

# Bayblend® FR 3000

- **(PC+ABS) blend**
- **Non-reinforced**
- **Flame-retardant, free from antimony, bromine and chlorine**
- **Injection molding grade for housing components in the data processing and electrical/electronic sectors**

## Product description

Bayblend® FR 3000 is a non-reinforced, flame-retardant, amorphous, thermoplastic polymer blend on the basis of polycarbonate (PC) and acrylonitrile butadiene styrene copolymer (ABS). The flame retardant is based on state-of-the-art phosphate/PTFE technology and contains no antimony, bromine or chlorine.

Bayblend® FR 3000 is the successor product to FR 2000. 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® FR 3000 is supplied as oval-shaped or cylindrical granules, packed in 25-kg polyethylene sacks, in large cartons with a PE inliner or in a silo truck. The products are available in their natural color and in a large number of opaque color shades.

The production plants for Bayblend® in Europe and those in Asia have been certified to DIN EN ISO 9001:2000 by the DQS (German Association for the Certification of Quality Systems, Berlin).

## Applications

The main fields of application for FR 3000 are the data processing and electrical/electronic sectors. Typical applications include housings/panels for computers, notebooks, monitors, printers, copiers, fax machines, electricity meter boxes and distribution box housings.

## Properties

Bayblend® FR 3000 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® FR 3000 is also a top-quality product from the ecological angle. It fulfils the current requirements of a large number of environmental labels, such as the Blauer Engel (Blue Angel), TCO'03 and Nordic Swan.

## Mechanical properties

FR 3000 has a high impact and notched impact strength over a broad temperature range. This ensures that housing parts made of this material can withstand high levels of external mechanical stressing without suffering any damage. The relatively high stiffness of FR 3000 (its modulus of elasticity in tension is 2700 MPa) means that applications can be implemented by the thin-wall technique and still offer the necessary stiffness.

## Thermal properties

Bayblend® FR 3000 considerably exceeds the required heat resistance of at least 75 °C in the ball pressure test (IEC 60335-1). This means that FR 3000 is particularly suitable as a housing material, which has to guarantee protection against contact with live parts.

The Vicat softening temperature (VST/B 120) of FR 3000 is approximately 97 °C on average.

With a low level of mechanical loading acting on components, no essential dimensional changes are to be expected with the short-term action of temperatures up to 87 °C. The maximum continuous service temperature is conditioned by the molded

part geometry, the nature of the loading and the specified requirements.

The melting range commences at around 200 °C. The products suffer material damage as of about 300 °C.

The coefficient of linear thermal expansion shows only a low direction-dependence and is in the region of  $0.8 \times 10^{-4}/K$ .

A glow wire temperature of 960 °C is achieved in accordance with IEC 60695-2-12 (GWFI) with a wall thickness of 2.0 mm.

FR 3000 has a UL 94V-0 classification 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).

### Rheological properties

The good flow behavior of FR 3000 makes it possible to fill even large-area and thin-walled injection moldings with just a few gates.

Viscosity curves and the flow length/wall thickness diagram are presented in the Annex.

### Chemical resistance

At room temperature, parts made of Bayblend® are resistant to mineral acids, a large number of organic acids and aqueous saline solutions. Parts in Bayblend® are generally not resistant to bases, aromatics, ketones, esters, chlorinated hydrocarbons and a series 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.

### Exposure to light/weathering

As with most thermoplastics, exposure to light/weathering leads to color changes and to a reduction in mechanical properties. This property reduction is, however, of an order of magnitude that will allow the products to meet the release requirements for housing materials in the data processing sector, for example.

The products reliably fulfill the lighting standard for indoor applications to ASTM D 4459 (the so-called IBM test), which is recognized worldwide in accordance with OEM requirements, with an admissible 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

FR 3000 is generally processed by injection molding. All modern injection molding machines are suitable.

#### Pre-treatment/drying

Bayblend® must be dried prior to processing. No more than preferably 0.02 % (max. 0.05 %) 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 FR 3000. Drying is best performed in dry-air dryers. The drying duration will be 3 to 4 hours in this case. Excessively long drying and temperatures above 85 °C should be avoided, since color changes or material damage may otherwise occur.

#### Processing temperature

The optimum processing temperature should be established as a function of the molded part and should be within a range of 220 to 270 °C. 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.

