Bayblend® FR3000

- **(PC+ABS) blend**
- **Non-reinforced**
- **Flame retardant, antimony-, bromine- and chlorine-free**
- **Injection molding grade for housing components in the E/E and IT/C sectors**

Short description

Injection molding grade; successor to FR2000; easy flow; heat resistance Vicat/B 120 = 97 °C; UL recognition 94 V-0 at 1.5 mm; antimony-, bromine- and chlorine-free flame retardant; meets the requirements for the glow wire tests to IEC 60335-1 (household appliances standard); no juicing; good light stability.

Characterization

Bayblend® FR3000 is a non-reinforced, flame-retardant, amorphous thermoplastic polymer blend based on polycarbonate (PC) and acrylonitrile-butadiene-styrene copolymer (ABS). Its flame retardant properties are achieved through the very latest phosphate/PTFE technology, and Bayblend® FR3000 is free from antimony, chlorine and bromine.

Bayblend® FR3000 is the successor product to FR2000. The use of a new flame retardant additive means that there is virtually no danger of condensable components being outgassed during processing.

Delivery form

Bayblend® FR3000 is available worldwide and supplied in the form of oval or cylindrical granules in 25-kg polyethylene sacks, large cartons with a PE liner, in big bags or in bulk. The product is available in its natural color or in a wide range of opaque shades.

The production plants for Bayblend® have been certificated to DIN ISO by the appropriate quality organizations.
The certificates can be found in the internet at http://www.bayermaterialscience.com (Customer Services/Certificates/Quality).

Applications

The main areas of application for Bayblend® FR3000 are in the electrical/electronics industry and the information technology and communications sector. Typical applications include housings for desktop computers, printers, monitors, electricity meter boxes and distribution box housings.

Properties (see also table)

Bayblend® FR3000 is noted for its balanced property combination of flowability, toughness, heat resistance and flame retardance. Particular emphasis should be placed on its excellent processing behavior.

Bayblend® FR3000 is also a product of choice from the ecological angle. In addition to complying with the WEEE and RoHS EU Directives, Bayblend® FR3000 generally (depending on its color) meets the requirements of the most important ecolabels, including the Blue Angel, the EU "Flower", the Nordic Swan and the TCO. Detailed information is available on the internet at http://plastics.bayer.com.

Mechanical properties

Bayblend® FR3000 has a high impact and notched impact strength over a wide range of temperatures. This ensures that housing components in this material can also withstand high external mechanical loading without sustaining any damage. The high stiffness for an unreinforced product (the modulus of elasticity in tension is around 2700 MPa) allows thin-walled parts to be produced with the necessary stiffness too.

Thermal properties

Bayblend® FR3000 has a Vicat softening temperature (VST/B 120) of around 97 °C.

This means it considerably exceeds the heat resistance of at least 75 °C in the ball pressure test (IEC 60335-1). FR3000 thus constitutes an ideal housing material for providing protection against contact with live parts.

When components are subjected to a low level of mechanical stressing, no major dimensional changes are to be expected on short-term exposure to temperatures of up to a maximum of 85 °C. The maximum permanent service temperature will depend on the molded part geometry, the type of stressing and the requirements profile.

The melting range starts as of approximately 200 °C, while thermal decomposition commences at about 300 °C.

The coefficient of linear thermal expansion (ISO 11359-1,-2, 23 °C – 55 °C) displays only a low anisotropy and is in the range of 0.8 x 10^{-4}/K.

Burning behaviour

Bayblend® FR3000 attains a UL 94 V-0 recognition in a wall thickness of 1.5 mm (all colors). A UL 94-5VB listing is available for a wall thickness of 2.0 mm (all colors), and a UL 94-5VA listing for a wall thickness of 3.0 mm (all colors).

The requirements set out in IEC 60335-1 for live appliances in unsupervised operation are met with a GWIT of 800 °C at a thickness of 0.75 mm and above, and a GWFI of 900 °C at a thickness of 0.75 mm and above and of 960 °C at a thickness of 1.5 mm and above, as recorded in the glow wire test to IEC 60695-2.

Rheological properties

The good flow behavior of FR3000 makes it possible to fill even large-area and thin-walled injection moldings with just a few gates.

