QUALITY RESISTS.

Pocan® HR – Improved
Hydrolysis Resistance

Pocan®

QUALITY WORKS.

LANXESS
Energizing Chemistry

POCAN® HR
IMPROVED HYDROLYSIS RESISTANCE

Broadly based property spectrum

Polybutylene terephthalates (PBT) in many applications need to be particularly resistant to the degradation caused by hot water, water vapor and other media. For this reason, we developed the Pocan® HR (hydrolysis-resistant) product family. It expands our successful range of Pocan® PBT-based compounds, and is characterized by excellent hydrolysis and aging resistance when exposed to media typical of certain applications. The Pocan® HR portfolio offers:

- A wide selection of products with diverse properties
- Extensive freedom in designing and selecting the production process
- Cost-efficient processing

We naturally support our customers through all phases of component development: from material selection and component and mold engineering to component testing and production. All of these services are part of our HiAnt® package of know-how and services.

Durable in humid environments

PBT is sufficiently resistant to hydrolysis up to approximately 60 °C and can therefore stand up to all natural climate conditions. At higher temperatures, such as those prevailing in engine compartments, partial degradation of the polymer chains due to moisture can occur in non-stabilized PBT grades. This effect impairs critical material properties, such as impact strength and strain. The members of the Pocan® HR product family have customized additive packages, which lastingly counteract this breakdown of the polymer chains and deterioration in properties (Fig. 1). The compounds are also easier to process and display outstanding mechanical properties. With these overall characteristics, Pocan® HR stands out from other comparable products. Its excellent processing behavior is expressed, for example, by:

- A stable manufacturing process
- Very good melt flow properties
- Significantly reduced deposit formation in the mold and hot runner feed system

Thanks to its additives, Pocan® is much more resistant to hydrolysis than comparable standard products, and that translates into greater reliability for components that must function flawlessly throughout their entire service life. The product is used, for instance, in numerous safety applications, such as in the vicinity of the engine compartment. Typical applications for Pocan HR include:

- Connectors in airbags and power steering systems
- Sensors and housings such as those on fuse boxes and control units
- Transmission housings on automatic parking brakes (Fig. 2)

Fig. 1: Comparison of hydrolysis resistance: Pocan® B3233HR ages much more slowly

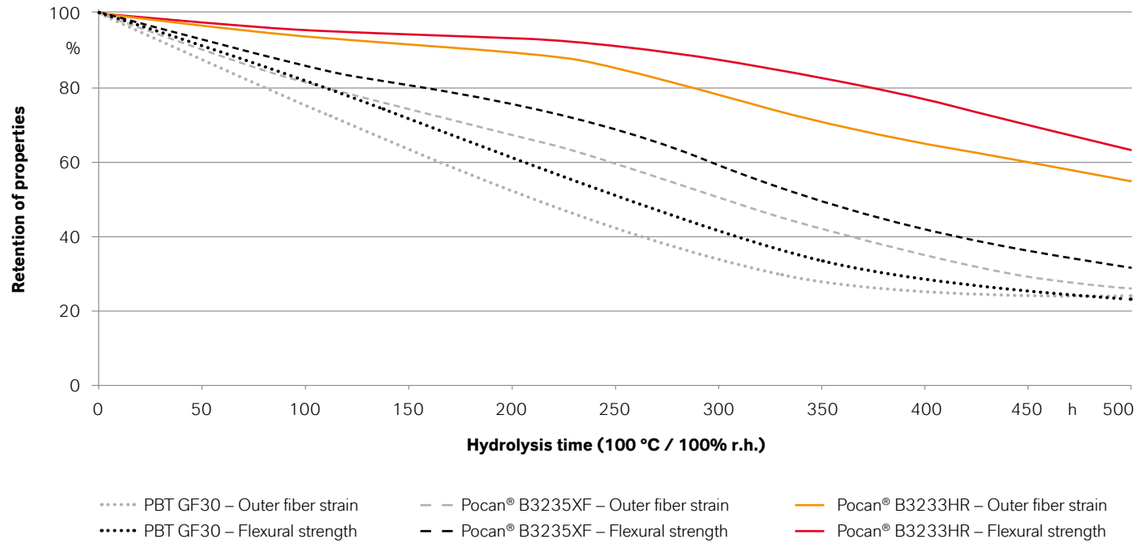

Fig. 2: The transmission housing of the automatic parking brake is made of Pocan® B3233HR.
Pocan® B3233HR displays not only high hydrolysis resistance, but also dimensional stability, good processing behavior and high strength and stiffness.

