

QUALITY PERFORMS.



EF-, XF- and high-modulus product lines:
Easy-flow and high-strength

X_Durethan® **X_Pocan®**

QUALITY WORKS.

LANXESS
Energizing Chemistry

TAILORED FOR OPTIMAL CUSTOMER BENEFIT

Our engineering plastics are designed to support customers in achieving maximum component performance and efficient processing. To meet these objectives, we established our **Durethan®** and **Pocan®** EF and XF product lines, a broad range of easy-flow polyamide 6 and 66 grades, and polybutylene terephthalates (PBT). "EF" stands for "EasyFlow," "XF" for "XtremeFlow." In addition, based on our standard easy-flow grades, we have developed what are known as "high-modulus thermoplastics" with glass fiber contents of 50% and more. These products display unusually high stiffness and strength and, despite their high filler content, can still be processed as easily and efficiently as comparable standard materials. They offer designers entirely new options.

More than twice the flowability

The melt flow of the EF and XF materials has been increased by a factor of two or more compared to the standard materials without compromising on the mechanical properties. The result is numerous advantages for processing that tangibly reduce manufacturing costs for molders. Because they make it possible to reduce wall thickness, our materials are very well suited to applications in lightweight design.

Alternative to metals, thermosets and SMCs

Our high-modulus materials frequently serve as alternatives to die-cast metals or thermosets, such as sheet molding compounds (SMC), because they are lighter and offer processing advantages. They have excellent opportunities in the field of lightweight design. Thanks to their high content of reinforcing fibers, these materials display outstanding mechanical properties at a comparatively low density. For instance, we have polyamide 6 grades in our range with a glass fiber content of 60%, including a new variation that offers increased flowability for ultra-thin walls and very good surface quality.



OVERVIEW ADVANTAGES OF EASY- FLOW THERMOPLASTICS

Our **Durethan®** and **Pocan®** EF and XF product lines display good flowability, which translates into a wider processing window. Molders gain four "control dials" that enable them to exploit all processing and cost advantages:

1 Reduction in injection pressure

A lower injection pressure reduces mold wear and maintenance efforts. Smaller injection molding machines with lower clamping forces can be used, which cuts costs and increases a processor's flexibility. Molds can be equipped with several cavities to boost throughput. Thin and complex component geometries can be fabricated with lower stresses. Additionally extending the holding pressure minimizes both warping and the risk of sink marks.

2 Reduction in melt temperature

A lower melt temperature shortens cooling and thus cycle times too, which also increases productivity. In most cases, our easy-flow materials help to achieve 15 to 30% shorter cycle times than with standard grades.

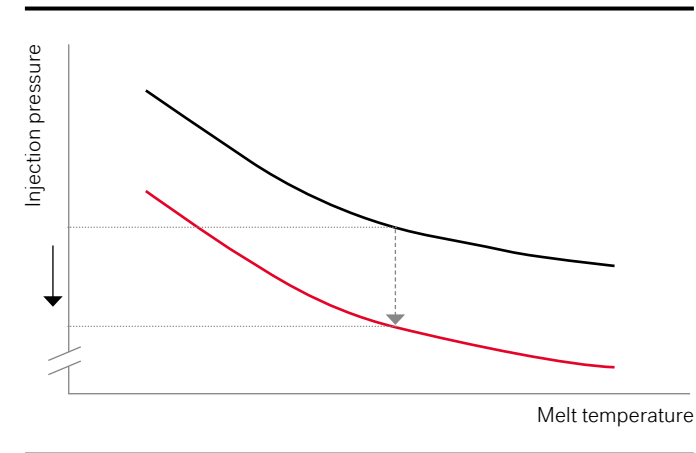
3 Increase in injection rate

Higher injection rates improve weld line strength and surface quality. Longer flow paths are possible, which permits the use of simpler molds, e.g. without hot runner technology.