The viscosity curves are presented in the Annex.

Chemical resistance

At room temperature, molded parts in Bayblend® are resistant to mineral acids, a large number of organic acids and also aqueous saline solutions. Bayblend® parts are not resistant to bases, aromatics, ketones, esters, chlorinated hydrocarbons and a number of greases and oils. Their resistance to chemicals is additionally a function of the temperature, the loading duration and the internal and external stress status of the molded part; it should be checked in the individual case.

Weatherability

As with most thermoplastics, exposure to light/weathering leads to color changes and to a reduction in mechanical properties. This reduction in properties, however, is not so pronounced, and the requirements of the data processing industry for housing materials, for example, can still be met.

The majority of colors reliably fulfil the light aging standard for indoor applications to ASTM D 4459 (the so-called IBM test), which is recognized worldwide in accordance with OEM requirements, with a permitted range of delta E = 1.5 max.

It is best to paint parts that have to meet particularly stringent requirements, such as for outdoor applications.

Processing

Processing is generally performed by injection molding. All modern injection molding machines may be used.

Drying

Bayblend® must be dried prior to processing. No more than preferably 0.02 % residual moisture should be present in the granules prior to injection molding. Moisture in the plastic melt can lead to surface defects in the form of streaks, as well as to hydrolytic degradation (reduced level of mechanical properties). A drying temperature of approximately 85 °C is recommended for FR3000. Drying is best performed in dry-air dryers. The drying duration will be 3 to 4 hours in this case.

Melt temperature[1)]

The optimum processing temperature must be established as a function of the molded part and should be within a range of 240 to 280 °C. It is advisable to check the actual melt temperature on the ejected press cake using a thermometer. Overheating and excessively long melt residence times in the cylinder are to be avoided, since this can result in material damage, such as a reduction in toughness or surface defects

in the form of streaks on the injection molded part. Thermal decomposition of the material commences at around 300 °C.

1) see also disclaimer at the end of this Technical Information

Mold temperature

The mold should be heated and cooled uniformly and be kept at a recommended temperature in the region of 60 to 80 °C. While lower temperatures permit shorter cycle times, they also lead to a poorer molded part quality. The degree of orientation, inherent stresses, and post-shrinkage increase, and the surface finish deteriorates.

Screw speed

The screw speed should be controlled in such a way that the circumferential velocity of the screw is between 0.1 and 0.3 m/s.

Shrinkage

The molding shrinkage is more or less identical in all axes (isotropic), at 0.5 to 0.7 %. Apart from the part geometry, the shrinkage is primarily dependent on the level and duration of the holding pressure as well as on the temperature of the melt and the mold, and the cooling conditions that prevail in the mold. Postshrinkage depends essentially on the storage temperature and time and is generally less than 0.1 %.

Further literature

Information on processing can also be found in the following technical publications:

"Processing Data for the Injection Molder",
"The Injection Molding of High-Quality Molded Parts".

Finishing

- Forming: hot-forming processes, such as thermoforming, bending, stamping.
- Machining: sawing, drilling, milling, turning, planing, filing, punching. The use of carbide-tipped tools is recommended.
- Joining: screw connections, gluing, welding.
- Post-treatment: painting, printing, foam-coating, metallizing, laser marking.

Recycling

After use, single-sort molded parts in Bayblend® FR3000 which do not contain any pollutants can be mechanically recycled. Molded parts which are not pollutant-free can be chemically recycled or incinerated with energy recovery.

Products should be labeled in accordance with DIN EN ISO 11469. For parts in Bayblend® FR3000 the labeling is:

>PC+ABS FR (40)<

Further details on this can be found in our Technical Information PCS-1164.

Further literature

Brochure: "Bayblend® - the Polycarbonate Blend" containing details of the range of grades – reference data – properties – processing.

Special notes

The information given in Safety Data Sheet No. 112000009624 must be observed.
The safety data sheet is available to registered customers on the internet at
http://www.bayerone.bayer.com
or can be sent out by request.
It contains details of labeling, handling and storage, as well as information on composition, product safety and toxicological/ecological profiles.

