



Bayblend[®] FR3010

- (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

Bayblend[®] FR3010

Injection molding grade; high toughness; increased heat resistance; Vicat/B 120 = 110 °C; UL recognition 94 V-0 at 1.5 mm; meets the requirements for the glow wire tests to IEC 60335-1 (household appliances standard); improved chemical resistance and stress cracking behavior; successor to FR2010.

Characterization

Bayblend[®] FR3010 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[®] FR3010 is free from antimony, chlorine and bromine.

Bayblend[®] FR3010 is the successor product to FR2010. The use of a new flame retardant additive means that there is virtually no danger of condensable components being outgassed during processing. In addition to this, a further improvement has been achieved in the chemical and hydrolysis resistance of the product.

Delivery form

Bayblend[®] FR3010 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 certified 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[®] FR3010 are in the electrical/electronics industry and the information technology and communications sector. Typical applications include housings for desktop computers, printers, monitors, gas water heaters, metering applications, including electricity meters, and white goods.

Properties (see also table)

The property profile of Bayblend[®] FR3010 combines high toughness and heat resistance with good flame retardancy and chemical resistance.

Bayblend[®] FR3010 is also a product of choice from the ecological angle. In addition to complying with the WEEE and RoHS EU Directives, Bayblend[®] FR3010 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[®] FR3010 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® FR3010 has a Vicat softening temperature (VST/B 120) of around 110 °C.

This means it considerably exceeds the heat resistance of at least 75 °C in the ball pressure test (IEC 60335-1). FR3010 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 100 °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 $0.8 \times 10^{-4}/K$.

Burning behaviour

Bayblend® FR3010 attains a UL 94 V-0 recognition in a wall thickness of 1.5 mm (all colors) and a V-1 recognition in a wall thickness of 1.2 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 850 °C at a thickness of 1 mm and above, and a GWFI of 960 °C at a thickness of 1 mm and above, as recorded in the glow wire test to IEC 60695-2.

Bayblend® FR3010 (European production) has been tested and certified by VDE according to DIN EN 60695-2-12 (VDE 0471 Part 2-12):2001-11; EN 60695-2-12:2001 and DIN EN 60695-2-13 (VDE 0471 Part 2-13):2001-11; EN 60695-2-13:2001.

Rheological properties

The good flow behavior of FR3010 makes it possible to fill even large-area and thin-walled injection mol-

dings 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. The resistance to chemicals is conditioned inter alia by the temperature, loading duration and the internal and external stress status of the molded part.

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 $\Delta E = 1.5 \text{ max}$.

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 95 °C is recommended for FR3010. Drying is best performed in dry-air dryers. The drying duration will be 3 to 4 hours in this case.

Melt temperature¹⁾

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 70 to 90 °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

Molding shrinkage is in the range from 0.5 to 0.7 % for Bayblend[®] FR3010. In addition to the geometry of the part, shrinkage is primarily dependent on the level and duration of holding pressure, as well as on the temperature of the melt and the mold and on 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[®] FR3010 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[®] FR3010 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. 112000009705 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.



