HIGHTECH PLASTICS ENERGIZED BY

LANXESS
Energizing Chemistry

High-tech plastics under the hood

Durethan® Pocan® Tepex® HiAnt®

HIGH-TECH-PLASTICS
UNDER THE HOOD

Improved performance in the engine compartment

Our Durethan® polyamides (PA 6, PA 66) and Pocan® polybutylene terephthalates (PBT) have proven themselves in a wide range of applications under the hood. They can frequently be used as replacements for metals such as steel and aluminum or for thermosetting plastics. Recently they have been confronted with tougher and often completely new conditions in the engine compartment, due among other things to the trend toward “green” low-emissions vehicles.

For example, they must

- withstand higher temperatures, e.g. on components for turbocharged engines
- be resistant to numerous chemical media such as biofuels
- pass more stringent flame retardance tests, e.g. in components for electric motors
- be more economical to manufacture
- exhibit improved surface qualities

With our high-performance materials and our HiAnt® development expertise we are well prepared to meet these and many other challenges. With their outstanding properties, Durethan® and Pocan® conform to the latest trends in engine and drive technology. Excellent opportunities are also opening up for our continuous-fiber-reinforced Tepex® high-performance composites, especially in the lightweight construction of structural parts in the engine compartment.

- Cooling water distributor made of Durethan® DP AKV 50 HR H2.0

Cooling system – outstanding long-term stability to coolants

The cooling system is the principal domain of the hydrolysis-stabilized polyamide 66 Durethan® HR (hydrolysis-resistant) grades. They resist aging at operating temperatures of up to 130 °C in the presence of water-glycol coolants. Typical applications include coolant pipes, distributors and expansion reservoirs. One example of this line is Durethan® DP AKV 50 HR H2.0. With its excellent stiffness at high temperature, it is especially well suited for oil modules with water-glycol cooling. Durethan® HR line also includes

- materials for special processes such as WIT and GIT – including grades that produce very smooth interior pipe surfaces
- highly reinforced injection molding grades for components of the cooling system that also perform load-bearing functions or have to withstand high industrial pressures
- very easy-flowing material variants for delicate and thin-walled parts

Airflow management – long-term stability at up to 200 °C

Our polyamide line for components of airflow management systems for engines such as air ducts, intake pipes, charge air tubes and clean air lines currently have two main areas of focus. New developments include, for example, Durethan® XTS1, which is characterized by its excellent stability in long-term exposure to temperatures of up to 200 °C.
The other focal point of our material development is high-viscosity polyamides with and without glass fiber reinforcement for blow molding, which we have designed as an economical alternative to elastomer combinations. They include highly flexible, super-tough materials such as a polyamide 6 with an elasticity modulus of only 210 MPa. These products are especially suitable for the production of charge air tubes with integrated bellows as a single-material solution using extrusion blow molding.

- Charge air tube produced by blow molding from Durethan® AKV 325 H2.0

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Oil circuit – easy-flow and high stiffness

Our polyamides also feel very much at home in the oil circuits of trucks and cars. They are used, for example, to manufacture engine and transmission oil pans, oil modules and even oil filter removal wrenches. Compared to die-cast aluminum, for example, Durethan®

- gallows greater design flexibility
- reduces component weight
- cuts costs by combining functions
- produces components ready for installation

Our Durethan® AKV 60 and BKV 60 polyamides, which are reinforced with 60% glass fiber but are still easy-flowing, are especially attractive. Their high strength and stiffness (elastic moduli up to 20,200 MPa) mean they can be used for the construction of very large or flat oil pans and modules that have almost no warpage and do not leak as a result of creep under a sealing load. Our tests have shown that both the polyamide 6 and 66 variants have comparable stability when exposed to hot oil. The polyamide 6 grades are even somewhat more heat resistant when exposed to hot air. They are also significantly more economical, which is why they are being used in modern oil pan designs.
Polyamide 6 Durethan® BG 60 X XF, which is reinforced with 60% of a special glass fiber/glass microbead mixture, is an innovative material designed especially for visible components of the oil system. It offers

- excellent surface quality
- practically no warpage
- and is very stiff and strong at elevated temperatures

Covers – low warpage and excellent surface quality

Even the hardware under the hood has to look appealing. That's why it is frequently equipped with plastic covers that also provide protection. We have developed a number of tailor-made polyamide materials for applications such as covers for toothed belts, ignition coils and engines. These polyamides are reinforced with special fillers. Their advantages include

- flawless component surfaces that can be textured with a fine grain
- good flow properties and low warpage, even on large covers
- high thermal stability up to 150 °C in long-term use

Examples of these materials are the polyamide 6 compounds Durethan® BG 30 X XF and BG 30 X H2.0 XF as well as BM 29 X H2.0 EF. They contain a mixture of glass fibers and microbeads or mineral fillers and are also characterized by excellent flow properties. For example, Durethan® BG 30 X XF and BG 30 X H2.0 XF are more than 30% more flowable than the standard material Durethan® BG 30 X. The material variants with H2.0 heat stabilization are designed for use in components that are black and are exposed to higher heat loads.

