




**Tomorrow, today will be yesterday.
High-tech thermoplastic
polyurethanes set trends.**



Desmopan[®]
flexible high-tech material



Texin[®]
high-tech material



Increased resistance to weathering and high energy radiation

Can be processed by injection molding, extrusion, slush molding, blow molding and calendaring

Recyclable

Good resistance to oil, grease and many solvents

property spectrum

Bursting with talent

Desmopan® and Texin®* synthetic resins have got what many other materials do not have: an abundance of talent.

And these talents can be skillfully combined to make all kinds of innovative products. As one of the world's leading global suppliers of TPU, we know how!

* Texin® is a product line of Bayer MaterialScience LLC, USA



Free of plasticizers

Highly wear resistant

Weldable and bondable

Can be brightly colored

Good elasticity and
low temperature impact strength

Pleasant tactile properties

High flexural strength

Good printability

Flexible over a wide temperature range

Desmopan® and Texin® plastics are thermoplastic polyurethane elastomers (TPUs). Each combines many of the valuable characteristics of rubber and thermoplastic materials and, on top of that, benefits from the strengths of polyurethane chemistry, which forms its chemical backbone. The trademark of TPUs is their rich variety and their outstanding versatility. Their properties can be adjusted by the modular principle through

careful selection of the raw materials. Basically, every one of the talents displayed by Desmopan® and Texin® resins can be tailored to the particular end-use. It is this flexibility that makes each of these TPU materials so innovative. That's why our range of materials stands out from the competition by offering a broad spectrum of properties – product quality for the most demanding of applications.



Tough door sills

Design-friendly material for center consoles



Highly chemical resistant cable connectors

automotive industry:today



Highly wear resistant bushings and seals for joints

A material for all seasons

The success story of Desmopan® and Texin® plastics in the automotive industry has spanned thirty years, and is set to continue. These products are now bringing bright, cheerful colors to car interiors.

What vehicle designers love about our TPU materials is their outstanding design for wear and increased scratch resistance and flexibility, plus their enhanced resistance to oils and grease. Examples of established applications in the automotive industry include grommets



Easy-to-handle gear knobs

and spring sleeves, bushings and dust caps for supporting joints and guide joints, while highly hydrolysis resistant Desmopan® and Texin® grades of plastic that are also highly resistant to microbial degradation are used for the production of cable sheathings and seals. For car components such as door sills and warm air ducts, designers prefer high-impact, glass fiber-reinforced grades (R-TPU), which have a particularly low expansion coefficient and good damping behavior at a medium elasticity modulus.

Combining hard and soft for a good grip

Desmopan® and Texin® plastics also have a lot to offer in terms of decoration, surface quality and tactile properties. This combination of properties is utilized, for example, in hard/soft

technology, in which soft TPU grades are combined with various hard thermoplastics. Typical applications inside the vehicle are center consoles and louvers overmolded with Desmopan® or Texin® thermoplastic – a process that produces soft-touch finishes that feel like leather but are still highly scratch resistant. Other examples are highly wear resistant gear knobs of Desmopan® or Texin® plastic and various kinds of trays and holders, where the Desmopan® or Texin® plastic surface has excellent sound-damping and dry slip-resistance qualities.

Outside the car, hard/soft technology is used to provide rear lights and brake lamps with enhanced weather-resistant sealing lips of Desmopan® or Texin® plastic that remain flexible over a wide temperature range.

A red wireframe illustration of a car's interior, showing the dashboard, steering wheel, and seats. The text 'automotive industry: tomorrow' is overlaid in white.

automotive industry: tomorrow



Colored TPU skins for instrument panels

A new trend – lightfast TPU: Desmopan® and Texin®

There are currently two noticeable new trends in car interior design: first, towards more light and friendly colors, and next, towards transparent, scratch-proof surfaces. Both trends are a problem for conventional aromatic TPU materials because they gradually turn yellow over the course of time. We responded to these developments and have come up with some new TPU grades that are based on aliphatic isocyanates with longer-term lightfastness.

Outstanding transparency and higher scratch resistance

We have a number of Desmopan® and Texin® grades of TPU that can be processed by extrusion and are highly transparent even at wall thicknesses of more than one centimeter. This makes them an attractive material for flexible rear windows in convertibles, for example. Compared with the materials previously used for this application, these TPU grades are much less sensitive to scratching and thus far better able to resist external mechanical stresses. TPU windows will also withstand the rigors of a



Lightfast, bright automotive interiors

Light-colored, highly scratch resistant louvers for center consoles

Flexible rear windows with increased buckling resistance for convertibles

car wash. The product's higher flexural fatigue strength and buckling resistance also mean that the windows will retain their transparency at points where they are folded over.