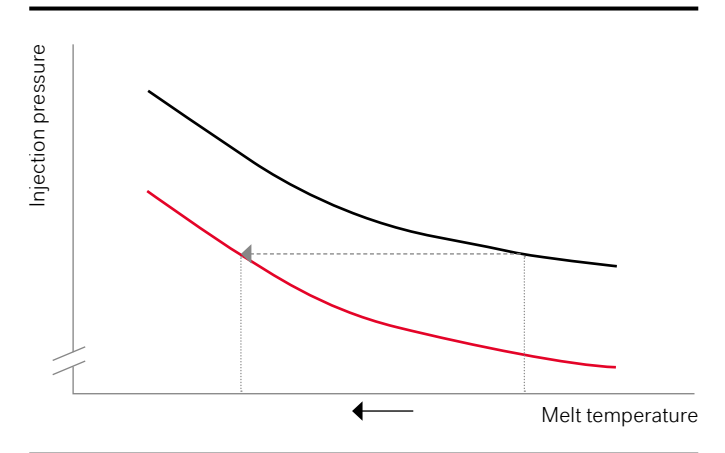
4 Extension of the flow path

With a longer flow distance, lower-cost molds with fewer gates can be used, resulting in fewer flow lines. Both wall thickness and material consumption can be reduced.

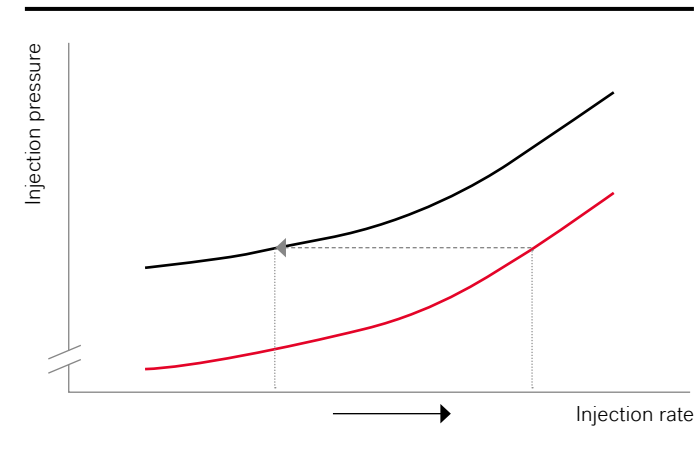
1: Original processing parameters



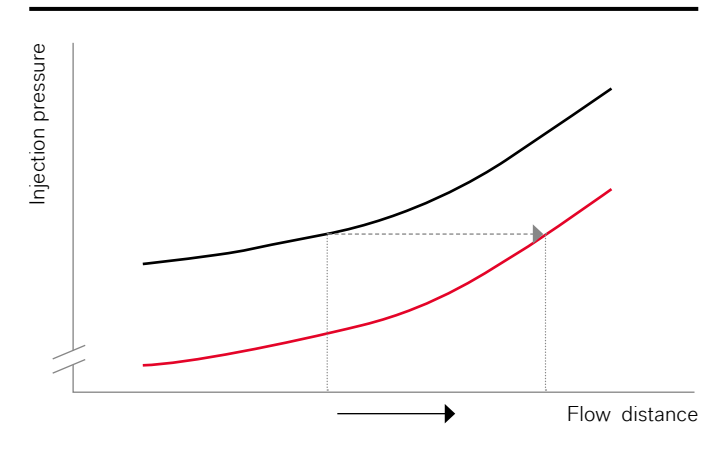
2: Reduction in melt temperature



3: Increase in injection rate



4: Increase in flow distance



OUR PRODUCT RANGE

DURETHAN® EF AND XF

Our range of easy-flow Durethan® grades is highly diverse and grouped according to the main applications and processing methods. It includes products with a glass fiber content of between 20 and 60%, with mineral, glass sphere or chopped carbon fiber reinforcement, and with heat- and hydrolysis-stabilized properties.

