rebound	Films and coatings, transparent footwear applications
	Very good hydrolysis resistance, high wear resistance, very low compression set, very good mechanical properties	Rollers, star couplings, dynamic seals
	Very good transparency, good abrasion resistance	Films and coatings, calendaring
	Color-fast, non-yellowing, hydrolysis-resistant (ether)	Films and coatings, injection molding automobile interiors
	Transparent, long-term UV-stability	Films and coatings
	Very good wet grip, very flexible, very soft in part, highly transparent in part, ESD grades with very good volume resistivity	Footwear
	Very good damping behavior and rebound, high temperature resistance, improved setting behavior, good demolding properties, color-fast, soft touch	Seals, damping elements
	Non-halogen-based flame retardant, increased flame retardancy, reduced smoke density and toxicity	Cable sheathing, connectors and bushings, hoses
	Very good compression set, extremely low creep behavior	Seals, sorting stars
	Glass fiber-reinforced, very high stiffness, low thermal expansion coefficient, low shrinkage, very good impact resistance	Injection molding engineering, housings
	Basic suitability for food contact applications in FDA and EU-regulated markets (see Food Contact Information)	Conveyor belts, films and coatings, hoses
	Excellent adhesive properties, good solubility with a broad viscosity range	Films and coatings, thermal lamination, footwear
	Excellent adhesive properties, low activation temperature, good solubility with a broad viscosity range	Solvent-based adhesives, extrusion coating in footwear and textiles, co-extrusion, bonding layer hose extrusion


Durable.
Versatile.
Creative.

Footwear

Excellent properties, such as mechanical strength, resistance to abrasion, and slip resistance, together with a broad range of possible degrees of hardness make Elastollan® an ideal material for footwear applications.

Soft grades are used for cushioning elements, medium hardness grades are suitable for compact or combination soles and hard grades are the best solution for heels and heel tips. Anti-static agents can be added to the Elastollan® so that it can be used for safety footwear.

Another significant benefit for the footwear industry is the enormous design freedom that Elastollan® offers.
The product range includes options from transparent, to translucent to black. The color and shape of the sole can be chosen depending on the design of the shoes, whether they are for sports, leisure, business or safety – the possible uses of Elastollan® are almost endless.

Designer cycling shoes with Elastollan® sole elements

The winning shoes in the Calzaturiero Politecnico (School of Footwear Design and Technology) design contest, Italy

Elastollan® Light

Elastollan® Light is a thermoplastic polyurethane which is mixed with a blowing agent masterbatch and which has been optimized for sole injection molding processes. It is used to manufacture particularly lightweight, high-grade soles, cost-efficiently. Elastollan® Light is used in outsoles, midsoles and in elements in leisure shoes.

Properties

- Density (0.4 – 0.9 g/L, depending on the quantity of blowing agent and geometry)
- Highly resistant to wear and hydrolysis
- Improved thermal insulation
- Unlimited coloring possibilities
- Straightforward processing by injection molding

Elastollan® Soft

Elastollan® Soft is winning over customers with its extraordinary softness – in Shore hardnesses of 35 A to 50 A. Its silicon-like feel and total slip-resistance are also impressive, especially given that it is just as robust, resistant to hydrolysis and durable as conventional TPU grades. This product is especially well-suited to producing safety and leisure footwear. However, this barely scratches the surface of its potential…

Properties

- Very good wet grip
- Excellent mechanical properties
- Anti-static agent for ESD (electrostatic discharge)
- Resistant to oil and gasoline
- SRC-rated (slip resistance, highest category)
- Design freedom

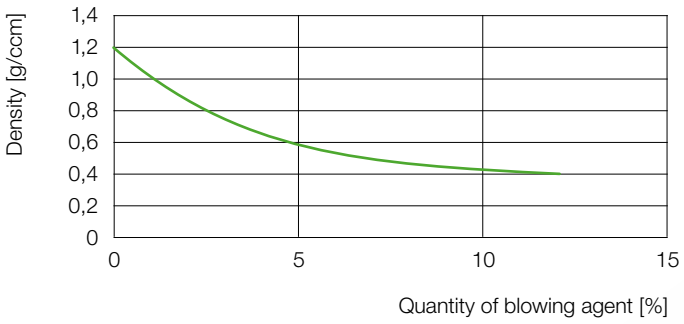


Fig.1: Density, depending on the quantity of blowing agent

Enormous design freedom for footwear soles, thanks to Elastollan®

Sports and Leisure

Materials are incredibly important in the sports and leisure sector; for professional sportsmen and women, having the right material can give them a competitive edge; in the leisure sector, it can increase comfort.

Each type of sport benefits differently from the properties that Elastollan® can offer. In winter sports, for example, Elastollan®'s excellent flexibility at low temperatures make it the material of choice. High resistance to abrasion and wear make applications in other sports possible, such as skating and cycling.

Elastollan® can be supplied in hardnesses of 55 Shore A to 74 Shore D. The degree of hardness can be tailored precisely to suit what is needed. Elastollan® is supplied in the form of granules and can be processed by injection molding or extrusion.

Its high resistance to abrasion and wear makes Elastollan® the ideal material for applications in the leisure sector e.g. in inline skates, skateboards and bicycles

Properties

- Abrasion-resistant
- impact resistance
- Rigid
- Flexible at low temperatures
- Good rebound
- Flexural strength
- Elastic
- Durable

Typical applications

- Ski boot shells
- Shells for snowboard boots
- Cap films
- Ski tips and ends
- Films for skis and snowboards
- Binder elements
- Kickboard rollers
- Longboard rollers
- Inline roller skate shells

Thanks to its flexibility at low temperatures,
Elastollan® is destined to be used for winter sports


High-grade.
Functional.
Efficient.

Automotive

Elastollan® in cars – for high-grade and versatile equipment.

Where conventional materials reach their limits, Elastollan® in vehicles can make all the difference. It is noted for its excellent surface feel and mechanics, as well as its good long-term durability. It gives freedom for a lot of design possibilities. Its strength lies in its versatility: the properties of Elastollan® can be readjusted and recombined time and again – depending on the application and the specific requirements of the component.

Properties

Tailor-made Elastollan® grades with outstanding properties for automotive components:

- High temperature resistance and dimensional stability
- Very good low temperature toughness
- Superior dynamic properties: flexible and elastic
- Good media resistance
- Excellent abrasion, scratch and wear resistance
- Very good resistance to weathering
- High tear strength
- Excellent damping behavior
- Good welding characteristics and adhesion to various materials

Applications

Elastollan® for the highest quality standards – established in many car applications:

- Gear lever knobs and door handles
- Tactile interior surfaces
- Sealings in the engine compartment
- Cable sheathing, cable sleeves and connector overmolding
- Vibration dampers
- Decorative cover strips and trim details
- Antenna overmolding
- Coil spring isolators

The Citroën C4 Cactus, with large, air-filled cushion bumpers in contrasting colors on the sides, front and rear

Exterior

Airbumps®

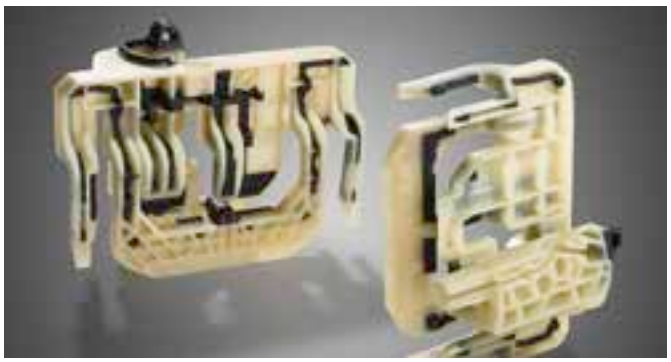
As the first TPU manufacturer, BASF has successfully optimized the material so that it can be applied extensively and unpainted on the vehicle exterior

The Airbumps® of PSA Peugeot Citroën are made of scratch-proof, UV- and weather-resistant Elastollan® AC 55D10 HPM

Snow chains

Snow chains made from Elastollan® B90A15 and B60A10WH meet the ÖNORM 5117 standard and are easy to fit. The two TPU grades are abrasion-resistant, flexible at low temperatures, and resistant to loose chippings and road salt

Window pane mount



Window pane mounts benefit from the excellent resilience and high abrasion resistance of Elastollan® even at low temperatures

Powertrain

Coil spring isolators

Coil spring isolators made of long-lasting, oil-resistant Elastollan® especially meet the extremely high specifications for chassis applications

Sealing lips

Flexible sealing lips made of Elastollan® protect the car against dirt and moisture while providing excellent adhesion to polyamides

Interior
Instrument panel

Interior

Instrument panel

With two-component injection molding, extensive and complex parts like instrument panels can be manufactured with excellent surfaces and appealing haptics. Due to the high lightfastness of the finish made of Elastollan® the costs for subsequent varnishing can be saved

Gear lever knob

Soft touch gear lever knobs made of Elastollan® offer a hand-friendly surface structure, are abrasion-resistant and show excellent mechanical and chemical strength

Door module

The high-quality and soft Elastollan® surface enhances the interior: It is lightfast, scratch-proof and resistant. During the manufacturing process of these prefabricated parts varnishing is not necessary

Door handle

Thanks to Elastollan® this interior door handle stands out for its pleasant touch and high-quality look as well as good damping properties and long service life

Trim panel

Shapely designed trim panels made of Elastollan® are long-lasting, lightfast and UV-resistant

Slush skin

High-quality surfaces, made from Elastollan®: The slush skin of this instrument panel is characterized by outstanding UV-resistance, low density and good low temperature properties


Resilient.
Resistant.
Strong.