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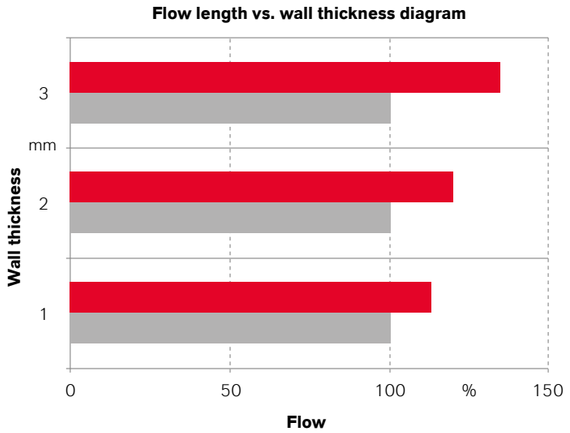
Versatile: the Pocan® HR range

Pocan® HR covers a wide range of properties and applications. The product line encompasses non-reinforced, reinforced, flame-retardant and laser-transparent grades (Fig. 9, table). One example is the non-reinforced grade Pocan® B1205HR. It is virtually impervious to warping, and supports the design of highly complex geometries. We offer our three Pocan® B3216HR, B3233HR and B3234HR compounds with a glass fiber content of 15% or 30%. The new grade Pocan® B3234HR is based on Pocan® B3233HR, but better for adhesion applications. To design very strong and stiff structural components, the range also includes a high-modulus product with a glass fiber content of 45%.

Besides hydrolysis resistance and good processing behavior, the advantages common to many of these materials are:

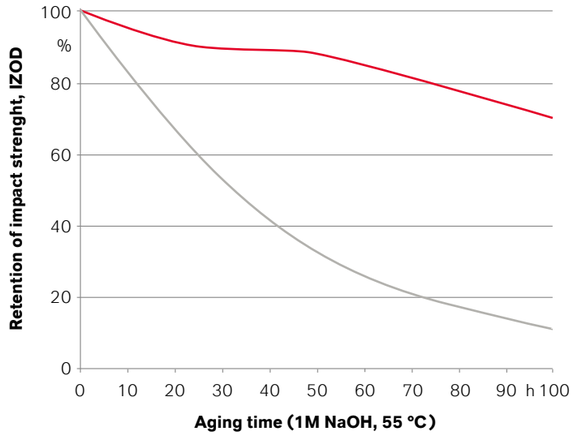
- Up to 35% higher flow length compared to standard products (Fig. 3)
- Improved chemical resistance, for instance against sodium hydroxide solutions (Fig. 4)
- Up to 5 % lower density compared to standard materials, without compromising the mechanical or rheological properties
- Good laser marking properties due to optimized colors, as e.g. essential for permanent marking of safety components

Fig. 3: Improved flow characteristics: Pocan® B3233HR is well suited for thin wall thicknesses



Calculated for 650 bar, 260 °C melt temperature, 80 °C mold temperature

Fig. 4: Good stability in alkaline solutions: decrease of Izod impact strength in Pocan® B3233HR after storage in a 1 molar NaOH solution at 55 °C