Durethan® EF and XF product range

Durethan EF/XF grade	Product characterization	Comparable standard grade
DPAKV30HREF	PA 66, 30% glass fibers, hydrolysis stabilized, easy-flow	AKV30HRH2.0
AKV60XF	PA 66, 60% glass fibers, extreme-flow	
BKV30H2.0EF	PA 6, 30% glass fibers, easy-flow	BKV30H2.0
BKV35H2.0EF	PA 6, 35% glass fibers, easy-flow	BKV35H2.0
BKV50H2.0EF	PA 6, 50% glass fibers, easy-flow	BKV50H2.0
BKV60H2.0EF DUS060	PA 6, 60% glass fibers, easy-flow	–
BKV60XF	PA 6, 60% glass fibers, extreme-flow	–
BM29XH2.0EF	PA 6, 30% glass fibers/mineral, easy-flow	–
BM40XH2.0 EF	PA 6, 40% glass fibers/mineral, easy-flow	–
BG30XH2.0XF	PA 6, 30% glass fibers/glass spheres, extreme-flow	BG30XH2.0

Very high coolant resistance

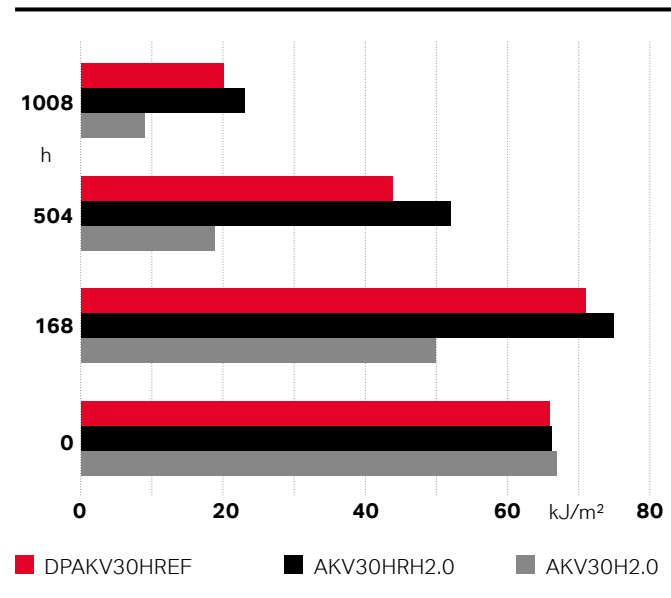
Durethan® DPAKV30HREF

This polyamide 66 specialty grade from the Durethan® HR line was developed for applications in passenger car cooling systems. Its significantly higher flowability compared to Durethan® AKV30HR is not achieved at the cost of its hydrolysis resistance. The two display similarly good long-term resistance in hot water/glycol mixtures.



■ A coolant tube was fabricated in a water injection process for the first time from hydrolysis-stabilized, easy-flow Durethan®. A special glass fiber mixture makes the outer and inner surfaces of the tube very smooth.

Izod impact strength to ISO 180-1U after storage in water/glycol at 130°C



Durethan® BG30XH2.0XF

For thin-walled electrical/electronic components

Reinforced with glass spheres and glass fibers, this polyamide 6 is optimized for components in automotive electrical systems, such as fuse boxes, central electronic control unit housings and multiway connectors. The flowability is about a third higher than the standard grade, Durethan® BG30X, which facilitates the low-warping fabrication of thin, complex component geometries.

Durethan® BM29XH2.0EF

Isotropic shrinkage, good surface quality

This heat-stabilized polyamide 6 targets visible, large-area components exposed to heat, such as engine covers. Thanks to the product's good flowability, such components can be fabricated on small injection molding machines. Reinforced with a mineral/glass fiber mixture, the advantages of this product are its isotropic shrinkage and good component surface quality.

OUR PRODUCT RANGE

POCAN® XF



Our range of easy-flow Pocan® XF products encompasses unreinforced variations, material grades with glass fiber reinforcement from 10 to 55% and one grade filled with glass spheres. Apart from purely PBT compounds, we also offer blends with polyethylene terephthalate (PET) and polycarbonate (PC). The various members of the Pocan® XF family – despite the significantly higher flowability of some – are all considerably more hydrolysis-resistant than the comparable standard grades. Many molders choose them over the standard materials for this reason, additionally benefiting in the process from a density advantage of up to 5%, meaning they can also reduce material consumption.