Array of light colors in the interior

TPU grades that can be colored in light shades are becoming increasingly popular. With their good flow properties, they are very easy to process by injection molding, and in car interiors, for example, the potential for parts produced by hard/soft technology is very good indeed. Colored components for the center console made of the new Desmopan® or Texin® grades of TPU are already coming off the production line.

Mission completed – colored instrument panel skins of TPU

Skins for instrument panels are regarded as one of the most demanding applications in a car's interior. Desmopan® and Texin® thermoplastics have the properties required for these

components and also have one important advantage over other materials already established in this application: they retain their flexibility in the cold. This is important to ensure the functioning of airbags at extremely low temperatures. With the new aliphatic Desmopan® and Texin® grades of TPU, the skins can also be made bright and colorful. We have developed compounds for this that can be turned into skins by the powder slush process.

And there's more: In cooperation with various partners, we have also developed alternative processes to slush-molding for the production of molded TPU skins for automotive interiors. These processes have been made possible by new aliphatic Desmopan® grades that form the visible, highly lightfast skin surface.



Ski goggles with increased low-temperature impact resistance

sports and leis

For more fun and improved performance

You will find Desmopan® and Texin® thermoplastics just about everywhere in the field of sports and leisure. They give an impressive demonstration of their fitness in the world of sports shoes, for example. And they are always good for something new.



desmopan®
flexible high-tech material



TEXIN®
high-tech material



Surfboard with elastic Desmopan® leg rope

Putter with a soft-feel insert

Durable covers for golf balls

Comfortable ski boot with good low-temperature flexibility

Highly wear resistant soles for sports shoes

Tough shells for inline skates

Highly scratch resistant ski boot with low-temperature impact resistance

ure:today

One of the key domains for Desmopan® and Texin® TPUs is in sports, leisure and safety shoes. In particular, they are used to manufacture soles and heel taps by injection molding. Their main selling points are their high abrasion resistance and elasticity combined with

good resilience and flexural strength. Thanks to their rigidity and toughness, they are also especially suitable for the shells of ski boots and inline skates. Surfers use leg ropes of elastic Desmopan® TPU to stop them from losing their boards. And the low-temperature impact strength of our material is invaluable in the frames of ski goggles and the housings of ski bindings.



Transparent shells for ski boots

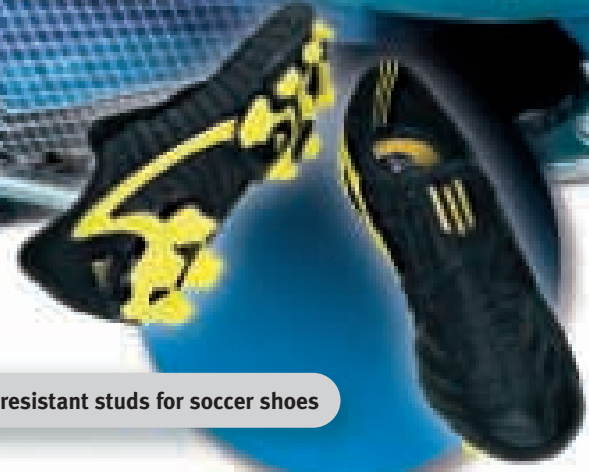
sports and leisure.com



Golf shoes with flexible and durable soles

New trend – fashionable Desmopan® grades of TPU for shoes

In the shoe industry, one fashion trend follows close on the heels of the next. Shoe designers are therefore constantly on the lookout for new materials with improved properties – and Desmopan® TPU can usually come up with an answer.



More wear resistant studs for soccer shoes

Plenty of punishment

Soles and studs of football boots, the stiletto heels of women's shoes, and golf shoes all have one thing in common – they have to take a considerable amount of punishment during everyday use. We have therefore developed a range of new Desmopan® grades of TPU with a 30 % lower abrasion loss than standard TPU grades. Parts manufactured from them can be readily demolded even at high wall thicknesses, making for economical production with short cycle times.