Industrial Manufacturing

Typical applications include components for the mining industry and the production of wheels and rollers. These components have to withstand the most demanding conditions in terms of impact and abrasion. Thanks to its excellent mechanical properties, Elastollan® is used for screens and guide rollers, for example.

Wheels and Rollers

Industrial wheels and rollers have to be able to withstand ever increasing loads. High performance drive motors are delivering ever greater acceleration and ever quicker reaction and access times, such as in modern high-bay warehouses. These loads inevitably lead to rapid rises in temperature in the materials used. Elastollan® CS in particular is characterized by the following properties:

- Optimized damping and temperature properties
- Very good compression set, even with substantial loads
- Low rolling resistance
- Low creep behavior at standstill
- Excellent adhesion to the wheel center

Mining

The conditions in the mining industry are extremely tough. Machines and plastic elements are exposed to high stresses from impact, abrasion and aggressive chemicals. This industry favors the use of Elastollan® (TPU) due its excellent mechanical characteristics for screens:

- Very good abrasion values
- Robust impact strength
- High tear and tensile strength

Photo: faigle Kunststoffe GmbH

Agriculture

Elastollan® is used in agriculture for plastic elements that are subjected to high stresses. The components have to withstand high mechanical stresses. Apart from being used in agricultural machinery, Elastollan® is widely used in the production of ID tags for the identification of livestock.

Agriculture

Highly wear-resistant components for agricultural machinery

Soil preparation, sowing and machine harvesting all make use of plastic elements which are subjected to extreme stresses, in wide-ranging types of agricultural machinery. These plastic elements are manufactured in part from Elastollan®, for example, sorting stars which separate stones from soil. High mechanical values such as compression set, tear strength and abrasion are essential in this instance. Plastics are also lighter than comparable metal parts. This lowers the overall weight of the agricultural machine and reduces soil compaction.

Animal ID tags

Traceability in meat production has become more important as quality standards in the food industry have become ever more stringent. What matters is the ability to identify livestock in terms of country of origin, fattening farm and fattening animal. Elastollan® is now widely used for this application. High resistance to weathering, discoloration and soiling are essential to ensure that the barcodes can be scanned correctly. At the same time, the flexibility of the plastic prevents any injuries to the animal.

Building and Infrastructure

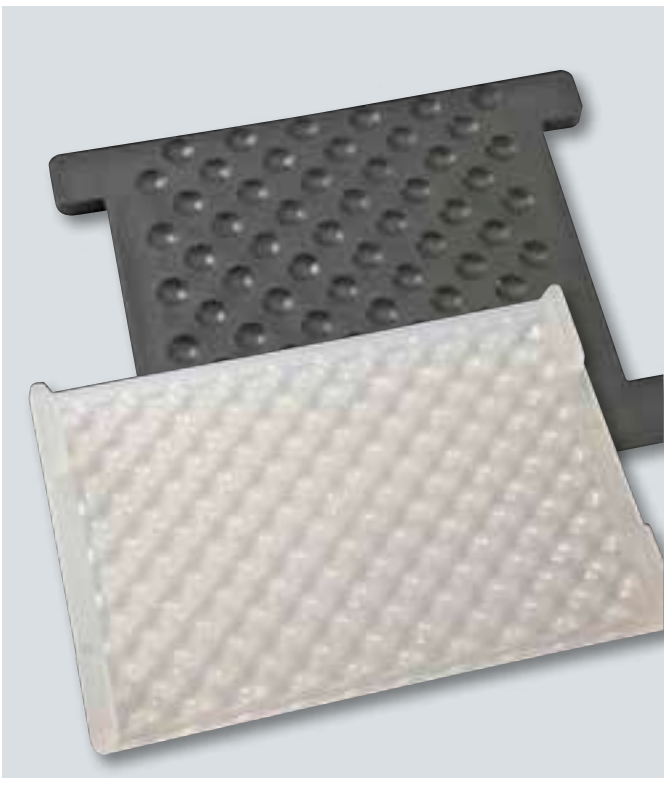
Forward-looking polyurethane application for Elastollan® railroad systems.

Railway Pads

Used in pads of railway tracks, Elastollan® delivers outstanding values. Its excellent elastic behavior and weather resistance make Elastollan® the number one choice for railway pads. This material is available in different hardness grades and has an impressive, extraordinarily good compression set. Elastollan® also scores points for its superior resistance to abrasion, unbeatable carrying capacity and outstanding damping properties. The durability of the materials is one of the reasons why TPU is particularly cost effective for railway pads.

Properties

- Can also be used in extreme climate conditions
- Good mechanics and abrasion resistance
- Good damping coefficient
- Good rebound
- Resistant to weathering and ozone



We would be pleased to send you the following brochure: Elastollan®- Product Range, with detailed information about the technical properties of Elastollan®.


Reliable.
Long-lasting.
Flexible.

Films and Extrusion Coatings

Flexible films made from Elastollan® not only look appealing, they also protect, seal and provide adhesion. Elastollan® has such a versatile set of properties that it has numerous possible applications in sectors such as the automotive industry, construction, textile and medical.

Membranes

In textile membranes and medical membranes, Elastollan® offers high water-vapor permeability whilst still being wind- and waterproof, combined with good elasticity.

Roof linings

Elastollan® roof linings are characterized by their excellent mechanics, aging resistance and high water-vapor permeability. In practice, roof linings manufactured from Elastollan® are not only more durable, they show above-average tear strength and penetration resistance as well as good adhesiveness of the individual sheets under lathing and tiles.

Special Morphology

Even without the use of additional additives, the unique morphology of Elastollan® grades SP 806 and SP 883 produces a matte, non-blocking film surface. It is characterized by a low surface tension and very good adhesion to the substrate. The surface is particularly skin-friendly, which is vital for medical applications among others.

Thermal lamination

When it comes to good adhesion to all kinds of substrates, including films, sheets or indeed PU foam systems, Elastollan® is the material of choice. Our Elastollan® product portfolio will have the right melting temperature profile, elasticities and resistances for your application and laminate.

Films for flexible chamber systems
Applications which make use of flexible chamber systems demand materials which combine high tensile strength with elasticity and which are also easily weldable. The weld seams of lumbar supports must stay absolutely tight for years in spite of constant mechanical stress.

Color-fast film applications
Alongside typical TPU characteristics like elasticity and high mechanical resilience, Elastollan® grades that are based on aliphatic raw materials offer lasting color-fastness and excellent transparency. Known applications are glazing, surface protection in the automotive and electronics sectors and graphic films.

Innovative and particularly long-lasting: When used for a wear layer on heavily used flooring, Elastollan®'s strengths are evident in walking comfort, excellent damping properties and pleasant surface feel.

Photo: Fritz Egger GmbH & Co. KG

Properties
- Abrasion-resistant
- Flexible from -40 to +125 °C
- Resistant to cuts and tear propagation
- Resistant to microbes (polyether grades)
- Hydrolysis-resistant
- Resistant to oil and grease
- Resistant to ozone and high-energy radiation
- Highly elastic and extensible

Typical applications
- Protective film for mattresses
- Packaging films
- Ski and snowboard films
- Cushions for shoe inserts
- Breathable weatherproofing membranes for functional clothing
- Skinning acoustic PU damping parts in the automotive industry
- Roof linings
- Plaster films
- Emblems
- Seals

Special Elastollan® grades are also
- Adapted to matte surfaces
- Non-halogen-based flame retardant
- Adherent to reaction foams and laminating adhesives
- Suitable for deep drawing and thermoforming
- Scratch-resistant
- Suitable for welding and thermal laminating
- Color-fast
- Highly transparent
- Water-vapor permeable

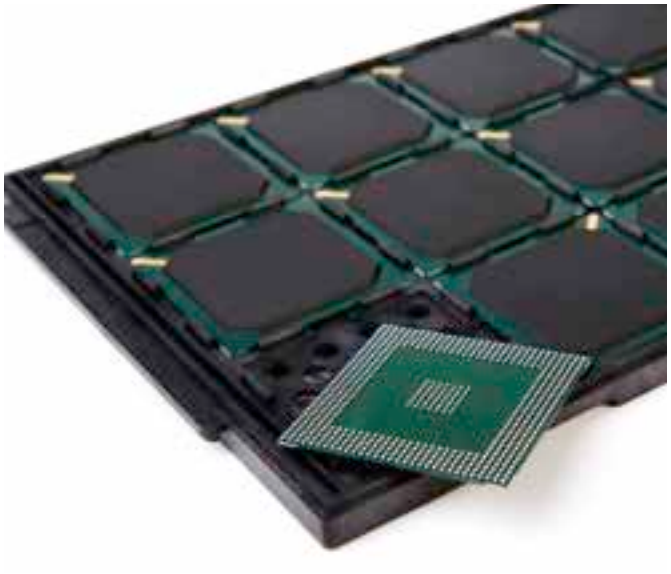
Sheet extrusion / multilayer systems

A critical factor when it comes to combining typical thermoplastic sheet materials like ABS with Elastollan® is that they respond well to processing using co-extrusion techniques, as we demonstrating good layer adhesion. Elastollan® scores points for excellent surface mechanics, wear resistance and surface feel. Damping characteristics and abrasion resistance are critical for deep-drawable transport systems for high-grade, sensitive components. When it comes to trim parts for vehicle interiors or trucks, colorfastness and mattness are important factors in choosing the right materials.