POCAN® HR
IMPROVED HYDROLYSIS RESISTANCE

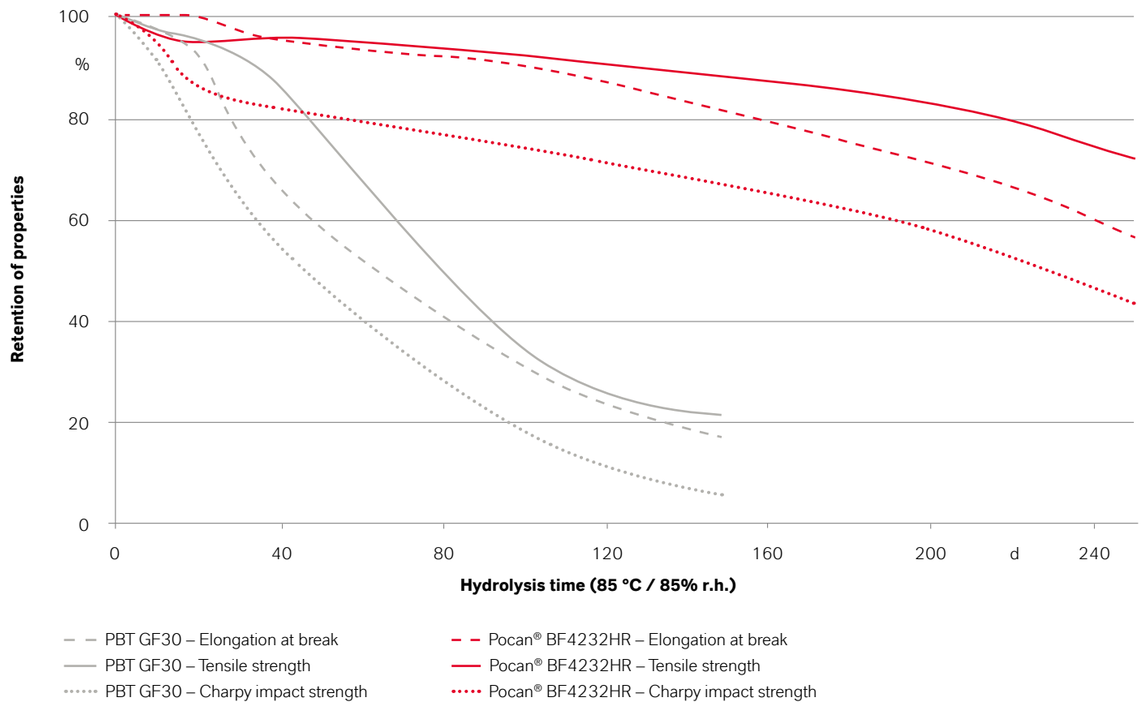
Selected material innovations

We regularly expand our Pocan® HR portfolio with new, innovative products. They are our response to market trends and reflect our close cooperation during development with partners in the respective industries.

Pocan® BF4232HR - Excellent flame retardance combined with hydrolysis resistance

We developed Pocan® BF4232HR as a flame-retardant compound reinforced with 30% glass fibers. It reaches the best classification of V-0, according to the fire safety standard UL94 of the Underwriter Laboratories (UL), at wall thicknesses down to 0.4 mm in all colors (Yellow Card registration). This grade simultaneously displays extraordinary hydrolysis resistance (Fig. 5). The combination of high flame retardance and hydrolysis resistance is very difficult to achieve in material development, and opens up entirely new fields of application for the material, such as in the rapidly growing market of e-mobility. In electrical motor vehicle drive systems, for example, it is suitable for use in components requiring very high flame retardance because of their exposure to high currents.

Fig. 5: Reduction of impact strength, tensile strength and elongation at break after storage at 85 °C and 85% rel. humidity: even after 200 days, the mechanical properties of Pocan® BF4232HR are still at a very high level compared to a standard PBT with a glass fiber content of 30%



POCAN® HR
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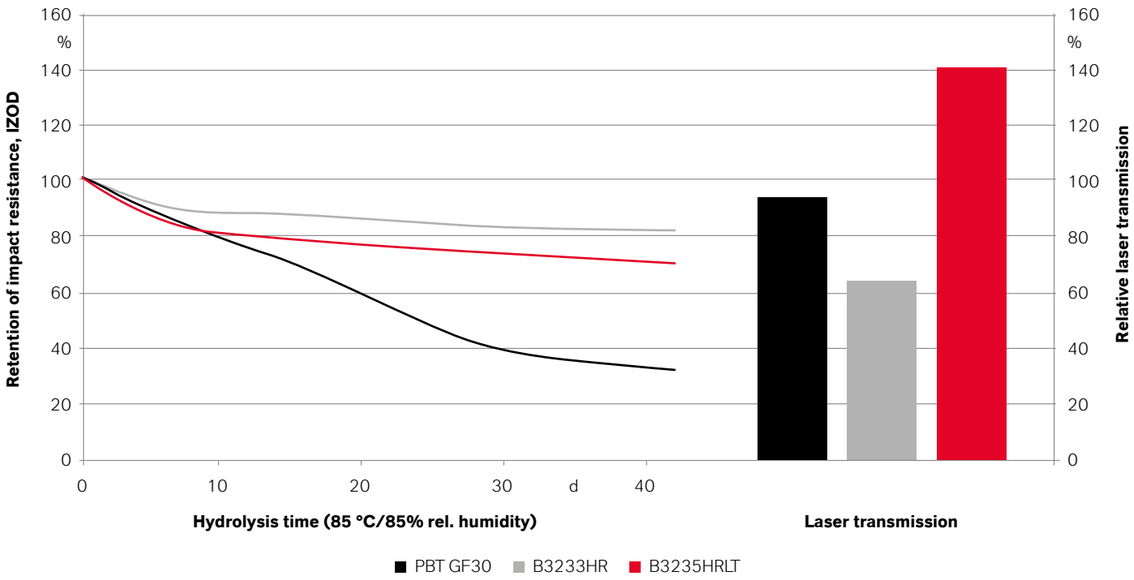
Pocan® HR LT - Customized for laser welding