More spring in soccer shoe soles

Transparent, highly impact resistant housing for ski bindings

Transparency – for a glimpse inside

Aromatic TPUs can be highly transparent, too – as evidenced by new extrudable and injection-moldable Desmopan® grades of TPU based on polyesters and polyethers. They can be used to produce transparent parts that show virtually no cloudiness even at wall thicknesses of up to 6 mm. Potential applications include wear resistant 'windows' for decoration or company logos in the soles of highly stressed modern sports shoes.

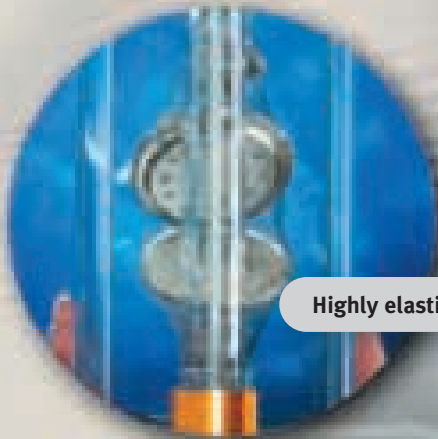
The polyether grades are also very impact resistant and flexible even in sub-zero conditions. This makes them the material of choice for ski boots and skates with a transparent outer shell that reveals the inside of the shoe.

More spring in sports shoe soles

The soles of modern day sports shoes need to have good springiness, and this is where the new polyether-based aliphatic Desmopan® grades of TPU come in. First of all, they are light-stable and can therefore be colored in any desired shade. Next, they have very high flexibility and elasticity combined with low density, making them ideal for particularly thin, lightweight soles. And finally, they bond well to most conventional shoe materials, especially to other TPU grades. With this property profile, they are an excellent alternative to polyether block amides for this application.



More wear resistant conveyor belts



Highly elastic membrane packaging

films&coatings:today

Thin layers for tough surfaces

Desmopan® and Texin® can also display their prowess in the form of wafer-thin films. One highly promising application is the combination of these films with other materials.



Watertight and breathable films for rain jackets



Light-colored and lightfast coatings for fabric sheeting



Highly bullet-resistant safety glass with Desmopan® composite film

Extruded films made of Desmopan® and Texin® have been in use for some considerable time, for example as air-protected packaging. Even in their thinnest form, the films are extremely tear resistant and highly extensible. For this reason, they can also be used in combination with glass to manufacture safety glass with increased resistance to hurricanes and bullets. TPU is also highly compatible with textile fabrics. The two materials can be combined by calendering, extrusion coating and powder coating. A typical example of an industrial fabric of this kind is the underlay sheeting used in the construction industry.



New trend – textile fabrics coated with TPU

There is currently an enormous boom in textile fabrics coated with TPU, where lightfast Desmopan® grades are opening up a number of new and attractive fields of application.

Colorful, transparent boat skins

We have developed a number of highly salt-water resistant Desmopan® grades of TPU for the coating of fabrics used for the skins of inflatable boats, collapsible canoes, life rafts, life jackets and oil barriers. They can be designed in any color and, being thermoplastics, are more economical to process than the rubber that is otherwise used for such applications. Desmopan® plastic skins have better mechanical properties than their PVC counterparts and much higher scratch and tear resistance. Fabrics

coated with lightfast Desmopan® TPU also have outstanding potential for applications in car interiors, for example as door liners or trunk covers.

We are also working on new transparent Desmopan® grades for the production of ski and snowboard skins and spray hoods for boats.

A clear view of fancy yarns

Besides coating the whole textile fabric with TPU, it is also possible to coat individual yarn filaments. Coverings such as this dramatically increase the tenacity of a yarn and protect it from soiling. One particularly appealing design feature can be achieved by covering fancy yarns with one of our new transparent, lightfast Desmopan® grades of TPU, because it adds