Flame retardant films

Films made from halogen-free flame retardant Elastollan® are the innovative choice for heavily used floors in the transport and aviation sectors as well as commercial construction. It is both comfortable to walk on and has excellent wear resistance whilst having a low grammage.

Even decorative textiles such as e.g. roller blinds and flexible partitions can be equipped with flame retardant film laminates.



Co-extruded surface films for transport packaging

Elastollan®-based wear layer for floors, especially in trains and airplanes

Ski films

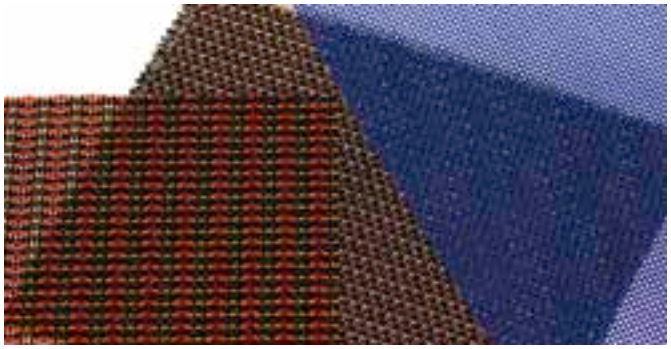
Icy pistes, damp and biting cold have nothing on cap films made from Elastollan®, thanks to its excellent scratch resistance, hydrolysis resistance and flexibility at low temperatures. High-grade decorative features are afforded the best possible protection by the transparent, UV-protected, reverse-printed surface film.

Transparent Elastollan® ski surface films

Technical Fibers and Nonwoven

Outstanding elasticity means that Elastollan® is particularly suitable for producing mono- and multi-filaments, as well for coating polyester and glass fibers. It can also be worked into nonwoven fabrics using the melt blown as well as spun bond techniques.

Polyester and glass fibers are processed into products including UV-resistant, highly flexible fabrics for shadingsystems and covering chairs. When it comes to decorative fibers, brushes and shoe uppers, Elastollan®-based materials are distinguished by their good tear and abrasion resistance and pleasant surface feel.



Fabrics made from TPU filaments

Nonwovens are used in filter, seal and hygiene applications. For these applications, particular importance is placed on product benefits such as elasticity of up to 500 %, high rebound and adjustable gas permeability. Good weldability in high-frequency and ultrasound processes, or suitability for food contact applications can also be a reason for choosing Elastollan®.

TPU nonwoven, e.g. for hygiene or filter applications

Cable Sheathing

The areas in which Elastollan® can be used as sheathing are as manifold as its properties, since it meets the stringent protective requirements for power and control cables.

Elastollan® cable sheathings are used in the automotive industry and in machinery construction. The plastic is also used for special cables used on oil rigs, in power stations and in airport apron areas. BASF offers consistently high product quality and batch-to-batch consistency, setting the standard in the extrusion of cable sheathings in terms of cost efficiency and processing reliability.

Machinery construction

In order to minimize downtime and ensure durability, control and power cables for industrial robots are produced with a sheathing of halogen-free flame retardant Elastollan®. This ensures that despite being under constant mechanical stress and having flame retardancy, they remain flexible, abrasion-resistant and hard-wearing, and guarantee the highest level of reliability and functional safety. Different flame retardancy requirements are fulfilled, depending on the structure of the cable, in accordance with IEC, VDE or UL standards.

Consumer electronics

Materials that are used in consumer electronics applications have to meet many different requirements in relation to reliability, surface feel and flame retardancy. Chemical resistance to substances such as olive oil, skin cream, ketchup, soft drinks or cleaning products is also included in the release criteria, which Elastollan® meets comfortably.

Special cables

Special Elastollan® variants are used in many other fields of application. Our extensive product portfolio offers a high number of possible solutions that are tailored to each individual set of requirements.

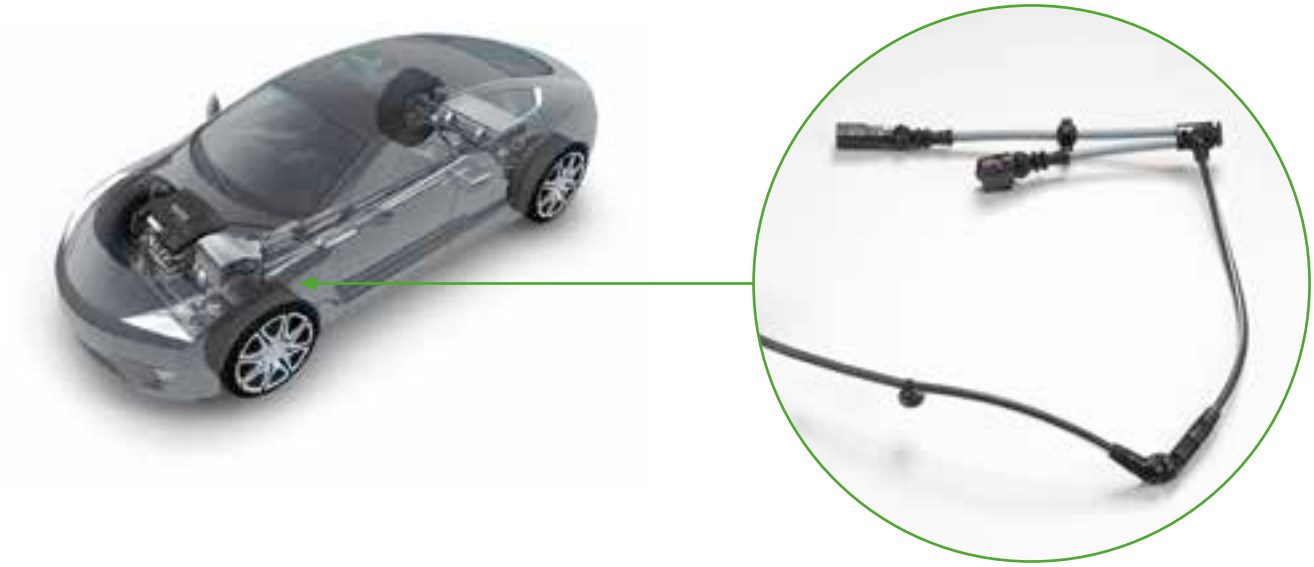
Connectors

A watertight, highly resilient connection between cable sheathing, contact carrier and bushing is achieved by means of direct injection, even when different Elastollan® grades are being used. The high resistance to wear and abrasion of Elastollan® characterizes all of these components. For molded connectors, anti-kink bushings and cable switches, which are used in industrial applications for example, flame retardant Elastollan® grades like 1185 A 10 FHF and 1185 A 10 HFFR are used alongside the standard polyether grades. The polyether grades Elastollan® 1154 D 10 FHF and 1280 D 10 FHF are particularly suitable for applications requiring higher grades of hardness.

Elastollan® 1175 A 10 W is widely used for anti-kink bushings in automotive engineering, as well as for ABS and ESP wires. Contact carriers and plug-in connectors, which need to have very good impact strength with high stiffness combined with a low thermal expansion coefficient and low shrinkage, can be manufactured particularly efficiently using the glass-fiber-reinforced, polyester-based Elastollan® R3000. This Elastollan® grade also displays outstanding electrical properties with a tracking resistance of 600.

Automotive cables

Speed sensor cables for ABS and ESP systems use outer-sheathings of Elastollan® to provide a secure flow of information – even in the area of the wheel house, close to the axle, which is at risk of impact from stones and exposure to water, vibration and cold. BASF thermoplastic polyurethane is also used in cable coverings for electric parking brakes, battery cables and rearview cameras.



E-mobility

New mobility concepts require innovative materials. Charging cables for electric vehicles also need cable sheathings ensuring a strong resistance to UV, weather, ozone and microbes. In order to make the charging process safe, cables should be made flame retardant without halogens, must be able to form a coil and must be flexible. Elastollan® is perfect for this complex requirements profile. Elastollan® further sets itself apart from other materials by being recyclable.