Electrical/electronic parts – excellent results in the SAE/USCAR-2 test

Our Pocan® PBT compounds are used primarily for electrical/electronic applications in the engine compartment, especially for the production of plug connectors, but also for housings for fuse boxes and control units. Demand for hydrolysis-stabilized PBT compounds is on the rise as a result of ever increasing temperatures under the hood. We have therefore developed a product family under the name Pocan® HR (hydrolysis-resistant), which has greater resistance than standard PBT products to hydrolytic degradation in a hot, damp environment. This capability was proved by the SAE/USCAR-2 Rev. 5 long-term test of the American Society of Automotive Engineers (SAE), which is the toughest test of all for the hydrolysis resistance of PBT plug connectors.

Various products in the Pocan® HR line comply with the conditions of the most stringent variation of this test without any significant deterioration in their mechanical properties such as flexural resistance and impact strength. One example of this material is Pocan® BF 4232 HR, which is reinforced with 30% glass fibers. In addition to its excellent hydrolysis stabil-ity, it has excellent flame retardance and earns the highest grade V-0 (0.4 mm) in the UL 94 test in all the colors tested.

■ Car engine oil sump made of Durethan® AKV 35 H2.0

Tailor-made for laser welding
Laser welding is increasingly being used to weld electrical/electronic housings for the engine compartment. One innovative material for this method is Pocan® B 3235 HR LT. Compared to Pocan® B 3233 HR, its laser transmission is more than twice as high in the wavelength range of 800 to 1,200 nanometers typical of laser welding. We offer the material in natural color tones and in a laser-transparent black for near-infrared.

Stable in operation and corrosion-free up to 200 °C
We have developed Durethan® XTS3 especially for highly stressed electrical/electronic parts under the hood that are in direct contact with metal. This material can be used at temperatures of up to 200 °C in long-term service. Contact corrosion problems are a thing of the past, thanks to its metal-free and halide-free heat stability. Potential applications include housing parts, plug connectors and connector strips.

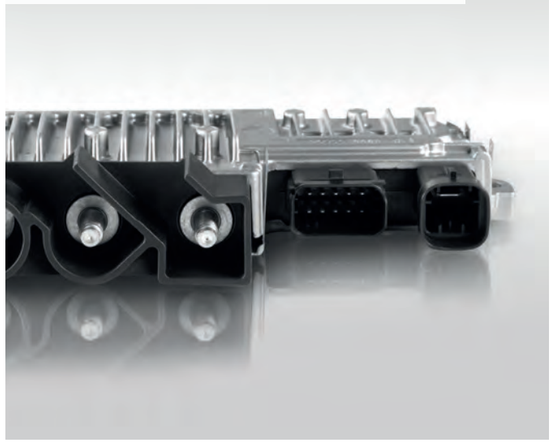
Extremely low warpage, high flame retardance and color stability
In Pocan® AF 4110 we have custom-developed an innovative, reinforced, flame-retardant blend based on of PBT and ASA (acrylonitrile-styrene-acrylate). It is ideal for applications such as mechanically stressed plug connectors as well as large and geometrically complex housings for batteries, battery cells and battery management systems. Their advantages include

- very low shrinkage and warpage
- excellent flame retardance (UL 94 V-0 at 0.4 mm)
- good resistance to hydrolysis

Exceptionally stiff and tough
Our polyamides 6 and 66 highly reinforced with short glass fibers and PBT compounds are the materials of choice for highly stressed electrical and electronic parts in the engine compartment such as battery trays for electric vehicles. They generally result in lighter-weight solutions than metals. The continuous-fiber-reinforced Tepex® family of composites represents a further advance in terms of stiffness and strength. This line includes polyamide 6 grades with a specific strength and stiffness that can compete with either steel or die-cast metals.