Snowboard with lightfast decorated Desmopan® film

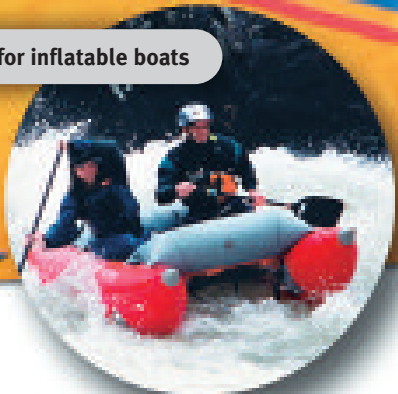


Transparent, highly resistant boat bottoms

More economically produced solar modules



Light-colored, durable skins for inflatable boats

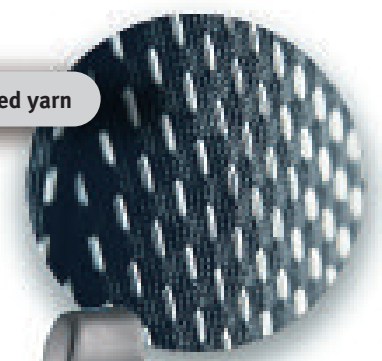


to its attractiveness and protects the yarns at the same time. Such covered yarns are especially suitable for the production of decorative fabrics for seats – for example, car seats, armchairs and office chairs.

More economical production of solar modules with TPU

Desmopan® TPU can also be used for the more economical production of solar modules. Until now, they have been manufactured by a complicated process of vacuum lamination with relatively long production cycles. With a tailor-made Desmopan® film that bonds the solar cells with glass and a PVF film, the lamination process can now be carried out continuously without a vacuum. The savings come from a faster, simpler manufacturing process and lower investment costs.

Transparent covered yarn



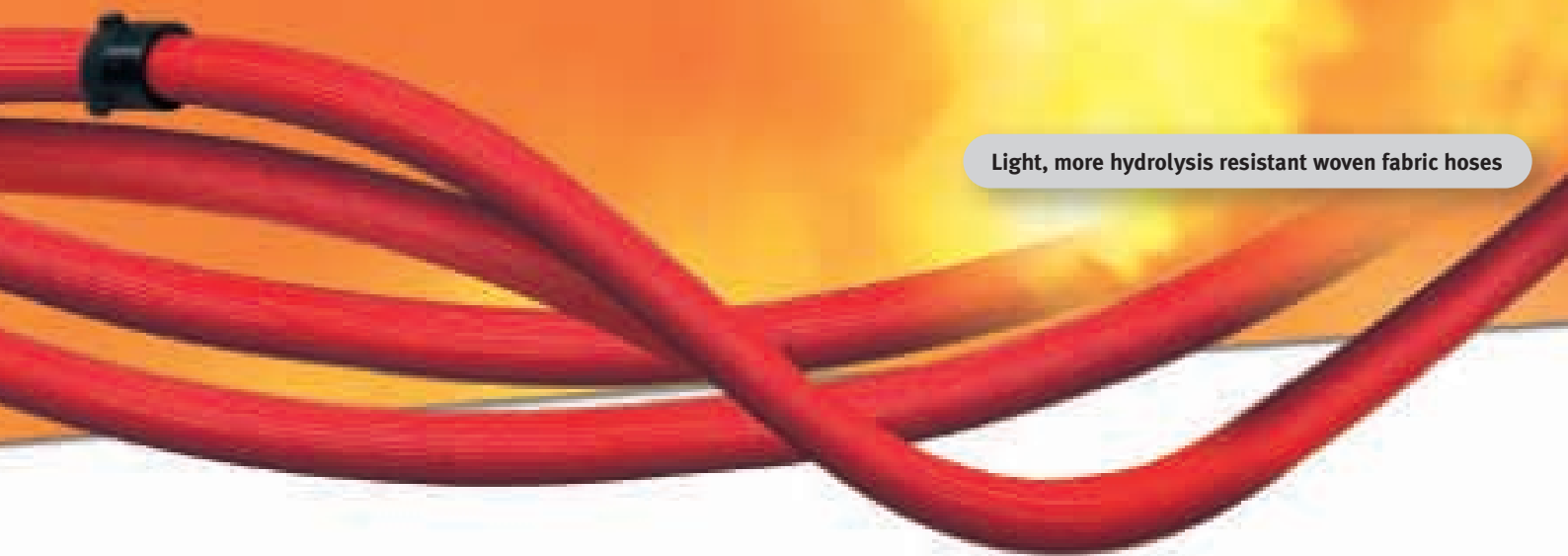
Car seat with transparent covered yarn





Cable and wire sheathing with greater wear resistance

belts.hoses.cables.profiles



Light, more hydrolysis resistant woven fabric hoses

No signs of weakness

Plastics for belts, hoses and cables are often exposed to extreme conditions. Generally speaking, these materials have to withstand a whole assortment of stresses at the same time, including high pressure, severe temperature changes and attack from chemical media.