Pocan® EF and XF product range

Pocan easy-flow	Product characterization	Comparable standard grade
B1205XF	PBT, unreinforced	B1305
B3215XF	PBT, 10% glass fibers	B3215
B3217XF	PBT, 16% glass fibers	KL1-7265
B3225XF	PBT, 20% glass fibers	B3225
B5220XF	PBT, 20% glass spheres	–
B3235XF	PBT, 30% glass fibers	B3235
B3233HR	PBT, 30% glass fibers hydrolysis stabilized	B3235
C3230XF	PBT+PC, 30% glass fibers	KU1-7635 POS151
T3150XF	PBT+PET, 55% glass fibers	–

Pocan® B5220XF

Effectively coatable surfaces

Reinforced with glass spheres, this compound shrinks very isotropically and has only a very minimal tendency to warp. It results in smooth, easy-to-coat surfaces. Another advantage is the high thermal stability expressed among other things by a deflection temperature under load of 170°C (0.45 MPa, ISO 75-1, -2). The material is ideal for large automotive body parts coated in an in-line process.

Pocan® C3230XF

Low warpage, isotropic shrinkage

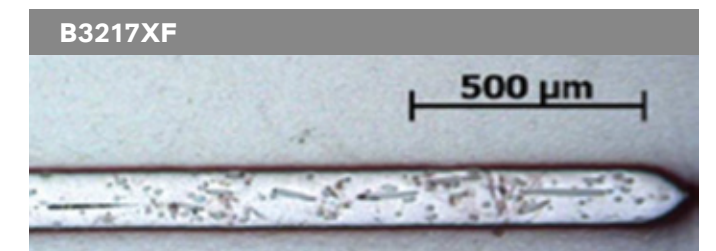
The strengths of this (PBT+PC) blend reinforced with 30% glass fibers are low warping and virtually isotropic shrinkage. It displays 40% better flowability, but a 30% higher toughness than the standard blend Pocan® KU1-7635, which is unusual because both properties usually have a negative effect on one another. The material yields excellent surfaces and is ideal for components that need to have very accurate dimensions, such as lamp housings or large panels.

Pocan® B3217XF

Uniform fiber distribution

Reinforced with 16% glass fibers, this PBT has better flowability by approximately one-quarter than the standard material Pocan® KL1-7265. Particularly in the case of thin-wall applications, it displays outstanding mold filling behavior, resulting in very uniform distribution of the glass fibers. Virtually no sink marks form in the process. Further advantages include its high toughness and hydrolysis resistance.

Pocan® B3217XF: Cross-section showing the distribution of glass fibers



■ Multiway connectors of complex geometry can be designed with Pocan® B3217XF, because it results in uniformly oriented glass fibers, lending even very thin-walled regions of a component good mechanical stability.

HIGH-MODULUS THERMOPLASTICS FOR THE MOST MECHANICALLY DEMANDING APPLICATIONS

Our high-modulus thermoplastics differ by the matrix used, the type and volume of reinforcing materials and the respective, optimized properties. The effective and efficient use of such high filler contents was first made possible by the technological advancements in improving flow described above.

They generally are characterized by very high strength and stiffness ratings. In terms of weight, they often are in the same league as metals. Compared to SMCs or die-cast zinc and aluminum, they offer greater freedom in component design and reduce overall weight due to their low density. Furthermore, the components do not require any reworking. In the case of high-volume production in particular, the injection molding method pays off thanks to the lower process costs. Integrating functions, such as mounts and guides, can further reduce manufacturing costs and simplify subsequent assembly steps. The high reinforcing filler content means higher thermal conductivity. In other words, the components can be removed from the mold sooner.



OUR HIGH-MODULUS THERMOPLASTICS DURETHAN®



As our Durethan® high-modulus thermoplastics, we offer polyamide 6 and 66 grades with a glass fiber content of 50 or 60%. Our range further includes polyamides reinforced with chopped carbon fiber contents of 20 to 40%. What is more, we have developed hydrolysis-stabilized products and others optimized for high weather resistance. For “hot”

applications, heat-stabilized materials are available that can withstand continuous operating temperatures of up to 200°C. Our reinforced polyamides have elasticity modulus values ranging from 10,000 to 14,500 MPa (conditioned).