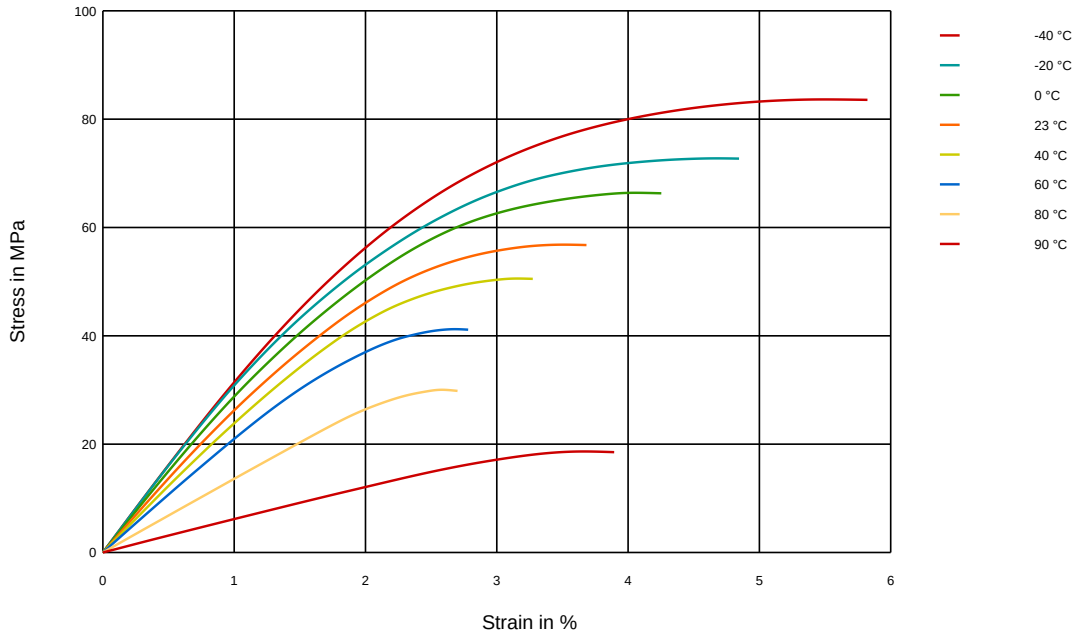

Fig. 1: Isothermal stress-strain curves from the short-time tensile test to ISO 527-1, -2 of Bayblend® FR3000.

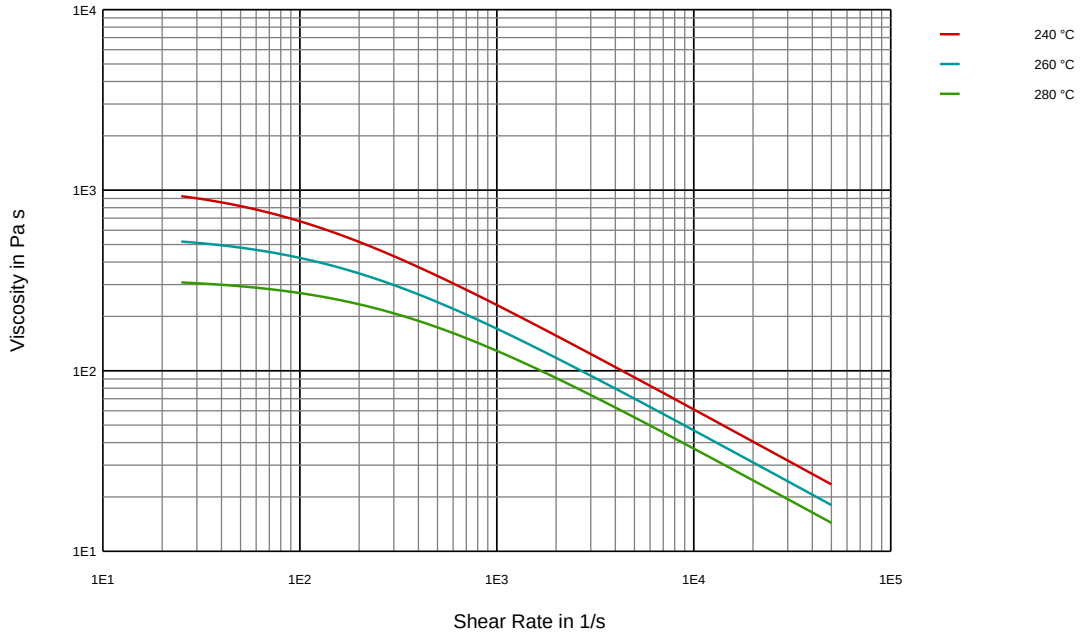

Fig. 2: Melt viscosity as a function of shear rate based on ISO 11443-A of Bayblend® FR3000.