In conditions such as these, Desmopan® and Texin® TPUs are in their element.



:today

Cable sheathing with improved tear resistance



Toothed belts with enhanced abrasion resistance



Spiral hoses with increased wear resistance



Whether used as sheathing for supply cables on oil platforms or for oceanographic measuring cables, Desmopan® and Texin® TPUs are much in demand as specialty materials for the manufacture of cables and supply lines. They remain flexible even at low temperatures, contain no plasticizers and, with their good cut and abrasion resistance and high tensile strength, offer outstanding long-term service properties. With tubes and hoses, TPU has the added advantage over rubber of a higher elasticity modulus and higher strength properties.

The hoses, therefore, can be manufactured in lower wall thicknesses and still have a very good bursting resistance. Typical applications include pneumatic, irrigation and drainage pipes. When it comes to hydraulic and fire-fighting hoses, Desmopan® and Texin® TPUs have yet another ace up their sleeve – they are unaffected by many chemical media. The high wear resistance and dynamic stability of these TPU materials are also very important when it comes to the production of toothed belts, for example.




Highly tear resistant maritime cables

belts.hoses.cables.pro

New trend – tailor-made customized solutions

The demands made on hoses, cables, belts and profiles (all of which are produced by extrusion) are far from being uniform. There is, quite simply, no such thing in this industry as a universal material. Success comes from tailoring Desmopan® and Texin® TPUs precisely to suit the final application.



Pneumatic and hydraulic hoses with high compressive strength

files:tomorrow

Optimizing the details

We are, for example, working on new Desmopan® and Texin® grades of TPU that are harder than the present types, but can still be extruded. They could be used to manufacture pneumatic hoses with even higher compressive strength and mechanical resistance. To make spiral hoses more pliant, we are intensively involved in the development of more flexible grades with hardnesses of around 70 Shore A.

Also at the development stage are halogen-free, flame-retardant Desmopan® grades of TPU that satisfy the strict US UL 94 standard (Underwriters Laboratories) with the top classification of V-0 at a specimen thickness of 3.0 mm.

To increase the heat resistance of belts, we are also working on more heat resistant Desmopan® grades of TPU.



More flexible bollards

agriculture. mechanical engineering industry:today



Wheelbarrow wheels with improved wear resistance



Soft-touch surfaces for hand prostheses

A hard-wearing all-round talent

Reliable, rugged and versatile – engineers, in particular, appreciate these characteristics of Desmopan® and Texin® TPUs when they are involved in the design of high-performance machines and engineering components.

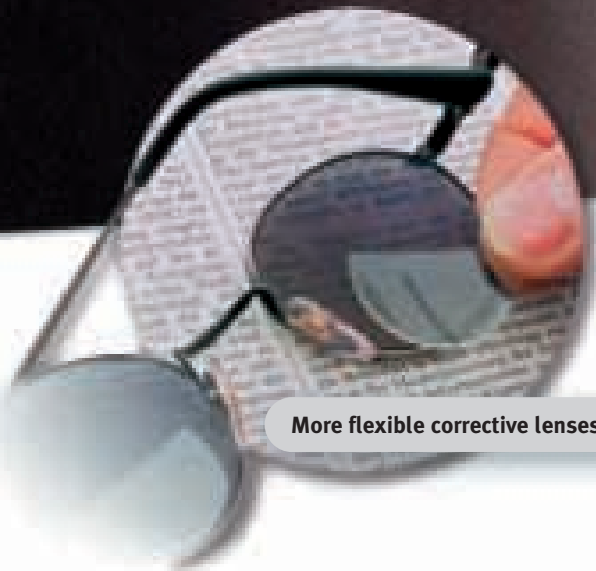
In the future, new and improved Desmopan® and Texin® materials will provide them with even greater design freedom.