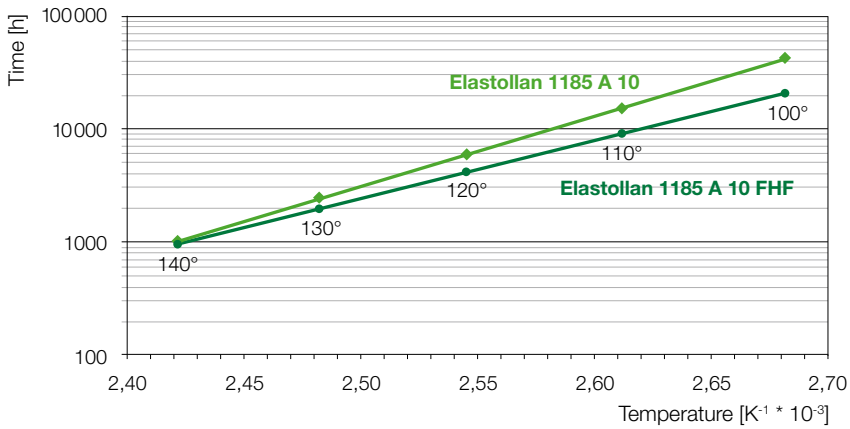


Fig. 2: Thermal long-term straight line for air aging according to DIN 2578 (end value criterion: elongation at break = 300 %)

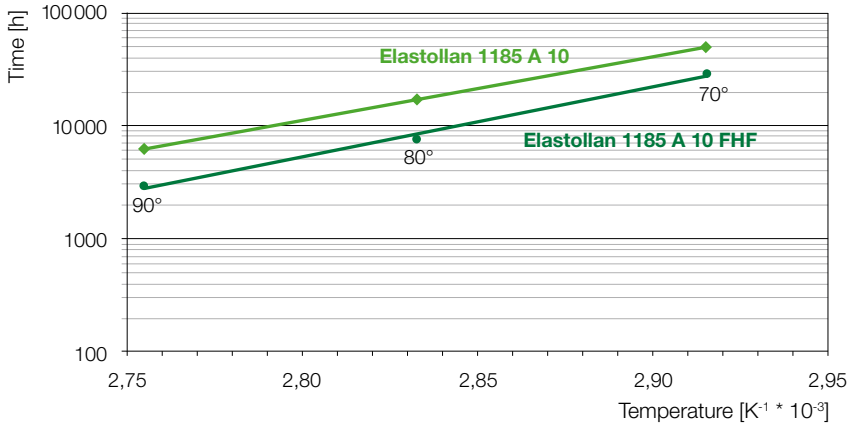


Fig. 3: Thermal long-term straight line for hydrolysis in accordance with DIN 2578 (end value criterion: elongation at break = 300 %)

Properties

- Abrasion-resistant
- Can be used across a broad range of temperatures
- Resistant to cuts and tear propagation
- Resistant to microbes
- Hydrolysis-resistant
- Resistant to oil and chemicals
- Resistant to environmental factors such as ozone, UV and weather
- Very good adhesion properties between the connector/bushing and sheathing

Typical applications

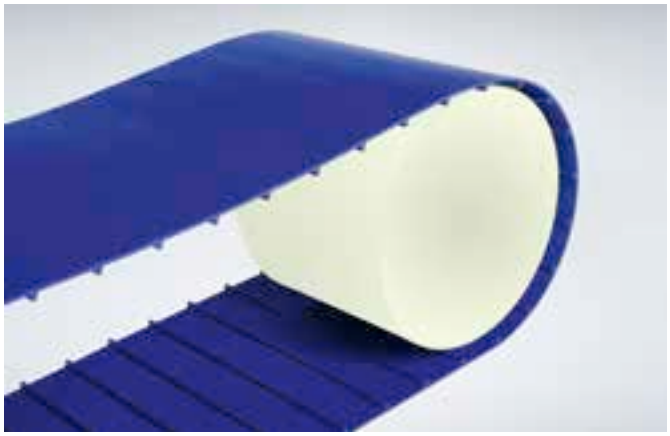
- Automobile cables: antilock braking system (ABS), electronic stability control (ESC), traction control system (TCS), battery cables
- Trailing cables in automation
- Feed lines for robots and handling equipment
- Supplying power to construction machines and devices
- Consumer electronics
- Exploration of raw materials
- Special cables for wind power plants, medical devices and rail vehicles

Belts and Profiles

Extruded belts and profiles are used in many different applications for power transmission and automation. Whenever safety, reliability and durability are paramount, Elastollan® provides cost-efficient solutions.

Conveyor belts

When in use, conveyor belts are subjected to continuous stress: How hard-wearing the material is quickly becomes obvious from its tensile strength and heat distortion resistance. Elastollan® is setting the standard for this application, with its wide range of Shore hardnesses for ester and ether grades and can also be used in food contact applications. It also has a low creep tendency, is highly resistant to cleaning agents and has good wear resistance.



Elevator belts

Materials for elevator belts need to have very good mechanical properties, together with high resistance to abrasion and very good creep behavior. The BASF portfolio also offers interesting alternatives combining halogen-free flame retardancy with good mechanical properties.

Drive belts

Round-section and V-belts made from Elastollan® are characterized by good abrasion resistance, low creep behavior, weldability and high flexibility. Suitability for food contact applications according to FDA and EU FC regulations completes the broad set of properties of the Elastollan® FC product portfolio.

Timing belts

With its optimized processing behavior and resistance to wear, the Elastollan® SP B grade is perfect for producing timing belts. The proven benefits of this product range also include good mechanics and resistance to heat distortion.

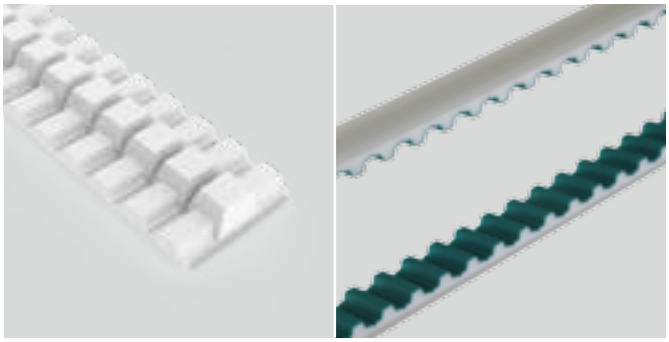


Photo: Gates Mectrol GmbH

Aliphatic light guides and light strips

Aliphatic Elastollan® is used for light guides since it is a material which only causes slight scattering, resulting in a high light yield. With its long-lasting color-fastness, Elastollan® is also ideal for light strip coatings, since it is highly transparent and displays the elasticity and flexibility that are typical of thermoplastic polyurethane.

Calendaring

Elastollan® grades that melt easily and do not adhere to rollers are suited to the production of belts and films using calendaring processes. Suitability for food contact applications is often a precondition for the production of films or conveyor belts from thermoplastic polyurethane.

Photo: SML Maschinengesellschaft mbH

Properties

- Abrasion-resistant
- Flexible through a broad temperature range (-40°C to +125°C)
- Resistant to cuts and tear propagation
- Resistant to ozone
- Resistant to microbes (polyether grades)
- Hydrolysis-resistant
- Resistant to oil and grease

Special Elastollan® grades are also

- Suitable for food contact applications
- Flame retardant, without the use of halogens
- Suitable for calendaring
- Adapted to matte surfaces

Typical applications

- Conveyor belts
- Timing belts
- Drive belts
- Elevator belts
- Strippers
- Round-section belts
- Sealing lips
- All types of profiles

Hoses

Elastollan® is ideally suited to use in numerous tube and hose applications, by virtue of its wear resistance, resistance to fluids and flexibility. BASF has many years of experience in producing thermoplastic polyurethane for extrusion applications, meaning that we can guarantee excellent, consistent product quality.

Elastollan® in pneumatic applications

Pneumatic hoses have to meet stringent requirements in order to guarantee lasting functional safety and avoid costly breaks in production. Particular emphasis is placed on minimal creep behavior, optimal burst behavior and the ability to deliver with small bending radii.

Apart from the established Elastollan® products C 98 A 10 and 1198 A 10, Elastollan® 1598 A 10 combines the very good hydrolysis and microbial resistance of an ether with the excellent mechanical properties of an ester-based TPU.

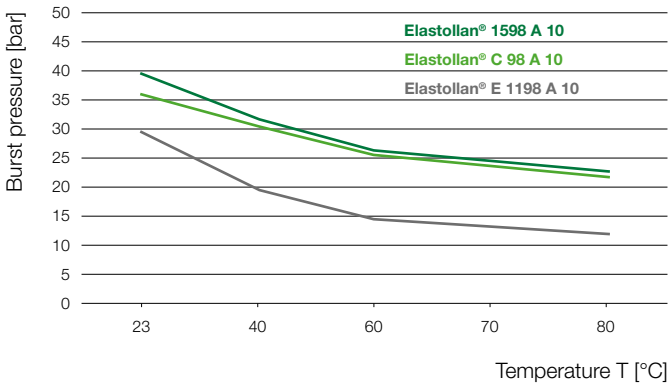


Fig. 4: Burst pressure, dependent on temperature

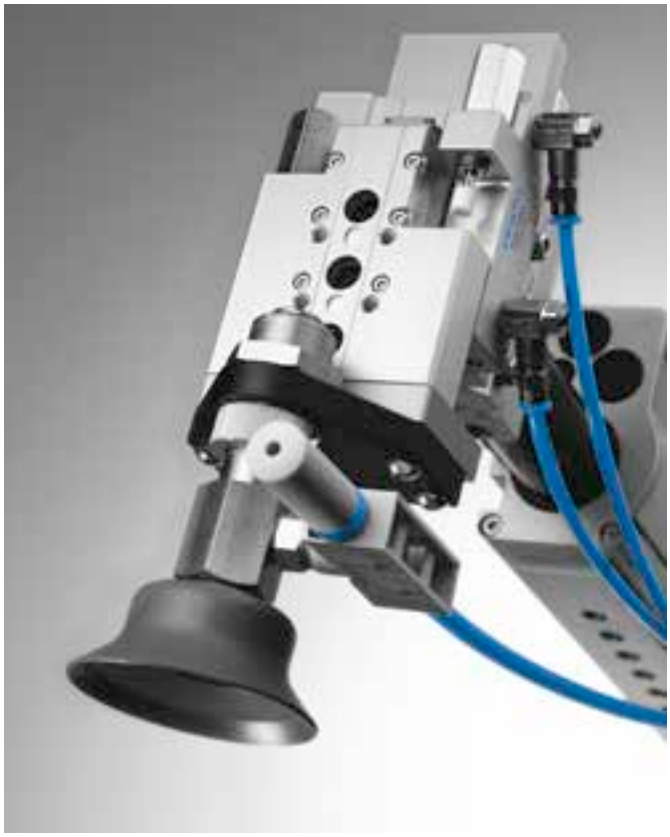


Photo: Festo AG & Co. KG

Photo: Ralph Bohle GmbH

Bicycle inner tubes

Another example of innovative product solutions using BASF thermoplastic polyurethane: Bicycle inner tubes made from Elastollan® have a thinner wall, making them more than 50 % lighter than conventional rubber inner tubes, without compromising their continuous load carrying capacity or their lifespan!