Typical Values

	Property	Test Condition	Unit	Standard	Bayblend® FR3000
Rheological properties					
C	Melt volume-flow rate	240 °C; 5 kg	cm³/10 min	ISO 1133	24
	Molding shrinkage, parallel	150x105x3; 240 °C / MT 80 °C	%	b.o. ISO 2577	0.5 - 0.7
	Molding shrinkage, normal	150x105x3; 240 °C / MT 80 °C	%	b.o. ISO 2577	0.5 - 0.7
	Melt viscosity	1000 s^-1^; 260 °C	Pa·s	b.o. ISO 11443-A	160
Mechanical properties (23 °C/50 % r. h.)					
C	Tensile modulus	1 mm/min	MPa	ISO 527-1,-2	2700
C	Yield stress	50 mm/min	MPa	ISO 527-1,-2	60
C	Yield strain	50 mm/min	%	ISO 527-1,-2	3.5
	Stress at break	50 mm/min	MPa	ISO 527-1,-2	45
	Strain at break	50 mm/min	%	b.o. ISO 527-1,-2	> 40
	Izod impact strength	23 °C	kJ/m²	ISO 180-U	N
	Izod notched impact strength	23 °C	kJ/m²	ISO 180-A	35
	Izod notched impact strength	-30 °C	kJ/m²	ISO 180-A	10
Thermal properties					
C	Temperature of deflection under load	1.80 MPa	°C	ISO 75-1,-2	82
C	Temperature of deflection under load	0.45 MPa	°C	ISO 75-1,-2	92
C	Vicat softening temperature	50 N; 50 °C/h	°C	ISO 306	95
	Vicat softening temperature	50 N; 120 °C/h	°C	ISO 306	97
C	Coefficient of linear thermal expansion, parallel	23 to 55 °C	10^{-4}/K	ISO 11359-1,-2	0.76
C	Coefficient of linear thermal expansion, transverse	23 to 55 °C	10^{-4}/K	ISO 11359-1,-2	0.8
C	Burning behavior UL 94 (1.5 mm)	1.5 mm	Class	UL 94	V-0
C	Burning behavior UL 94-5V	2.0 mm	Class	UL 94	5VB
	Burning behavior UL 94-5V	3.0 mm	Class	UL 94	5VA
Electrical properties (23 °C/50 % r. h.)					
C	Relative permittivity	100 Hz	-	IEC 60250	3.2
C	Relative permittivity	1 MHz	-	IEC 60250	3.1
C	Dissipation factor	100 Hz	10^{-4}	IEC 60250	50
C	Dissipation factor	1 MHz	10^{-4}	IEC 60250	60
C	Volume resistivity		Ohm·m	IEC 60093	1E14
C	Surface resistivity		Ohm	IEC 60093	1E16
C	Electrical strength	1 mm	kV/mm	IEC 60243-1	35
C	Comparative tracking index CTI	Solution A	Rating	IEC 60112	350
Other properties (23 °C)					
C	Water absorption (saturation value)	Water at 23 °C	%	ISO 62	0.5
C	Water absorption (equilibrium value)	23 °C; 50 % r. h.	%	ISO 62	0.2
C	Density		kg/m³	ISO 1183-1	1180
Processing conditions for test specimens					
C	Injection molding-Melt temperature		°C	ISO 294	240
C	Injection molding-Mold temperature		°C	ISO 294	80
C	Injection molding-Injection velocity		mm/s	ISO 294	240

C These property characteristics are taken from the CAMPUS plastics data bank and are based on the international catalogue of basic data for plastics according to ISO 10350.

Impact properties: N = non-break, P = partial break, C = complete break

colored fields = UL recognition

Remark melt viscosity: true viscosity determined using the method of representative viscosity.

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