Laser transmission welding is increasingly being used to join electrical/electronic housings located, for instance, in the vicinity of the engine compartment. We developed the new, laser-transparent grade Pocan® B3235HRLT specifically for components that have to be impervious to heat and moisture. Compared with Pocan® B3233HR, its laser transmission is more than twice as high in the 800 to 1,200 nm wavelength range typical of laser welding. At the same time, it is very hydrolysis-resistant (Fig. 6). The material is available in natural color as well as in a laser-transparent black (near infrared).

Specialty Pocan® XF products

In addition to the Pocan® HR product family, our PBT XF grades Pocan® B1205XF, B3217XF and B3235XF (XtremeFlow), with their very good flow properties, dis-play higher resistance to humid environments compared to sim-ilar standard PBT grades (Fig. 1). Several achieve a Class 3 rating in SAE/USCAR-2 Rev. 5 long-term testing (+125 °C peak temperature). Further advantages of this range of product grades are excellent mechanical behavior and easy processing in a very wide processing window.

Fig. 6: Comparison of laser transmission in the 800 to 1,200 nm wavelength range, and of hydrolysis resistance between Pocan® B3235HR LT and Pocan® B3233HR



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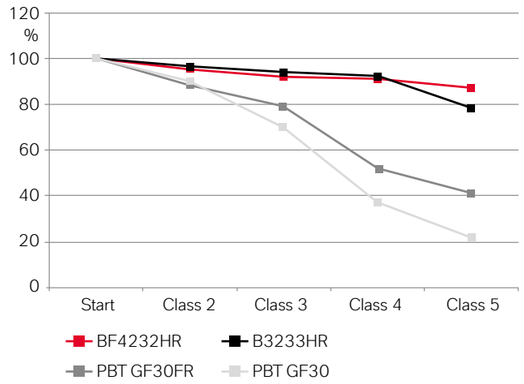
Top results in the SAE/USCAR test

One of the crucial tests for the hydrolysis resistance of PBT electrical connectors is the long-term SAE/USCAR-2 Rev. 5 test of the American Society of Automotive Engineers (SAE). A finished part is exposed in numerous cycles to temperatures of -40 °C to +175 °C (Class 5) at relative humidities of up to 100%.

Temperature changes, heat and moisture interact to increase the damaging effect on the materials during aging.

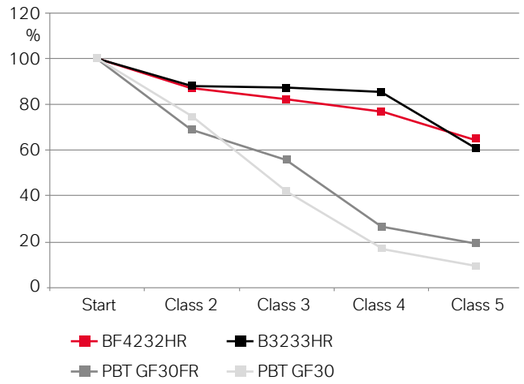
In tests with specimens under conditions similar to those in the USCAR test, Pocan® B3233HR, Pocan® B3234HR and Pocan® BF4232HR, for example, demonstrate their outstanding aging resistance. They retain about 80% of their original flexural strength (Fig. 7) and 50% of their impact resistance (Fig. 8) even under Class 5 testing conditions. In contrast, the flexural strength and impact resistance of standard PBT falls to much lower values.