Hydraulic hoses
In mechanical engineering and vehicle construction Elastollan® provides flexibility and durability to the hoses along with good resistance to oil and grease.

Conveyor hoses
Vacuuming up materials such as wood chips, gravel and sand calls for excellent abrasion resistance on the part of the conveying hoses used. By combining considerable strength and lasting flexibility Elastollan® guarantees that the hoses are in use for the maximum length of time.

High performance hoses for industry, mining and agriculture
Elastollan®-based high performance hoses are found in a wide range of industrial applications. Properties such as resistance to oil, gasoline and chemicals are especially significant in this area.

High abrasion resistance and flexibility, good resistance to ozone, UV and liquid manure mean that Elastollan® hoses are also ideally suited to use as trailing hoses in agricultural applications, Photo: Jakob Eschbach GmbH

Should approval for drinking water be required for water pipes, Elastollan® 1185 A 10 T meets the stringent standards set by the German Recommendations Pertaining to Plastics and Drinking Water (KTW) (Recommendation category A), the WRAS (BS 6920-1:2000) and the German Technical and Scientific Association for Gas and Water (DVGW) (W270), Photo: Jakob Eschbach GmbH

Properties
- Abrasion-resistant
- Flexible from -40 to +100 °C
- Resistant to cuts and tear propagation
- Resistant to ozone
- Resistant to microbes (polyether grades)
- Hydrolysis-resistant
- Resistant to oil and grease

Special Elastollan® grades are also
- Flame retardant, without the use of halogens
- Adapted to matte surfaces

Typical applications
- Pneumatic hoses
- Spiral hoses
- Conveying hoses
- Hydraulic hoses
- Bicycle inner tubes
- Agricultural hoses, trailing hoses
- Water pipes

Flexible and resilient in a broad temperature range

Spiralized hoses for use in automation applications require materials that can offer a combination of mechanical resistance and flexibility. Ether- and ester-based products like Elastollan® 1198 A 10 and C 98 A 10, as well as flame retardant special products like Elastollan® 1154 A 10 FHF and 1192 A 10 FHF are therefore the materials of choice.

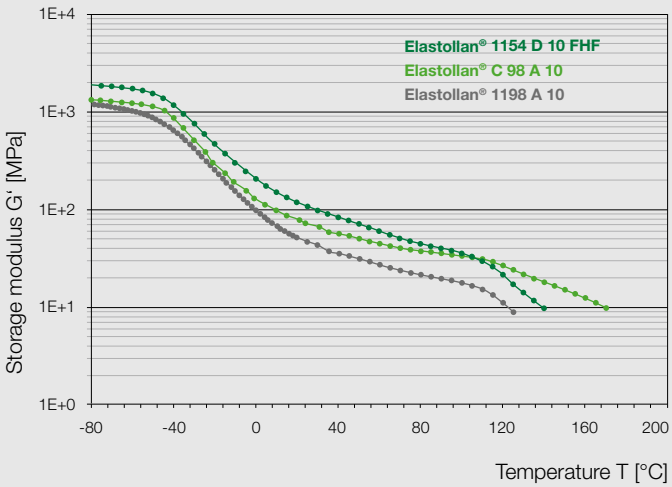


Fig. 5: Storage modulus, depending on temperature

Food Contact

The Elastollan® FC portfolio has been specially developed for the use in food contact applications and is often used in the food industry or in drinking water applications.

Safe food contact applications

Conveyor belts or conveying hoses that are used as system components must not exude any critical substances which are transferred to food and could alter the taste, odor or composition of the food.

BASF's Elastollan® FC grades comply with both the guidelines in the EU legislation on food contact applications and the FDA (Food and Drug Administration) regulations. They are produced in accordance with the stringent safety standards of the GMP (Guidance for Good Manufacturing Practice 2023/2006/EG).

Properties

- Flexibility at temperatures up to -40°C
- Resistance to a wide range of chemicals
- Tensile strength
- Tear strength
- Low creep tendency
- Good abrasion resistance

Typical applications

- Conveyor belts
- Nonwovens
- Profiles
- Conveying hoses
- Injection molded components for sorting machines
- Pneumatic hoses
- Films

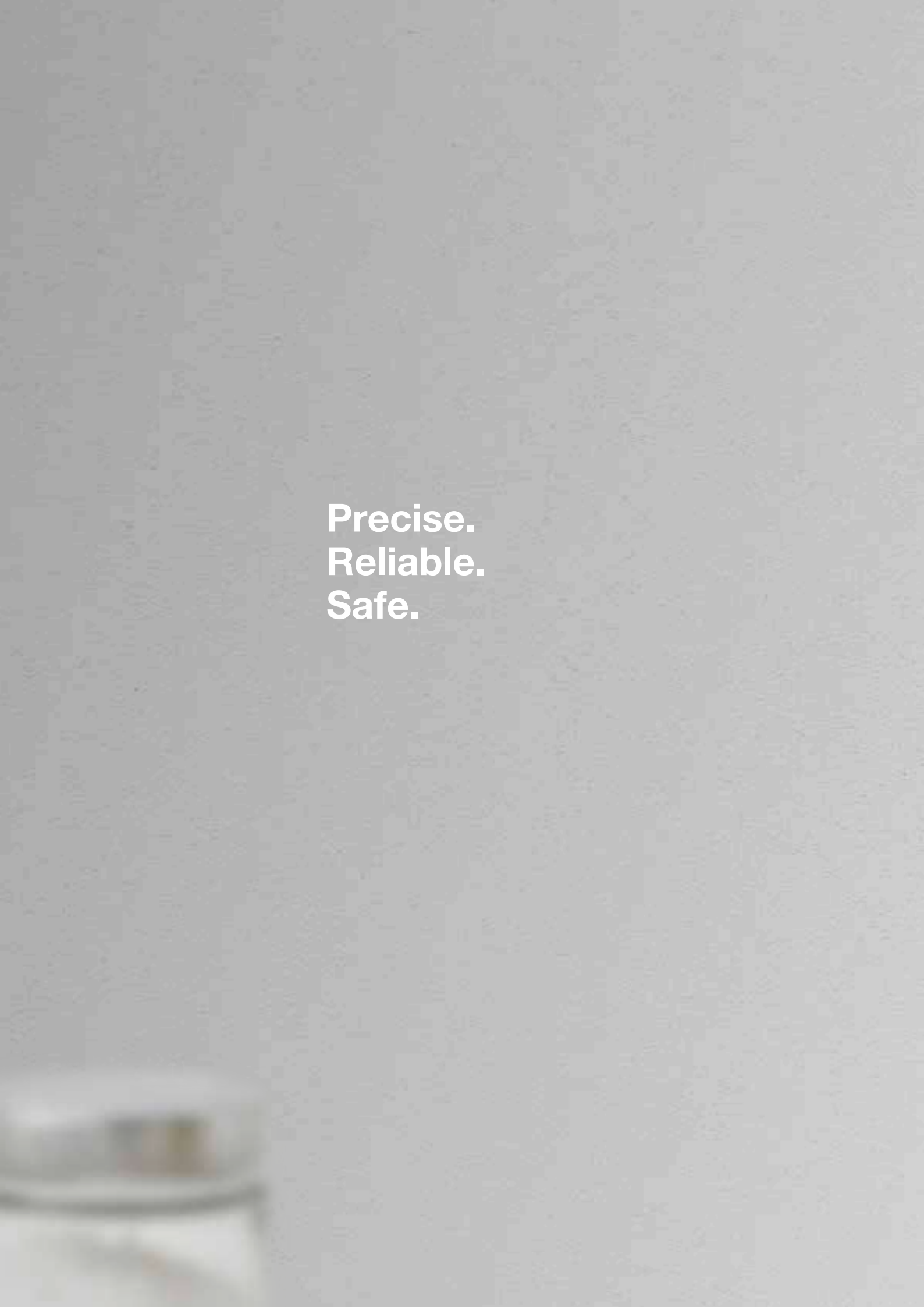
Good manufacturing practice (2023/2006/EC)

By implementing additional GMP measures, BASF ensures a constantly high product quality. Important GMP aspects deal with system suitability tests, carrying out risk analyses relating to contamination risks, comprehensive documentation of process and quality control data and adhering to defined cleaning cycles, as well as the specified clearance of suppliers and raw materials.

Broad portfolio

The new Elastollan® FC portfolio consists of more than 20 products and concentrates and includes both ether- and ester-based grades. This comprehensive portfolio means that BASF can help customers to develop a wide range of TPU applications with food contact.

To determine the suitability of these BASF products for certain applications a thorough evaluation by the processor(s), manufacturer(s) and/or distributor(s) is required. Where specific regional regulations do not exist, the current legal EU and US requirements as well as globally accepted standards for consumer articles, food contact articles and medical devices should be used as reference. Please contact our Sales Office in case of further questions.