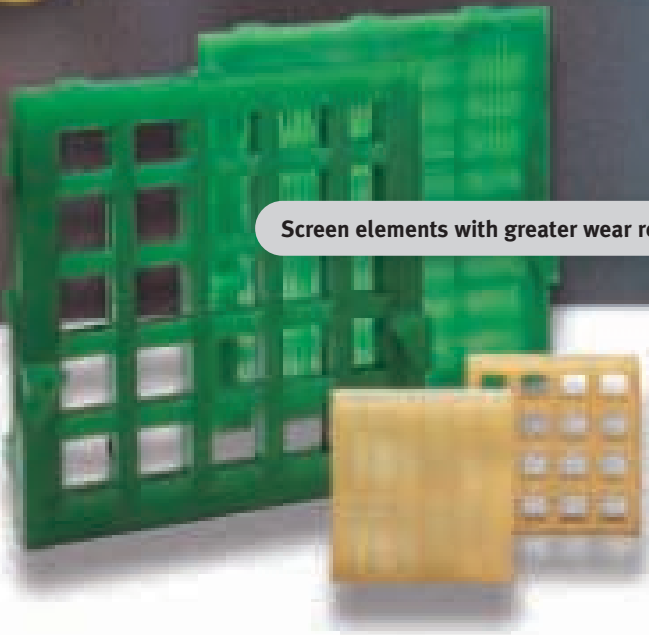
More durable animal marking tags



Highly abrasion resistant bearing surfaces



More flexible corrective lenses



Screen elements with greater wear resistance


Traditional applications for Desmopan® and Texin® TPUs in industry and mechanical engineering include rollers for transport trucks, all kinds of seals and gaskets, conveyor rolls, screen elements for ore extraction and sliding protective rings for the steel cables of diamond saws. For such injection-molded parts, our TPUs' outstanding wear resistance is indispensable, but so too are their excellent dynamic load-bearing resistance, damping properties, resilience and chemical resistance. Soft

touch and a good grip are the key requirements for plastic machine handles, as they are for furniture, which is overmolded by the hard/soft technique using Desmopan® or Texin® TPU.

Desmopan® TPU also helps farmers to sow and harvest their crops. All kinds of different harrows and picking prongs, for example, are made of TPU. There is also a growing demand for animal marking tags made of Desmopan® and Texin® TPUs.



High-grip handles



Good drop test performance and
integral hinge capability



Handles with improved wear resistance

New trend – new material properties, new opportunities

Desmopan® and Texin® TPUs are constantly revealing new talents – talents that are opening up more and more innovative applications in the construction of machinery and apparatus, especially with new technologies.



desmopan®
flexible high-tech material



TEXIN®
high-tech material

agriculture.
mechanical engineering.
industry:tomorrow

Soft-touch surfaces

Good adhesion to thermoplastics

Even more flexible, and free of plasticizers

We have now developed some new, more flexible Desmopan® grades of TPU that have hardness values of only 60–80 Shore A and are also free of plasticizers. This was achieved without any significant compromise either on wear or abrasion properties. The new TPU grades are thus an attractive alternative to established thermoplastic elastomers of comparable hard-

ness. Possible applications include spring elements, integral hinges, molded-in sealing lips, impact strips and bellows. Because of their good 'soft-touch' properties, these Desmopan® grades of TPU are also suitable for overmolding plastic grips and handles. They also adhere well to many thermoplastics.



tomorrow's world

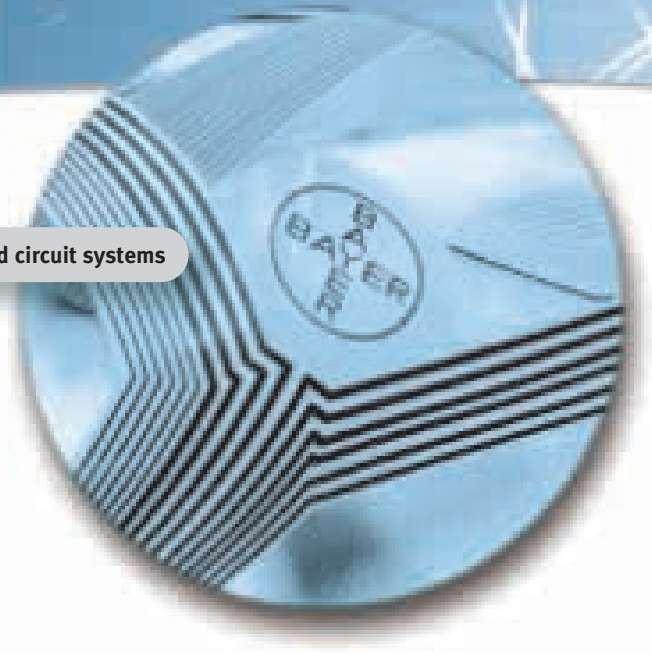
The New Business segment – recognizing and shaping the future

Anyone who thinks systematically about what our world will look like in ten or twenty years and responds accordingly by developing new materials, technologies and applications will be in an excellent position to secure tomorrow's business. This is precisely the task of our New Business segment – and that also means **Desmopan®** and **Texin®** TPUs.