	Elasticity modulus		Tensile stress at break		Izod impact strength		Density	Comment
	Dry	Conditioned	Dry	Conditioned	Dry	Conditioned		
	MPa	MPa	MPa	MPa	kJ/m ²	kJ/m ²	kg/m ³	
Durethan®								
AKV50H2.0 PA 66 GF50	16,000	10,200	230	160	90	90	1.570	Standard
DPAKV50HRH2.0 PA 66 GF50	15,800	10,500	225	160	100	95	1.570	Hydrolysis-stabilized
AKV60XF PA 66 GF60	20,200	13,300	210	145	70	60	1.680	Extreme-flow
BKV50H2.0EF PA 6 GF50	16,200	10,000	215	140	85	80	1.570	Easy-flow
BKV60H2.0EF DUS060 PA 6 GF60	20,000	12,000	225	145	80	80	1.700	Easy-flow
BKV60XF PA 6 GF60	20,200	13,000	215	140	80	75	1.693	Extremely good flowability
BG60XXF PA 6 (GF+GB) 60	19,000	12,300	210	135	80	70	1.680	Isotropic shrinkage
BCF30H2.0EF PA 6 CF30	23,000	11,500	225	135	50	55	1.260	Carbon fibers
TP038-002 („BCF40H2.0EF“) PA 6 CF40	29,000	14,500	230	165	45	55	1.315	Carbon fibers



■ The front end carrier of the Škoda Octavia is made entirely of Durethan® DPBKV60H2.0EF. Thanks to the extremely high stiffness and strength of the polyamide, even the top cross-member of the component, extending all the way to the fender carriers, contains no sheet-metal reinforcements.

Lightweight design reaches perfection

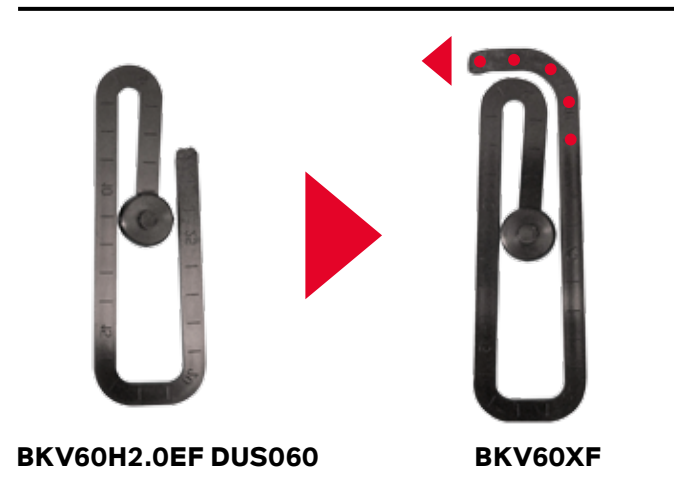
With their high strength and stiffness, our high-modulus materials are the preferred choice when it comes to the lightweight design of structural components exposed to high stresses. The opportunities they offer in this connection are demonstrated by the automotive front end mentioned above, which is mass produced from a high-modulus grade. Compared to a virtual carrier designed by LANXESS from a standard polyamide 6 with 30 percent glass fibers, it is about 1.2 kilograms or 25 percent lighter. Responsible for these results are not only the significantly better mechanical properties, but also the good flow behavior of the material, which enables very thin walls. In fact, the wall thickness in areas subject to lower stresses was reduced to just 1.8 millimeters.