Fig. 7: Decrease in flexural strength after storage as per SAE/USCAR-2 Rev. 5



Test specimens: 80 mm x 10 mm x 4 mm

Fig. 8: Decrease in Charpy impact resistance after storage as per SAE/USCAR-2 Rev. 5



Test specimens: 80 mm x 10 mm x 4 mm

HiAnt® - Know-how for tailored customer service

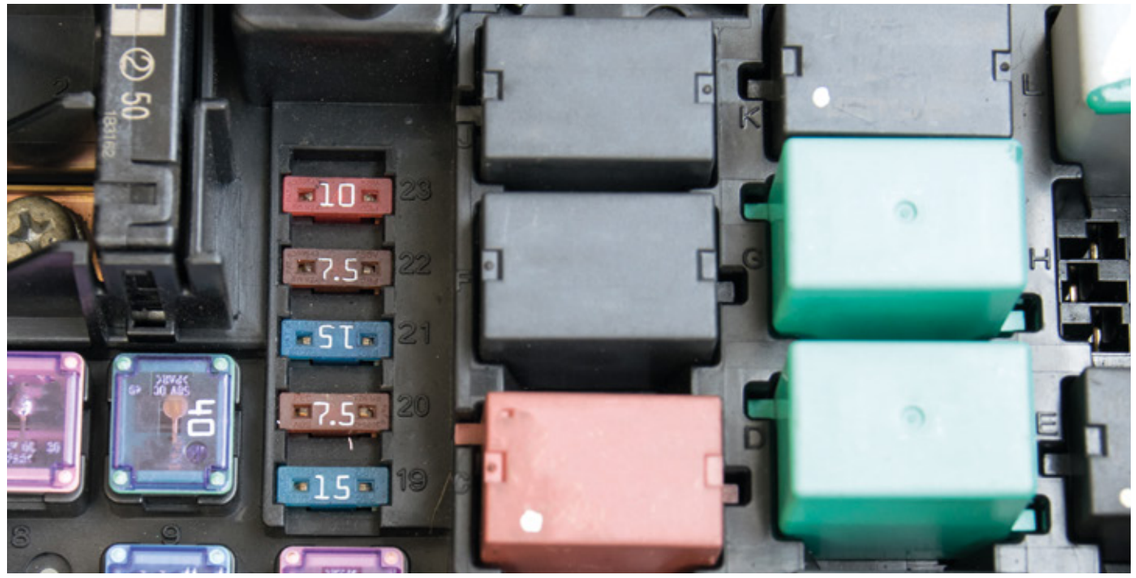
With HiAnt®, we support customers through all stages of developing components made of Pocan® HR. For example, we determine key material data for customers, such as mechanical and rheological behavior. Another area of focus is material-based engineering with various CAE tools, including calculation methods for predicting component behavior, such as integrative simulation, simulated structural optimization and mold filling simulation to minimize warpage. At our Technical Service Center, we have several injection molding machines for optimizing materials and processes using customer molds. Our component testing team conducts virtually all relevant tests in line with customer standards. We further offer climate storage and media aging testing. Moreover we also provide support for initial sampling and for optimizing the series production process.

POCAN® HR
PRODUCT OVERVIEW

Fig. 9: Key characteristic values of Pocan® HR

Product overview					Performance profile	Density kg/m³	Tensile modulus MPa	Tensile strain at yield/Elongation at break %	Impact strength (Izod/Charpy) kJ/m²	HDT-A °C	CTI V	FR UL94 class	USCAR class
Pocan® B1205HR	PBT	Non-reinforced	HR	Low-warpage	A	1,290	2,600	3.5/-	150	75	600	HB	3
Pocan® B3216HR	PBT	GF15	HR	Excellent processing + HR	A	1,400	5,900	-/3.7	45/50	190	275	HB	3
Pocan® B3235XF	PBT	GF30	XF	ExtremeFlow	S+	1,470	9,200	-/2.7	55/60	205	450	HB	3
Pocan® B3233HR	PBT	GF30	HR	Excellent processing + HR	A	1,480	9,600	-/2.9	55/65	205	450	HB	4-5
Pocan® B3234HR	PBT	GF30	HR	Improved silicone adhesion	A	1,490	9,600	-/2.9	55/65	205	425	HB	4-5
Pocan® B3235HRLT	PBT	GF30	HR + LT	Improved laser transparency	A	1,520	10,000	-/2.8	53/60	190	300	HB	n.d.
Pocan® BF4232HR	PBT	GF30	HR + FR	Flame-retardant	A+	1,670	9,800	-/2.0	35/40	195	225	V-0	4-5
Pocan® TP139-002	PBT	GF45	HR	High-modulus	A	1,610	13,000	-/2.4	50/-	205	n.d.	HB	4

S = Standard PBT S+ = Slightly improved hydrolysis resistance
A = Improved hydrolysis resistance A+ = Greatly improved hydrolysis resistance
n.d. = not determined



Pocan® B3216HR for automotive headlamp connectors

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