The New Business trend scouts pursue a double-track strategy as they analyze the trends of the future. First, they scrutinize a wide variety of industry segments to detect possible applications for plastics in the generation after next and develop strategies to implement them. Next, they sift through and evaluate all the new process and material developments in the plastics industry. This results in ideas for new projects, which are further developed for the particular branch of industry to create marketable products and technologies. Because of their versatility and controllable property profile, **Desmopan®** and **Texin®** TPUs play a key role in this strategy.



Flat flexible printed circuit systems



Shape Memory – plastics that never forget

We are currently working on intelligent TPU materials – so-called Shape Memory plastics – that change their form under defined external parameters. They are first made into a permanent shape by conventional processing. After this, a temporary, generally simple form is impressed on the component. The original permanent form remains stored in the material and can, for example, be recreated by heating. The material “remembers” its original shape and can change back to it again at any time. The range of applications for such TPU materials is almost unlimited. It extends from temperature sensors through artificial muscles, self-loosening screws and toys, to intelligent garments that become either permeable or impermeable to body moisture depending on whether the conditions are hot or cold.

Intelligent modular solutions – flexible printed circuit systems

TPUs have a particularly bright future in car production for flat, flexible printed circuit systems

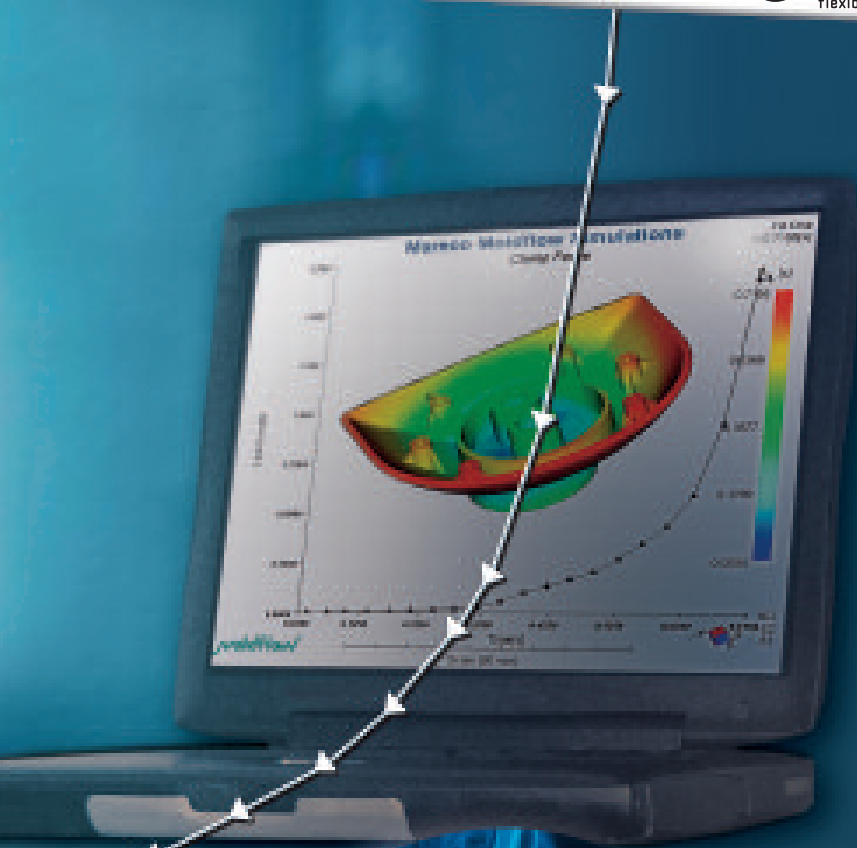
based on plastic film – also called “smart wiring”. They are a space-saving alternative to normal cables for control currents. In addition to these “Flexible Flat Cables” (FFCs), we are in the process of developing a “Flexible Printed Circuit” system (FPC), also based on Desmopan® TPU, which is intended to replace contemporary adhesive-containing systems. A TPU film serves as a fusible bonding agent, and the conductive copper layer is “encapsulated” on both sides with a polycarbonate film. The goal here is to produce fully connected modules that have no need of complex connecting systems. In this way Desmopan® TPU is helping to drive the trend toward component modularization.

service



All-round service to make products successful quickly

By offering customized service packages from the conception of the idea to the production of the actual product we can help you to reduce your time-to-market.