■ Engine cover, Durethan® BM 29 X H2.0 EF

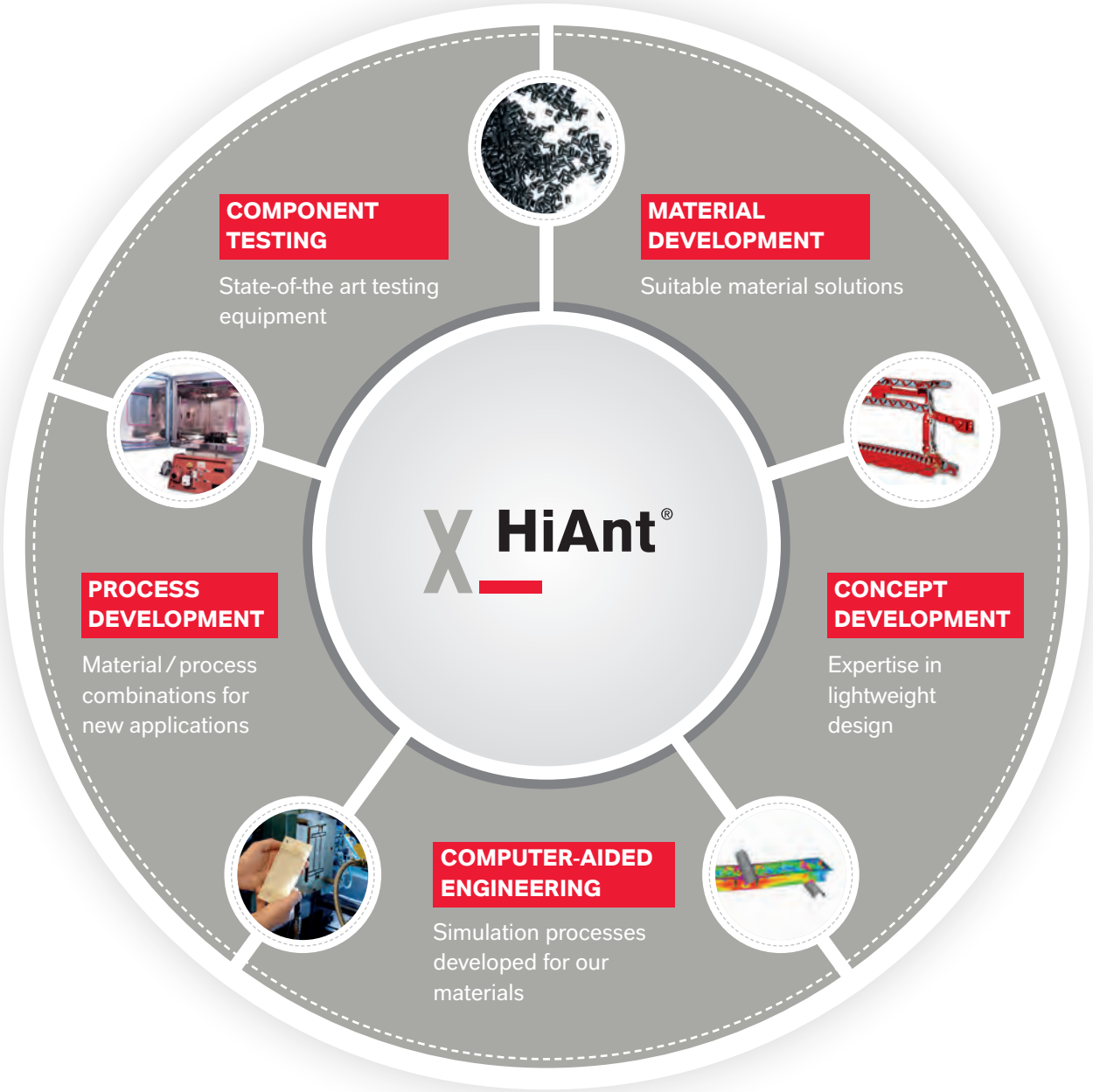
■ E-booster automatic start-stop system, Pocan® B 4235



HIANT® – BUNDLED KNOW-HOW FOR CUSTOM-DESIGNED SERVICE

We support customers in developing parts made of our high-tech plastics with our HiAnt® know-how package. These services include:

- determination of material parameters that are a function of the elongation rate by means of high-speed tensile tests
- material-specific design with CAE tools such as integrative simulation
- the calculation of the creep behavior of our polyamides, such as virtual testing of leak behavior of oil pan flanges and modules under sealing loads
- customer tests on injection molding machines with auxiliary installations for GIT and WIT in our Technical Center for optimization of materials and methods
- component tests to customer standards as well as all conventional vibration tests, for example
- aging and media aging tests under climate-controlled conditions
- pendulum impact tests and oscillating compression tests on components of the vehicle cooling system
- burst pressure tests and alternating pressure and backfire tests on intake modules
- technical support for injection molding, sampling and the launch of series production.