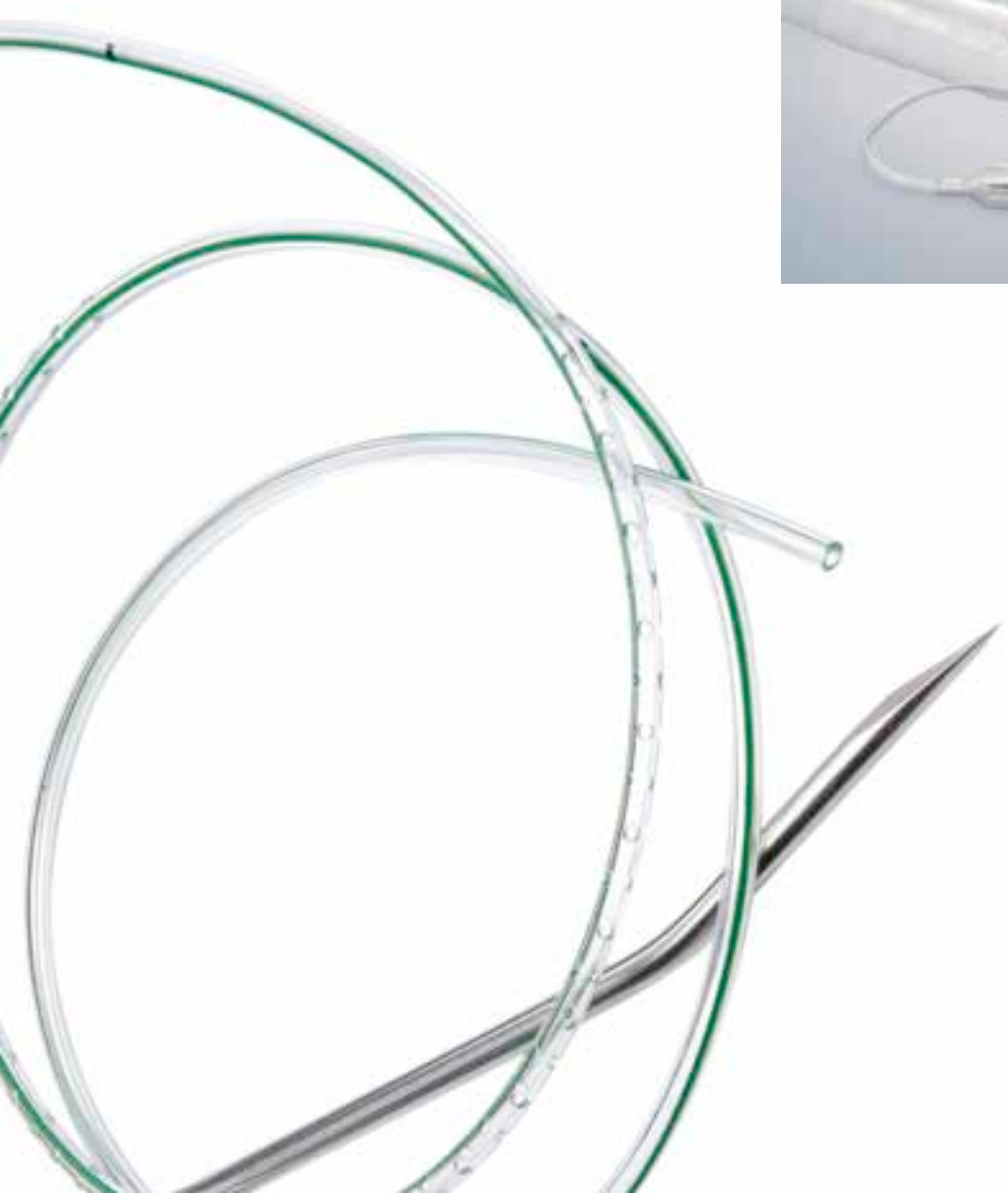

Precise.
Reliable.
Safe.

Medical Engineering

Medical engineering is a demanding market – after all, it's about human health. Manufacturers of medical engineering applications are therefore required to follow strict government guidelines. Medical products made from Elastollan® provide safety during operations and post-operative patient care.

Drains

Redon-Drains, which are made from Elastollan® and feature X-ray contrast strips made by the company Medinorm Medizintechnik GmbH, are very flexible and therefore build up a good tension even with little elongation. This allows the drain to be applied directly to the delivery needle (without an adapter). Elastollan® drains are also biocompatible: The drain does not grow into the tissue and is easy to remove.



Stool drainage system

Shaped into films with extremely thin walls, in complex shapes: The company Creative Balloons uses Elastollan® to produce a balloon that adapts to the anatomy. This prevents constant pressure being placed on the body's tissues. The 15 µm thin, foldable tube elements are highly flexible yet have a high tear resistance.

Hollow fiber membranes

The oxygenator produced by Maquet Cardiopulmonary GmbH takes over lung function during open heart surgeries. Elastollan® membranes, produced with great precision, function as heat exchangers. The plastic makes it possible for these fibers, which have walls only 70 µm thick, to be produced safely.

Infusion system

The ProSet infusion system from B. Braun Melsungen AG is used in the sensitive area of oncology. It ensures sterile handling of the infusion regimen. The use of components made from Elastollan® prevents active agents being lost through drugs interacting. The patient's mobility can also be adapted to the particular space, thanks to Elastollan® spiral lines with excellent elasticity.

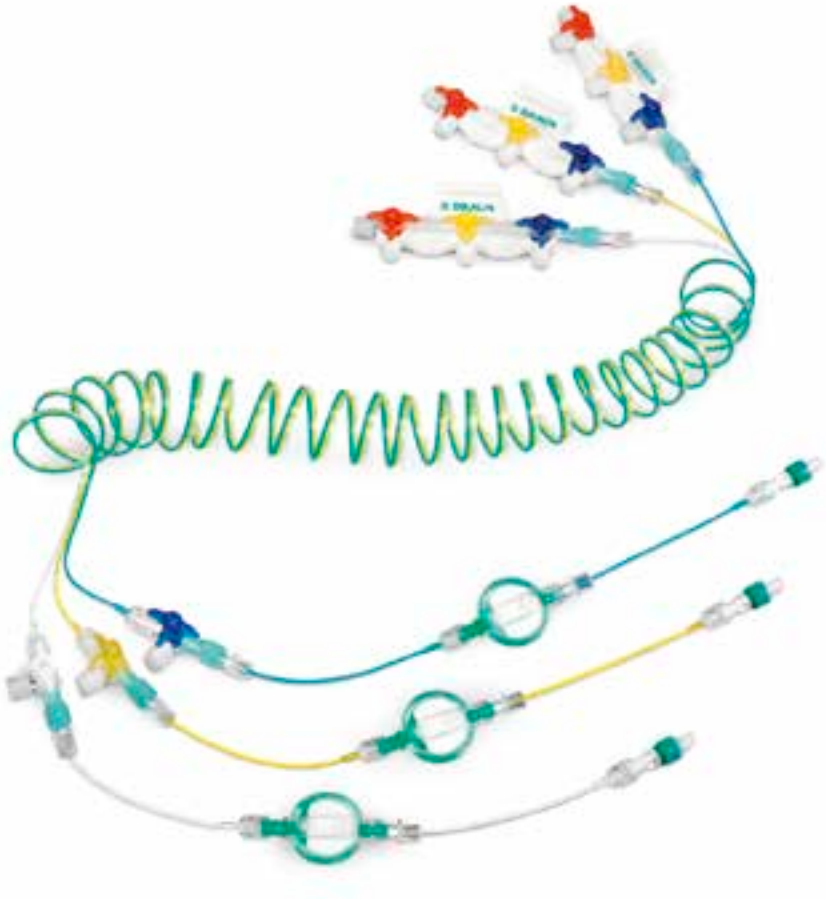


Photo: B. Braun Melsungen AG

General properties

- Highly transparent
- Resistant to chemicals
- Readily processible
- Extremely tear-resistant and flexible
- Kink-resistant
- Easy to sterilize with ethylene oxide and gamma radiation
- No plasticizers

Examples of applications from our customers

- Infusion kits
- Redon drains
- Hollow fiber membrane for oxygenators
- Urinary catheter
- Tracheal cannula
- Wound coverings
- Peripheral venous catheters
- Catheters in general, single and multi-lumen
- Drainage systems

Please note the disclaimer on page 60 in respect of medical applications.

Versatile.
Innovative.
Sustainable.

Adhesives

BASF offers TPU for adhesives, with Elastollan® Bondura and Elastollan® Hotbond. These products complement the TPU range and underline BASF's position as a provider of integrated solutions for TPU and TPU-based adhesives. This is how we are able to develop innovative solutions efficiently, in collaboration with our customers.

Elastollan® Bondura

Elastollan® Bondura is a TPU for adhesives that contain solvents, and extrusion coatings. It can be used as a base polymer for single component adhesives or in combination with crosslinking agents.