0.7455

0.3577

0.0789



Fire test in the testing laboratory

Customer advice – personalized and market-oriented

Our primary objective is to cooperate closely with you to fully exploit the potential of Desmopan® and Texin® plastics. We are not afraid to break new ground and take risks. In fact, we have consolidated our market reputation as an innovation-driven company by doing precisely that. We want you to be successful, too.

That is why we have put together five service modules for you.

- Customer advice
- Research and development
- Technical service laboratory
- Testing technology
- The TechCenter

Our colleagues from Marketing, Business Development and Applications Engineering can accompany you from the initial idea for an application to the start-up of production, and will take your individual requirements into account. They know their way around your markets. They can advise you on the choice of materials, help with the design of a component (for example, through Mold-Flow analysis), and make suggestions on mold and part design. Customers can also visit our workshops where you can find out about new technologies and materials, and also start concrete discussions with us on actual projects.



Research and development – creative and future-oriented

As part of our cooperation with you, our Research and Development team has the task not only of refining the overall properties of our TPU material, but also of adding other useful qualities – like improved transparency, for instance. Another area of focus is the optimization of processing techniques and, in some cases, finding new ones. By cooperating with a number of partner companies, we have been able to tailor TPU for a variety of different processes.

Our customers also profit from the research work we carry out in anticipation of market developments. One good example is provided by the new light-stable Desmopan® and Texin® grades. They have now become the material of choice for TPU components for which high, longer-term color stability is specified.

Technical service laboratory – effective and product-oriented

For performing trials in our technical service department, we can make available virtually all the machines and peripherals you are likely to need for TPU processing – including the know-how of our teams of experts. For example, apart from conventional injection molding ma-



Determining the plastic behavior of a plastic melt

Testing a lightfast Desmopan® film

chines and extruders, we also have facilities for blown film extrusion, extrusion coating and co-extrusion. Equipment for overmolding "hard" thermoplastics with "soft" TPU grades (hard/soft technology) plus a fully equipped laboratory for powder slush applications is also available.

Testing technology – fast and accurate

In our Bayer MaterialScience Thermoplastics Testing Centers (TTCs), customers can have around 200 different material tests performed, including, for example, tensile modulus tests, fire tests and heat-aging tests. A variety of tests on finished components can also be carried out. Our full service package also covers the production of test specimens. The TTCs are certified according to certified testing agencies in the countries in which we operate.

The TechCenter – information at the click of a mouse

By visiting our web sites you can download a wide range of informative material, extending from technical service information to product data sheets and individual case studies on pioneering new TPU applications. Various processing techniques are also presented.

Web Site for Europe, Middle East, Africa, Latin America and Asia:

www.desmopan.com

Web Site for United States, Canada and Mexico:

www.bayermaterialsciencenafta.com



Global supply with a local focus

We regard our supply chain management as an essential module for success in dealings with our customers – regardless of where their production facilities are located in the world.

Global presence

With our production sites in Europe, Asia and the NAFTA region, and our globally operating sales and marketing centers, we are one of the few TPU producers who can claim to be a truly global supplier. We have warehouses in all of the world's major markets. That means we're always close at hand to serve you reliably, quickly and flexibly.



Regional Customer Service Centers – your personal contact

Our regional Customer Service Centers are the crux of the logistic processes, from receipt of order to final delivery. There you will find your partner who takes your order and speaks your language. You can find out from the RSC Team, for example, the status of your order at all times. The Service Centers are at the heart of a tight sales network that spans the world. We have selected the logistic partners with whom we work together locally (e.g. haulage companies) according to very strict quality criteria. They all have many years of experience in handling TPU.

Customized logistics solutions

As part of our all-embracing logistical process, we also see to it that you have the full documentation including the freight and customs papers, accurate labeling of the packaging, and a quality report for the delivered batch.

We do everything we can to provide timely shipments. Where feasible, we do our best to take into account your specific needs, and when we develop new applications, make every effort to provide timely samples so that you can launch your product on the market as soon as possible. If necessary, we can consider assessing together the feasibility for customized logistic solutions to support you – for example, deliveries in silo tankers with associated vendor tank management.

We're there for you – with expertise and commitment all over the world:

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In the future, visit our additional web sites at

www.desmopan.com and www.texin.com



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