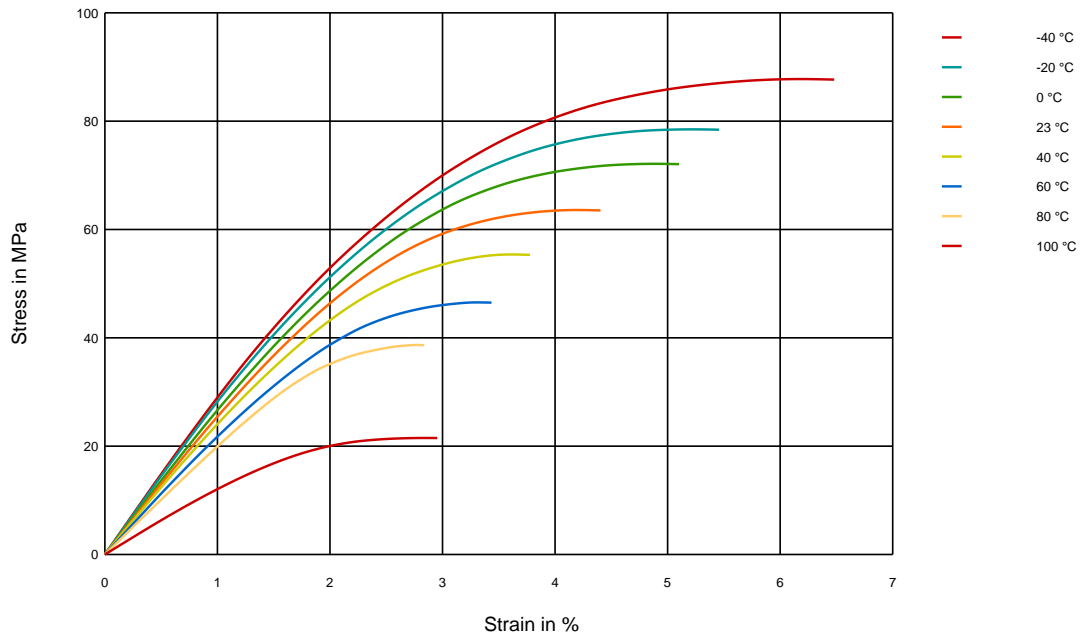


Fig. 1: Isothermal stress-strain curve from the short-time tensile test to ISO 527-1,-2 of Bayblend® FR3010.

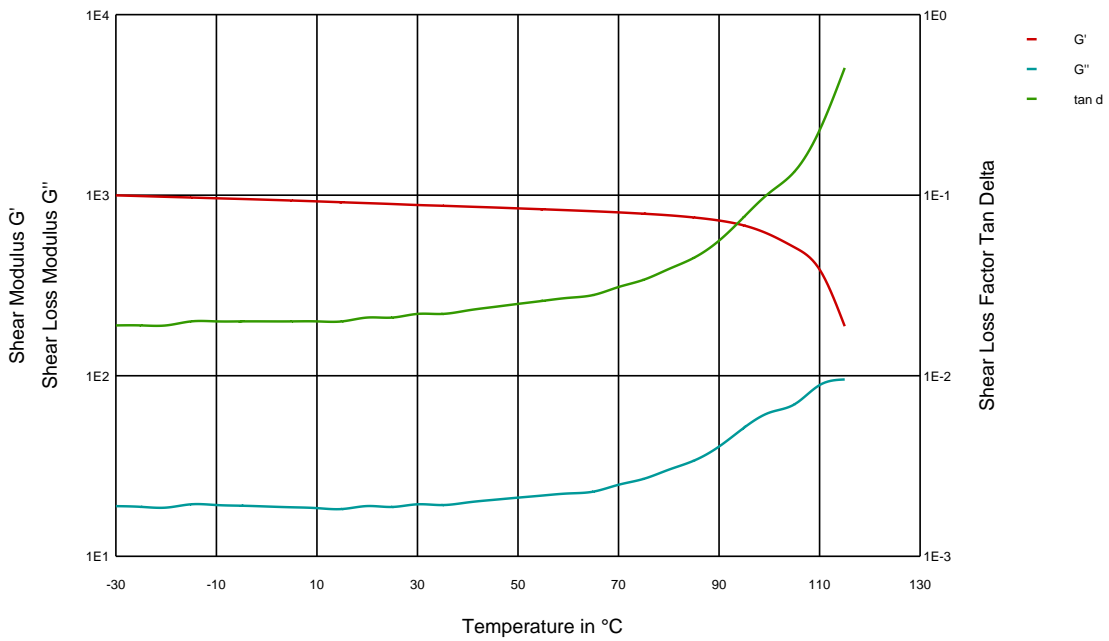


Fig. 2: Shear modulus as a function of temperature to ISO 6721-7 of Bayblend® FR3010.