PRODUCT RANGE

						Tensile modulus (1)	Stress (1,2)	Strain (1,3)	HDT/A (4)	Impact strength (5)	Density (6)	Remark	Cover	Electrical / electronic parts	Cooling circuit	Airflow management	Oil circuit
						MPa	MPa	%	°C	kJ/m²	g/cm³						
STANDARD GRADES																	
Durethan®	AKV 30 H2.0	PA 66	reinforced	GF30		10000/6000	175/110	3.0/6.0	> 240	75/85	1.36					■	■
	AKV 35 H2.0	PA 66	reinforced	GF35		11200/7500	200/125	3.1/6.4	250	85/90	1.41					■	■
	BKV 30 H2.0	PA 6	reinforced	GF30		9500/5800	170/100	3.0/6.0	200	75/90	1.36					■	■
	BKV 35 H2.0	PA 6	reinforced	GF35		10700/6800	180/110	3.0/5.0	205	80/90	1.41					■	■
EASY-FLOW + XTREM FLOW GRADES																	
Durethan®	BKV 30 H2.0 EF	PA 6	reinforced	GF30	Easy Flow (EF)	9400/5500	170/100	3.0/5.8	210	65/80	1.35	also available as XF version	■			■	■
	BKV 35 H2.0 EF	PA 6	reinforced	GF35	Easy Flow (EF)	10800/6700	180/115	3.0/6.0	210	85/80	1.40	also available as XF version				■	■
	BM 29 X H2.0 EF	PA 6	reinforced	(GF+MD)30	Easy Flow (EF)	6500/2900	110/60	3.0/20	190	35/110	1.36		■				
	BM 40 X H2.0 EF	PA 6	reinforced	(GF+MD)40	Easy Flow (EF)	9000/4500	125/65	2.5/8.7	195	40/65	1.45		■				
	BG 30 X H2.0 XF	PA 6	reinforced	(GF+GB)30	Xtreme Flow (XF)	5300/2800	90/45	2.2/6.5	210	50/55	1.32		■				
HIGHLY REINFORCED (HIGH-MODULUS) GRADES FOR METAL SUBSTITUTION																	
Durethan®	BKV 50 H2.0 EF	PA 6	reinforced	GF50	Easy Flow (EF)	16200/10000	215/140	2.7/3.5	210	100/85	1.57					■	■
	BKV 60 H2.0 EF DUS060	PA 6	reinforced	GF60	Easy Flow (EF)	20000/12000	225/145	2.4/3.5	220	90/90	1.70					■	■
	BG 60 X XF	PA 6	reinforced	(GF+GB)60	Xtreme Flow (XF)	19000/12300	210/135	2.2/3.3	210	85/75	1.68					■	■
	AKV 50 H2.0	PA 66	reinforced	GF50		16000/10200	230/155	2.6/4.3	250	95/-	1.57					■	■
	TP 202-035 („AKV 60 XF“)	PA 66	reinforced	GF60	Xtreme Flow (XF)	20000/13300	235/145	1.5/2.7	250	70/60	1.68						■
HYDROLYSIS-STABILIZED GRADES (HR)																	
Durethan®	DP AKV 30 X HR EF	PA 66	reinforced	GF30	hydrolysis-stabilized. suitable for GIT/WIT process	7800/4500	120/75	3.3/8.5	230	60/75	1.34				■		■
	AKV 30 G HR DUS023	PA 66	reinforced	GF30	hydrolysis-stabilized. suitable for GIT/WIT process	8500/5600	135/90	3.2/6.5	200	70/65	1.34				■		■
	AKV 30 HR H2.0	PA 66	reinforced	GF30	hydrolysis-stabilized	9500/6100	180/120	4.0/8.0	245	75/90	1.36	also available as GF35 standard			■		■
	DP AKV 30 HR EF	PA 66	reinforced	GF30	Easy Flow. hydrolysis-stabilized	8200/5000	150/100	3.6/8.0	240	80/80	1.32				■		■
	DP AKV 50 HR H2.0	PA 66	reinforced	GF50	High-modulus. hydrolysis-stabilized	15500/10600	220/159	2.7/4.4	245	100/95	1.57				■		■
BLOW MOLDING GRADES																	
Durethan®	BC 700 HTS DUSXBL	PA 6	non-reinforced	-	impact-modified	980/210	28/-	6.5/-	48	N/N	1.03					■	■
	BC 550 Z DUSXBL	PA 6	non-reinforced	-	impact-modified. heat-stabilized	2000/430	50/-	4.0/-	53	N/N	1.07					■	■
	BKV 315 Z H2.0	PA 6	reinforced	GF15	pseudoplastic blow molding grade	5300/2500	105/55	5.0/19	175	80/105	1.20					■	■