Product portfolio

- General grades – polyester grades
- Hydrolysis-resistant grades – PCL grades
- Non-yellowing aliphatic grades
- Maximum toluene-solubility, MC-soluble grade – TDI grade

Main characteristics

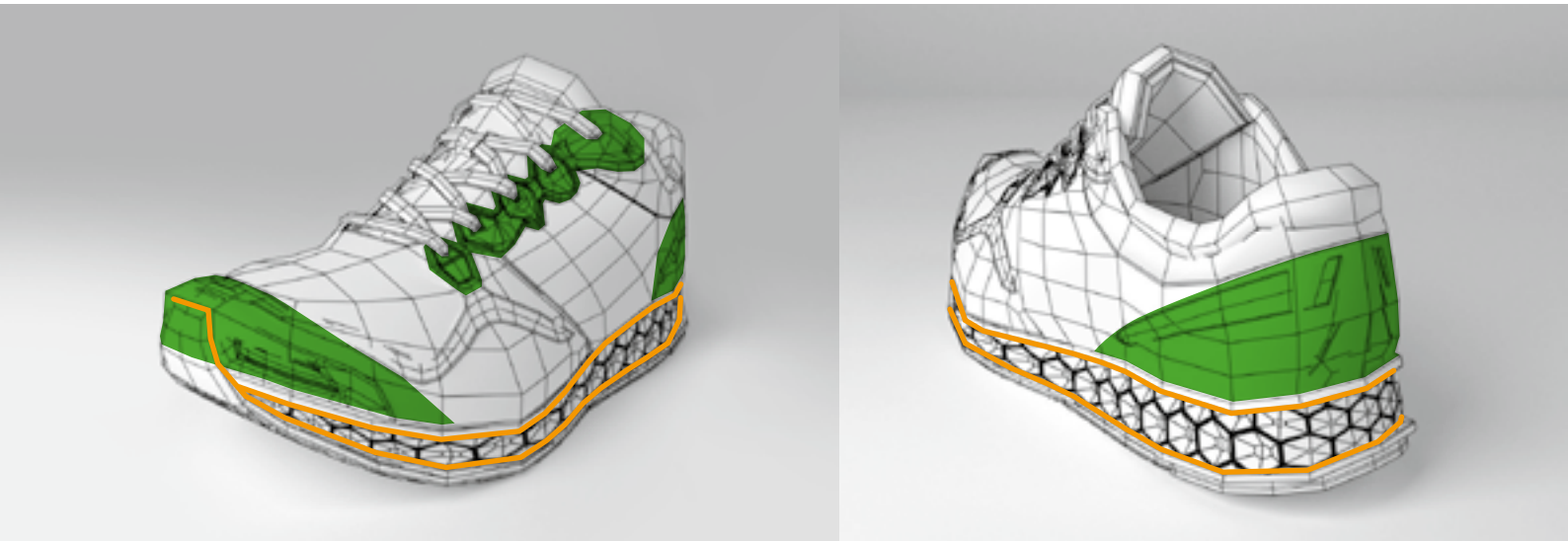
- Excellent adhesion to TPU, PVC, PA, polyester fabrics and leather
- Activation temperature 55 - 65 °C
- Good initial bonding
- Good solubility with a broad viscosity range

Applications

- Coating of footwear materials
- Coating of textiles
- Spray technology
- Extrusion coating and co-extrusion
- Adhesive layer for fire hoses

Elastollan® Bondura for solvent-based adhesives

Fields of application of Elastollan® grades for solvent-based adhesives (Bondura: orange) and reinforcement elements (Hotbond: green) in footwear



Elastollan® Hotbond

Elastollan® Hotbond is a TPU for melt adhesives.
The melt flow index can be adapted to the individual classes.

Product portfolio

- Soft TPU melt adhesives (Shore hardness 70 A-92 A)
- Hard TPU melt adhesives (Shore hardness 95 A-97 A)
- Non-yellowing TPU melt adhesives (Shore-hardness 85 A-98 A)

Main characteristics

- Excellent adhesion to TPU, PVC, PA, polyester fabrics and leather
- Hardness grade of 70 A to 98 A
- Flow temperature 60 - 140 °C
- Tack free time of 2 to 25 minutes
- Broad range of products
- Can be adapted quickly

Applications

- Film extrusion (hot melt film adhesive, adhesive layer for seam sealing tape)
- Thermal lamination
- Heel and toe caps for the footwear industry
- Powder coating

Infinergy® (E-TPU)

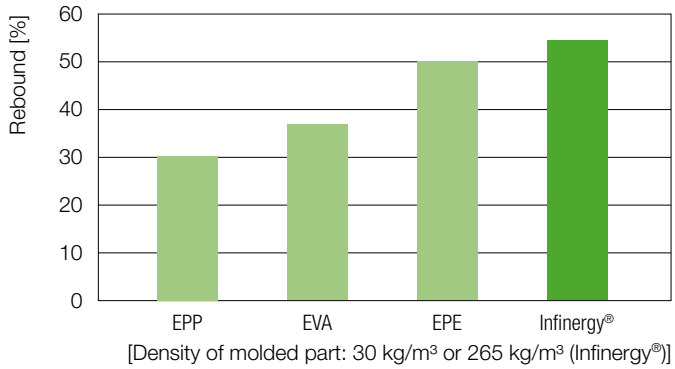
This closed-cell, elastic particle foam combines the properties of TPU with the advantages of foams.

Infinergy® is the world's first expanded thermoplastic polyurethane (E-TPU). It is characterized by its:

- Low density
- High elasticity
- Excellent rebound
- High abrasion resistance
- High tensile strength
- Good resistance to chemicals
- High durability across a broad temperature window

High restoring force is one of the outstanding features of Infinergy®. In rebound tests in accordance with ISO 8307 (ball rebound test) and DIN 53512 (with a defined swing hammer), Infinergy® was shown to reach rebound of over 55 %. This puts it clearly ahead of similar foams such as expanded polypropylene (EPP) (27 %), ethylene-vinyl acetate (EVA) (37 %) and expanded polyethylene (EPE) (50 %). Infinergy® also maintains its high restoring force under prolonged stress.

Fig. 6:
Rebound of different foams in comparison



[Density of molded part: 30 kg/m³ or 265 kg/m³ (Infinergy®)]

The scanning electron microscope image shows the closed cells inside an Infinergy® particle

The individual Infinergy® particles are 5 to 10 mm in size and are delivered with an average bulk density of 110 kg/m³

Applications

Infinergy® can be used wherever a combination of low weight, excellent mechanical properties and high durability is needed. It is already used as standard in the footwear industry: Infinergy® heralded a revolution in running shoes when it was used by adidas for their Energy Boost shoes. Used in midsoles, it makes shoes more comfortable to wear and provides good running properties. After each step, the sole immediately springs back into its original form: This high rebound-effect, which is a result of the material's high restoring force, reduces the force needed by the runner.

In ELTEN safety footwear, Infinergy®'s unique resilience and damping properties help to prevent symptoms of fatigue and joint problems.

However, the potential of Infinergy® stretches beyond these applications; other fields of application for this resistant material include:

- Sports and leisure (ground coverings e.g. for playgrounds or running tracks, bicycle tires)
- Vehicle construction (e.g. vibration isolation)
- Machinery construction (e.g. as damping elements and buffers in industrial rod assemblies)
- Reusable load carriers in the field of logistics

Processing

Infinergy® can generally be processed into molded parts on shape molding machines that are suitable for processing expanded polypropylene (EPP). Processing by means of crack splitting methods and pressure filling methods is also possible. Care should be taken to use suitable filling systems. In addition, because polyurethane binders adhere so well to Infinergy®, there are other processing techniques such as gluing and foam sealing of the particles. 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.

Symptoms of fatigue as well as joint problems are prevented with Infinergy® in an Elten safety boot

High rebound thanks to the restoring force of Infinergy®, in adidas boost running shoe, Photo: adidas AG

Elastostat®

Most polymers have insulating properties and are therefore susceptible to electrostatic charges. By adding Elastostat®, the Elastollan®-based anti-static masterbatch from BASF, these materials can be made anti-static.

Elastostat® presents clear advantages over existing solutions:

- **Processing**
  As a masterbatch, Elastostat® is very easy to add and process in injection molding or extrusion. Simple mixing with the respective base polymer produces excellent homogeneity, meaning resource-intensive compounding is no longer necessary.
- **Permanent effect**
  The anti-static effect is permanent in the various plastics and it is not necessary to maintain any special marginal conditions such as air humidity.
- **Compatibility with other plastics**
  The material is very compatible with nonpolar standard plastics like polyethylene (PE), polypropylene (PP), polystyrene (PS) and polyvinyl chloride (PVC).
- **FDA and EU Food Contact compliant**
  Approved for food contact applications in accordance with FDA and EU10/2011 (for dry goods up to 60 °C).
- **Colorless**

Can make suction hoses and conveying hoses anti-static

Applications

One important application for Elastostat® are IBCs (Intermediate Bulk Containers), which are used for the industrial transportation of liquids. They usually consist of a PE inner container combined with an external metal structure and a tray.

Elastostat® can also be used to make many other applications anti-static, such as packaging films, buckets and canisters used to transport chemicals, food, cosmetics, and pharmaceuticals.

It can also be useful in the production of pipes, conveying hoses and transport belts, to prevent electrostatic charging of the goods being transported.

IBC (Intermediate Bulk Container)

Big bag / FIBC (Flexible Intermediate Bulk Container)

Product Name	Food Contact	Polymers	Applications
Elastostat® 10-01	FDA	PP PS / ABS PVC	Buckets / cans sheets / semi-finished products floors
Elastostat® 10-02	FDA EU10 / 2011	HD-PE LD-PE	IBC / canisters packaging films / big bags
Elastostat® 15-01	FDA EU10 / 2011	TPU / PVC	Conveyor hoses / transport belts

Small packing units: Buckets and canisters

Masterbatches / Additives

BASF offers an extensive range of color masterbatches and additives which can be used as agents for processing and demolding, as cross-linking agents or for coloring the base polymer, for example.