Durethan® BKV60XF
Extremely thin walls, excellent surfaces

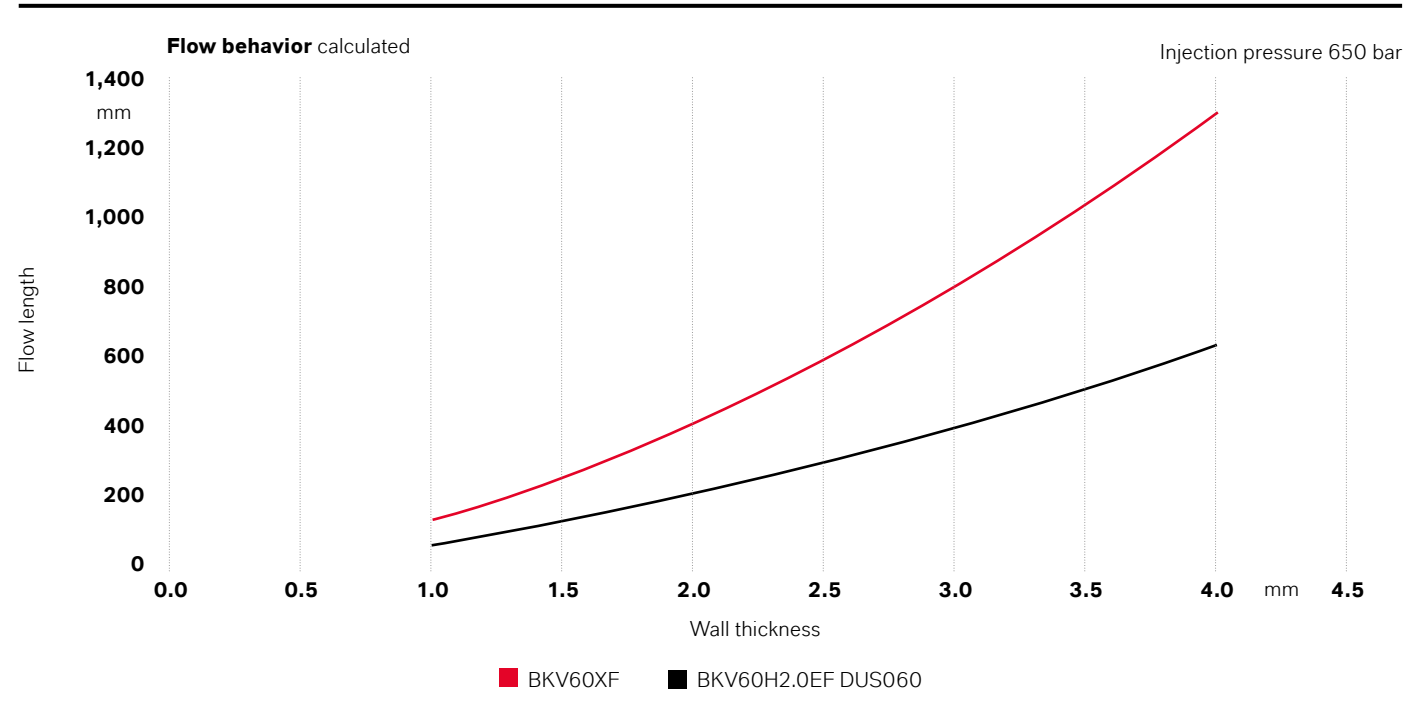
A special material innovation for lightweight design and “ultra-thin-wall technology” is Durethan® BKV60XF. The polyamide 6 is an advancement of our very successful product Durethan® BKV60H2.0EF DUS060. Its flowability has been boosted by another 30%, although it otherwise still has comparable, high-performance, mechanical properties.

It therefore is suitable for applications involving extremely thin walls of 1 mm or less. The surface qualities have also been significantly improved based on an optimized crystallization process and higher injection rates, which are possible thanks to the high flowability. Even with low injection rates and pressures, the advantages of a wide processing window can be fully exploited. Another advantage of this engineering material – which also permits laser marking – is its improved resistance to thermal aging.