	BKV 325 Z H2.0	PA 6	reinforced	GF25	pseudoplastic blow molding grade	8000/4000	130/70	3.2/8.5	190	75/95	1.28					■	■
	AKV 325 H2.0	PA 66	reinforced	GF25	pseudoplastic blow molding grade. hydrolysis-stabilized	8200/5000	150/100	40393	236	80/90	1.31				■	■	■
SPECIAL GRADES																	
Durethan®	BCF 30 X H2.0	PA 6	reinforced	(GF+CF)30	electrostatically discharging	13500/6700	185/100	2.9/5.0	205	75/80	1.33	also available as PA 66 version	■	■			■
	BKV 30 XWP HV	PA 6	reinforced	GF30	pseudoplastic. improved welding properties	9800/5600	170/100	3.0/8.0	200	80/95	1.36					■	■
	BKV 30 XWP XT	PA 6	reinforced	GF30	improved welding properties in high-temperature	10000/5100	170/90	3.5/7.5	200	70/95	1.37						
	BKV 235 XCP	PA 6	reinforced	GF35	optimized for cold impact	9500/-	165/	5.5/	203	110/	1.36	oilpan with cold impact requirement				■	■
	BKV 30 XWP LT	PA 6	reinforced	GF30	improved welding properties for laser welding	9500/7250	175/125	3.3/4.2	200	65/75 (7)	1.36	improfed laser transparency		■		■	■
	BKV 25 H2.0 LT	PA 6	reinforced	GF25	optimized for IR welding	8400/5100	160/90	3.0/6.0	215	60/80	1.32			■		■	■
	BTC 75 H3.0 EF	PA 6	reinforced	MD75	good thermal conductivity	14700/-	90/-	1.8/-	200	28/- (7)	2.29			■			
	BTC 65 H3.0 EF	PA 6	reinforced	MD65	good thermal conductivity	9900/3500	90/50	3.0/5	190	45/35 (7)	2.01			■			
	BKV 35 CX H2.0	PA 6	reinforced	GF35	(MuCell® process) foamed moldings	10500/6500	180/110	3.0/5.5	205	70/- (7)	1.40		■			■	■
	AKV 35 CX H2.0	PA 66	reinforced	GF35	(MuCell® process) foamed moldings	11000/-	197/-	2.8/-	>240	58/- (7)	1.41		■			■	■
HIGH-TEMPERATURE GRADES																	
Durethan®	BKV 30 XTS1	PA 6	reinforced	GF30	high-temperature stabilized	9000/5300	170/85	3.0/5.5	200	60/-	1.36	also avaliable as XTS3 Version				■	■
	BKV 35 XTS1	PA 6	reinforced	GF35	high-temperature stabilized	10700/6500	180/100	3.0/5	205	70/80	1.41					■	■
	AKV 30 XTS1	PA 66	reinforced	GF30	high-temperature stabilized	9900/6000	175/110	3.0/5.5	> 240	50/80 (7)	1.36	also avaliable as XTS3 Version				■	■
	AKV 35 XTS1	PA 66	reinforced	GF35	high-temperature stabilized	10800/6800	185/105	3.2/5	250	75/85	1.41					■	■

(1) ISO 527-1,-2; freshly molded/conditioned, (2) with non-reinforced products yield stress, with reinforced products, stress at break, (3) with non-reinforced products elongation, with reinforced products, elongation at break, (4) ISO 75-1,-2; (5) ISO 179-1eU (23 °C), (6) ISO 1183, N = no fracture, n/n = freshly molded/conditioned, conditioned in line with ISO 1110 (70 °C, 62 % r. F.), (7) Izod impact strength to ISO 180-1U, ® MuCell is a registred trademark Trexel, Inc. 100 Research Drive, Wilmington, MA 01887 USA

Please note that our product information and data are subject to ongoing examination and updating. For the latest version, go to www.durethan.com, www.pocan.com.

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Our products are sold in accordance with the current version of our General Conditions of Sale and Delivery.

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Order No.: LXS-HPM-061-EN, Edition: 2016-10