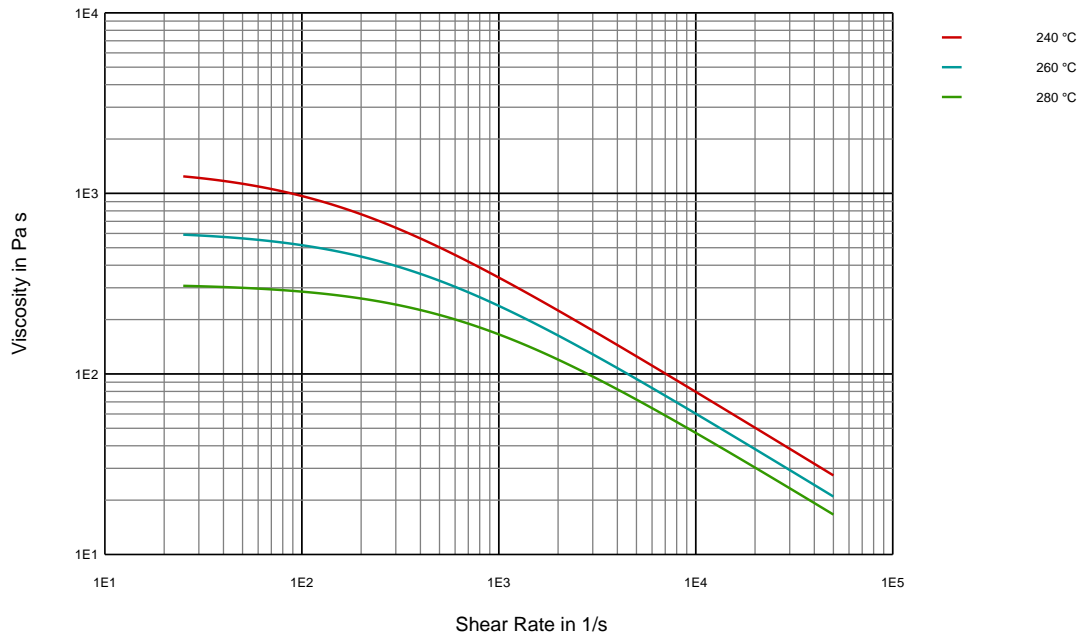


Fig. 3: Melt viscosity as a function of shear rate b. o. ISO 11443-A of Bayblend[®] FR3010.



Typical Values

| Property | Test Condition | Unit | Standard | Bayblend® FR3010 |
|---|-------------------------------|-------------------------|-------------------|---------------------|
| Rheological properties | | | | |
| C Melt volume-flow rate | 240 °C; 5 kg | cm ³ /10 min | ISO 1133 | 15 |
| 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 | 245 |
| 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 | 4.0 |
| Stress at break | 50 mm/min | MPa | ISO 527-1,-2 | 50 |
| Strain at break | 50 mm/min | % | b.o. ISO 527-1,-2 | > 50 |
| Izod impact strength | 23 °C | kJ/m ² | ISO 180-U | N |
| Izod notched impact strength | 23 °C | kJ/m ² | ISO 180-A | 35 |
| Izod notched impact strength | -30 °C | kJ/m ² | ISO 180-A | 10 |
| Thermal properties | | | | |
| C Temperature of deflection under load | 1.80 MPa | °C | ISO 75-1,-2 | 90 |
| C Temperature of deflection under load | 0.45 MPa | °C | ISO 75-1,-2 | 100 |
| C Vicat softening temperature | 50 N; 50 °C/h | °C | ISO 306 | 108 |
| Vicat softening temperature | 50 N; 120 °C/h | °C | ISO 306 | 110 |
| 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 | 70 |
| 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/m ³ | 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.

This information and our technical advice - whether verbal, in writing or by way of trials - are given in good faith but without warranty, and this also applies where proprietary rights of third parties are involved. Our advice does not release you from the obligation to check its validity and to test our products as to their suitability for the intended processes and uses. The application, use and processing of our products and the products manufactured by you on the basis of our technical advice are beyond our control and, therefore, entirely your own responsibility. Our products are sold in accordance with the current version of our General Conditions of Sale and Delivery.

Unless specified to the contrary, the values given have been established on standardized test specimens at room temperature. The figures should be regarded as guide values only and not as binding minimum values. Please note that, under certain conditions, the properties can be affected to a considerable extent by the design of the mold/die, the processing conditions and coloring.

Under the recommended processing conditions small quantities of decomposition product may be given off during processing. To preclude any risk to the health and well-being of the machine operatives, tolerance limits for the work environment must be ensured by the provision of efficient exhaust ventilation and fresh air at the workplace in accordance with the Safety Data Sheet. In order to prevent the partial decomposition of the polymer and the generation of volatile decomposition products, the prescribed processing temperatures should not be substantially exceeded.

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