Further improvement in flowability



Flow distance versus wall thickness for different PA 6 GF60 products

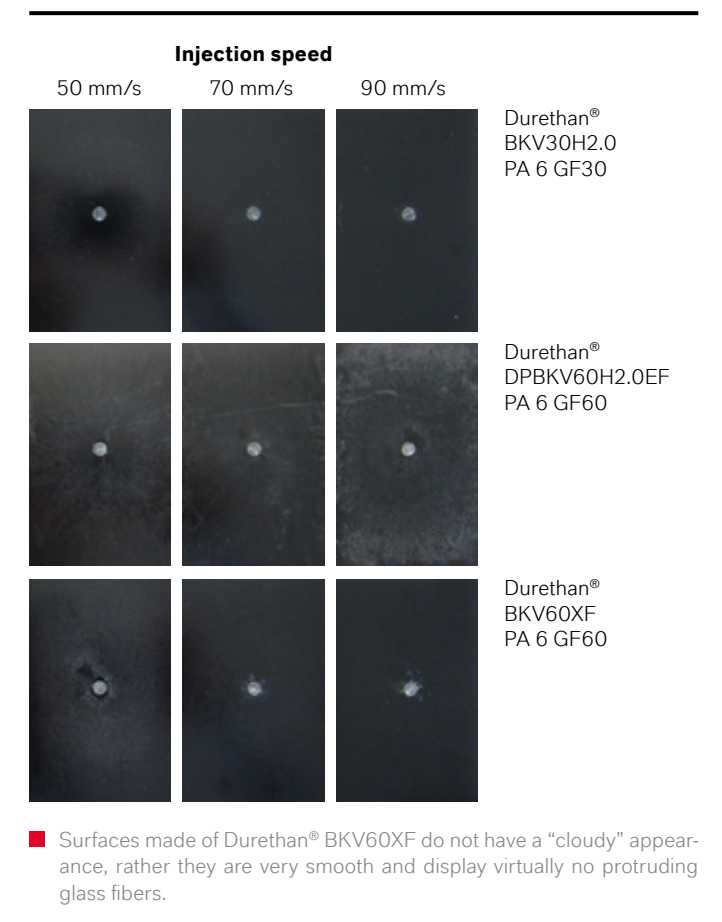


Durethan® BCF30H2.0EF
As strong as die-cast aluminum

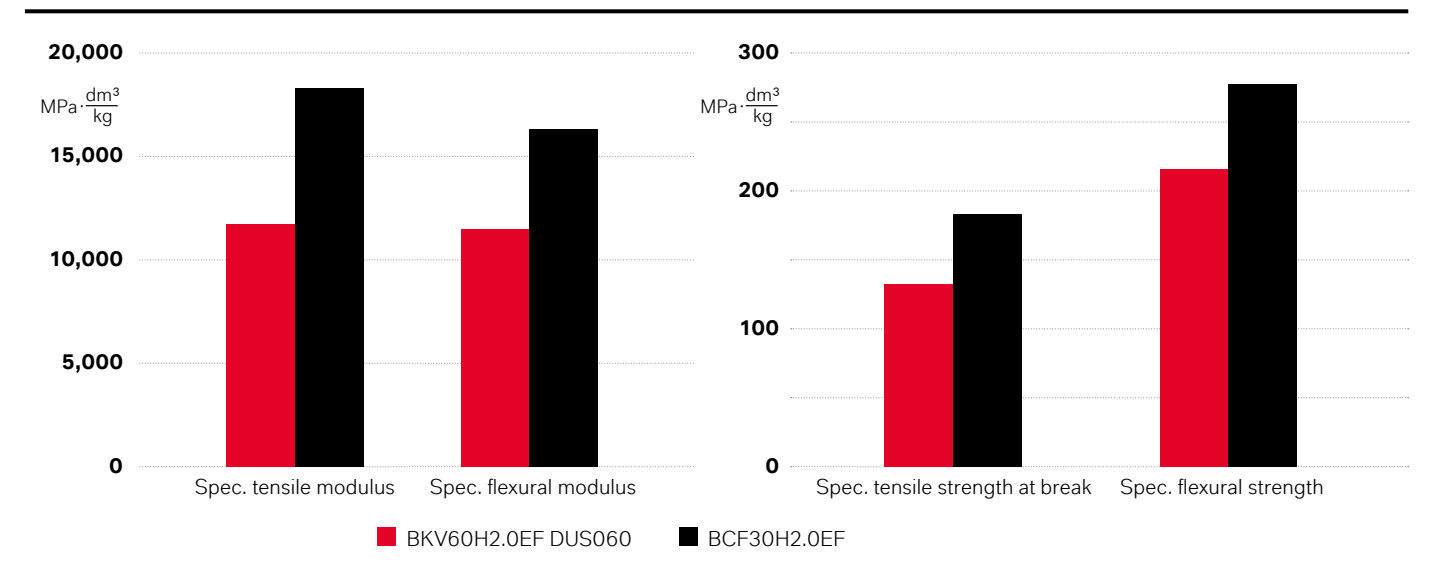
This polyamide 6 grade contains 30% carbon fibers. Thanks to its low density, its specific strength (adjusted for weight) is approximately twice as high as most commonly used steel and die-cast zinc materials, putting the material on a par with die-cast aluminum. This material therefore is ideal for high-stress components that must be particularly thin-walled because of small installation spaces, but at the same time extremely stiff and strong.