Color	Corresponds to RAL	Conc
Yellow	1021/1018	133F
	1012	138
	1021	139
		V 2856
Orange	2004	201 F
	2003	202 F/1
Red	3000	315 F
		2941
Dark blue	5015	530/1
	5015	530/4
Light blue	5000	2939
		2947
	5003	2948
	5015	2949
Green	6028	602/1
	6001	618/1
	1805050	2945
Gray	7000	704
	7032	718
	7046	725
		2946
Black	9005	917/3
	9005	917/4
White	9010	955

Fig. 7: Extract from the Elastollan® portfolio of color masterbatches and additives

Demolding agents:

- Conc 950/1 – suitable for polyether- and polyester-based Elastollan® grades
- Conc 978 – suitable for polyether- and polyester-based Elastollan® grades, especially for low-viscosity grades
- Conc V 2871 – suitable for polyether- and polyester-based Elastollan® grades especially for low-viscosity grades
- Conc 2907 – suitable for polyether- and polyester-based Elastollan® grades with improved sliding friction properties (extrusion)
- Conc 2913 – suitable for polyether-based Elastollan® grades with reduced blooming behavior

Cross-linker concentrates for improving rebound and temperature resistance:

- X-Flex 2905 – bi-functional cross-linker
- X-Flex 2909 – bi- and tri-functional cross-linker

Abrasion enhancers:

- Conc V 2881/1 – especially for expanded Elastollan®
- Conc V 2821 – for improved sliding friction and reduced abrasion

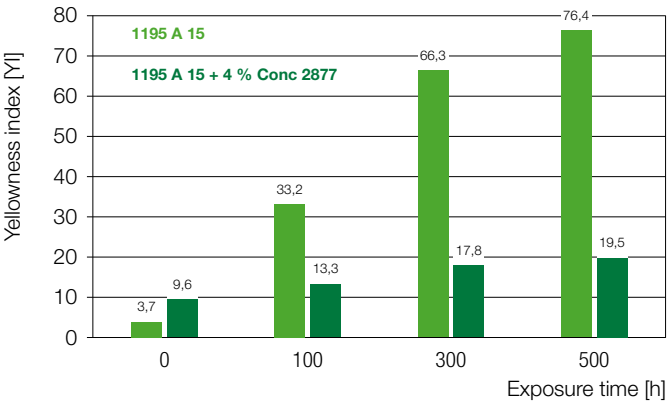


Fig. 8: Influence of Conc 2877 on the yellowness index, depending on the exposure time

UV-stabilizers:

- Conc 2876 – for polyester-based Elastollan® grades
- Conc 2877 – for polyether-based Elastollan® grades

Laser marking:

- Conc V 2804 B – antimony-free additive
- Conc 2918 – based on encapsulated antimony with improved contrast properties

Blowing agents:

- Conc V 2893 – chemical blowing agent – suitable for use in combination with physical blowing agents
- Conc V 2894, Conc 2919 – physical blowing agents

Others:

- Conc 926 – matting agents for extrusion
- Conc V 2464 – X-ray contrast agents
- Conc V 2880 – optical brighteners for reducing yellowing
- Conc 2908, Conc 2925 – for lending anti-static properties

Recycling

Protecting the environment and sustainable use of resources are laid down in BASF's corporate objectives.

Thermoplastic polyurethanes can usually be recycled in environmentally compatible ways (ecology, product safety and cost efficiency factors have to be examined on a case by case basis):

1. Materials recycling
Waste TPU and TPU-molded parts are re-granulated for the purposes of recycling.
Max. 30 % milled reclaimed TPU can be added to original granulate.

2. Thermal recovery
Only a small proportion of thermoplastic polyurethanes cannot be introduced back into processing.
These TPUs are used in electricity generation, in modern waste incineration plants.

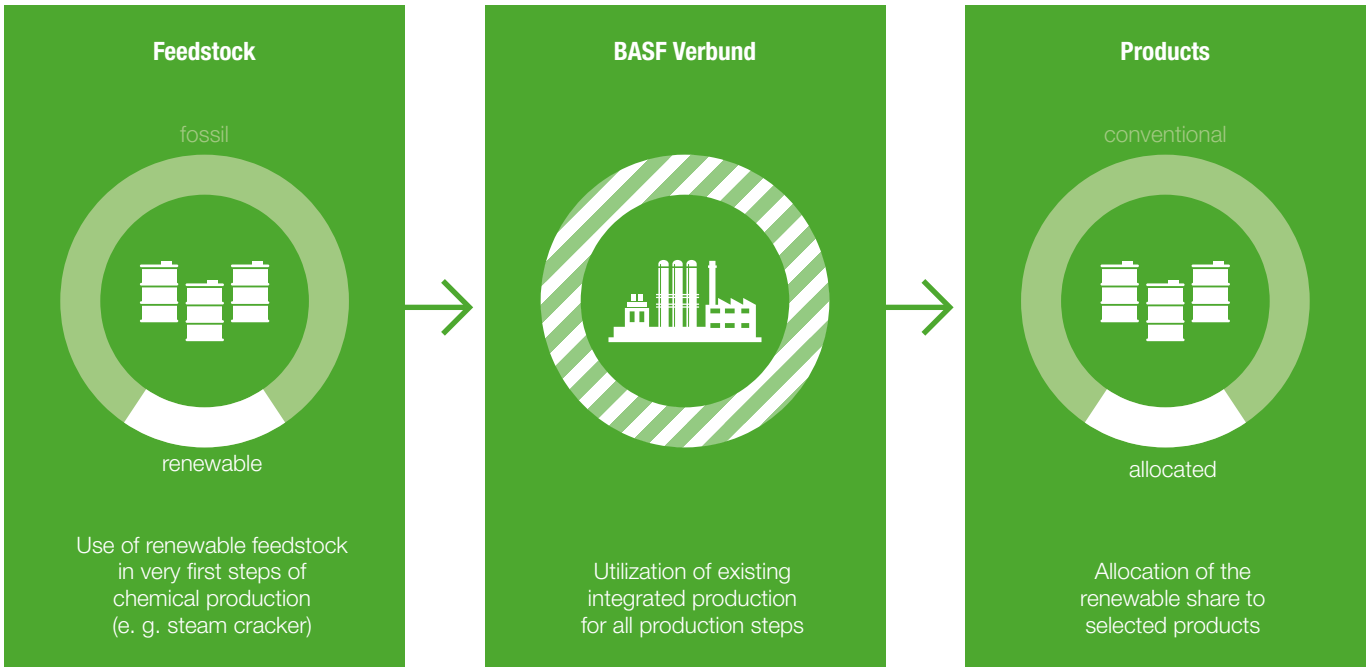
Biomass Balance

BASF's biomass balance approach contributes to the use of renewable raw materials in its integrated production system and can be applied to the majority of the products in its portfolio.

BASF developed the innovative "biomass balance method" together with TÜV SÜD, in which fossil resources in the current Production Verbund are replaced by renewable resources with sustainability certification. The formulation and quality of the corresponding end products remain unchanged. In this process, renewable raw materials are used as feedstock at the very beginning of production in the Verbund, and allocated to the respective sales products using the novel certification method. The certified products thus contribute to sustainable development by saving fossil resources and reducing greenhouse gas emissions.

Benefits of the biomass balance approach:

- Drives the use of renewable resources
- Fossil resource saving
- Reduced greenhouse gas emissions
- Independently certified
- Same product quality and properties
- Ready-made solution for our customers



Certification

BASF has established a closed chain of custody from the renewable feedstock it uses through to the final product. An independent certification confirms that BASF has replaced the required quantities of fossil feedstock for the sold biomass balanced product with renewable feedstock in the production site (www.tuev-sued.de/rr-id).

This certified approach is also valid for the Elastollan® product range of BASF. Please get in touch!

Disclaimer:

BASF makes no warranties, express or implied, concerning the suitability of Product for use in any medical device and pharmaceutical applications.

BASF does not claim suitability of Product for any specific medical device or pharmaceutical applications including packaging of parenteral and ophthalmic products as well as inhalers and, therefore, the decision on the use of Product for a specific application is solely at your own risk. It is the responsibility of the medical device or pharmaceutical manufacturer to determine that the medical device or pharmaceutical application manufactured using the Product is safe, lawful and technically suitable for the intended use.

Provided an agreement can be reached which takes into account the circumstances of each individual case and a disclaimer is accepted by the customer BASF is prepared to supply plastics for individual medical applications within risk class II (with the exception of implants) including packaging of parenterala and ophthalmic products as well as inhalers.

Should a customer wish to use BASF plastics in applications within risk class III which are not implants, sale is possible only in very exceptional cases (not including commodities) at the special request of the customer. However, a detailed risk assessment has to be provided.

BASF does not supply its plastics for the manufacture of implants in any risk class.

FOR YOUR NOTES

Selected product literature:

- Elastollan® – Main brochure
- Ultramid® – Main brochure
- Ultradur® – Main brochure
- Ultraform® – Main brochure
- Ultrason® – Main brochure

Note

The data contained in this publication are based on our current knowledge and experience. In view of many factors that may affect processing and application of our product, these data do not relieve processors from carrying out their 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 2016)

Please also visit our website:
www.elastollan.de

Brochure requests:
PM/K, F 204
Fax: + 49 621 60-49497

If you have any technical questions about the products please get in touch via the Elastollan®-Infopoint.

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