Durethan® BG60XXF
Tailored for tablet PC back shells

This polyamide 6 was tailored for the thin, but very stiff back shells on tablet PCs. It is reinforced with a special mixture of glass fibers and glass spheres. Its stiffness and strength are about as high as those of Durethan® BKV60H2.0EF DUS060, although it shrinks very isotropically and displays only a low tendency to warp. It results in excellent surface qualities.



The significantly lower density of carbon-fiber-reinforced Durethan® BCF30H2.0EF compared to Durethan® BKV60H2.0EFDUS060 results in improved weight-specific characteristics, such as much higher specific stiffness and strength (values dry as molded).



OUR HIGH-MODULUS THERMOPLASTICS

POCAN®

Our range of Pocan® high-modulus thermoplastics encompasses product grades with glass fiber reinforcement from 45 to 55%, including one grade with a high content of post-consumer recycled material. The Young's modulus values range from 16,000 to 18,500 MPa depending on the grade. Tensile modulus, tensile strength at break and elongation at break are at a similarly high level as our polyamides reinforced with 60% glass fibers. As is typical for PBT, these high-performance materials absorb virtually no water. Their mechanical properties therefore are constant regardless of moisture. In addition, another one of the strengths of these materials is their high dimensional stability.

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	Elasticity modulus	Tensile stress at break	Izod impact strength	Density
Pocan®	MPa	MPa	kJ/m ²	kg/m ³
T7391 (PBT+PET) GF45	16,000	160	55	1,690
T3150XF (PBT+PET) GF55	18,500	160	45	1,770
ECOT3240 (PBT+PET) GF45	16,000	160	55	1,690

Pocan® T3150XF

Very strong and weather resistant

Reinforced with 55% chopped glass strands, this (PBT+PET) blend is formulated for easy-flow characteristics. With an elasticity modulus of 18,500 MPa, it displays very high stiffness and is very tough. Its strength is somewhat higher than that of Durethan® BKV60H2.OEF DUS060 (60% glass fiber reinforcement) in a conditioned state. This low-warp, high-tech thermoplastic therefore is ideal for replacing metal. Its unique feature is its good weather resistance despite the high glass fiber content.

Pocan® T7391

Withstands high continuous static stresses

This (PBT+PET) blend displays unusually high stiffness and strength; its elasticity modulus is almost 16,000 MPa. It is ideal for components that are subject to continuous dynamic load and must absorb high forces. Despite its high glass fiber content of 45%, it results in very good surface qualities. The engineering material is dimensionally stable, displays low warpage and does not tend to creep. Its high thermal stability is expressed in a deflection temperature under load of 225°C (0.45 MPa, ISO 75-1, -2). Pocan® ECOT3240 is a particularly sustainable version of this product, because it contains at least 25% post-consumer recycled material from PET beverage bottles, while otherwise offering the same properties.



■ Thanks to its unusually high stiffness, Pocan® T7391 was used to fabricate a large junction box for trucks. Subject to strong vibration, this component used to be welded from sheet metal. With our PBT, however, this complex, three-dimensional part can be fabricated more simply and cost-efficiently, and is significantly lighter.



■ Stator and rotor of a forced induction engine made of Pocan® T7391, which can withstand very high dynamic stresses. Manufacturing these two engine components using a die-cast metal process would have involved considerable reworking due to the component's complex



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