#### Mold heating/cooling

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 in a range of 0.05 to 0.2 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.

## Fabrication

- Forming:  
Thermoforming, such as deep-drawing, bending, embossing.
- Machining:  
Sawing, drilling, milling, turning, planing, filing, punching.
- Joining:  
Screwed connections, gluing, welding.
- Finishing:  
Painting, printing, foam coating, metallization, laser marking.

## Recycling

Single-sort moldings in Bayblend® FR 3000 which do not contain any harmful substances can be mechanically recycled after use. Molded parts containing harmful substances can be chemically or thermally recycled.

Parts should be marked in accordance with DIN ISO 11469. The identification mark for parts made of Bayblend® FR 3000 is as follows:



**>PC+ABS-FR<**

Further details may be found in our Technical Information brochure KU21164.

## Further reading

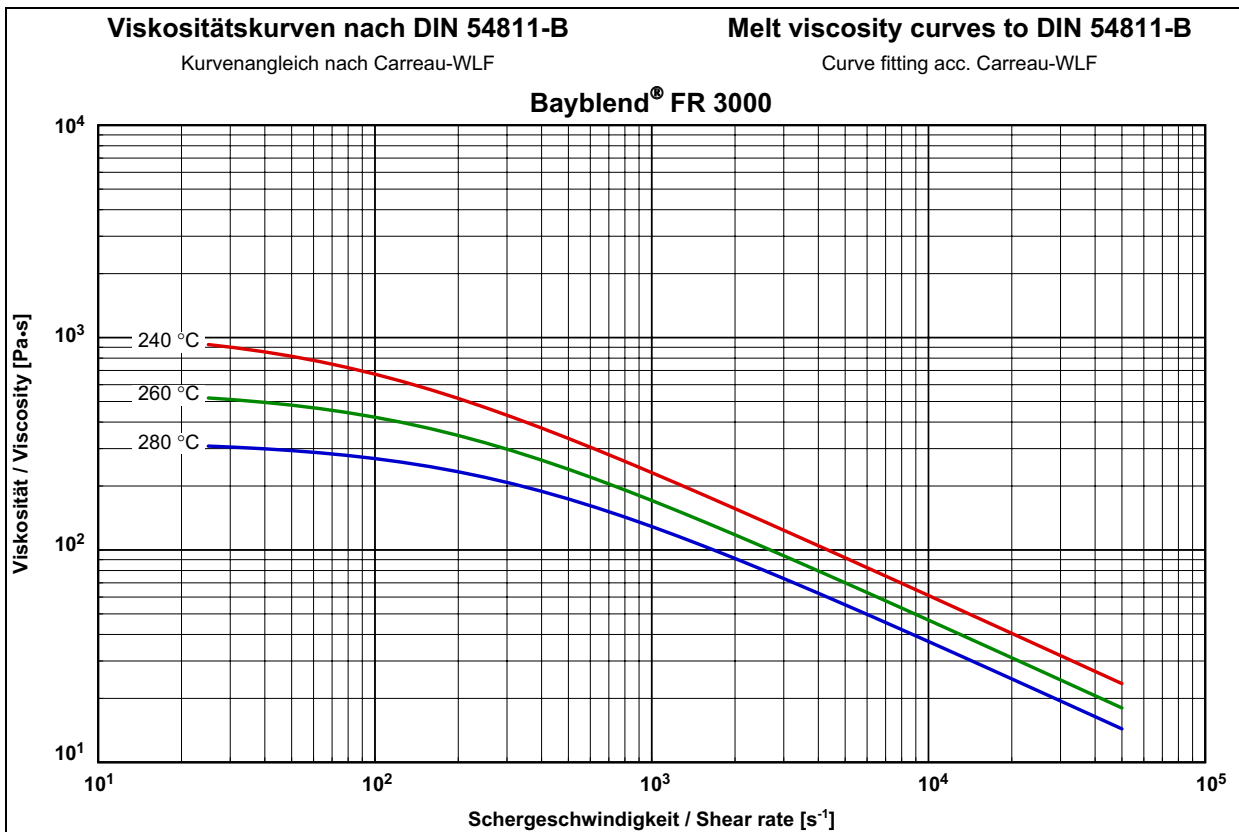
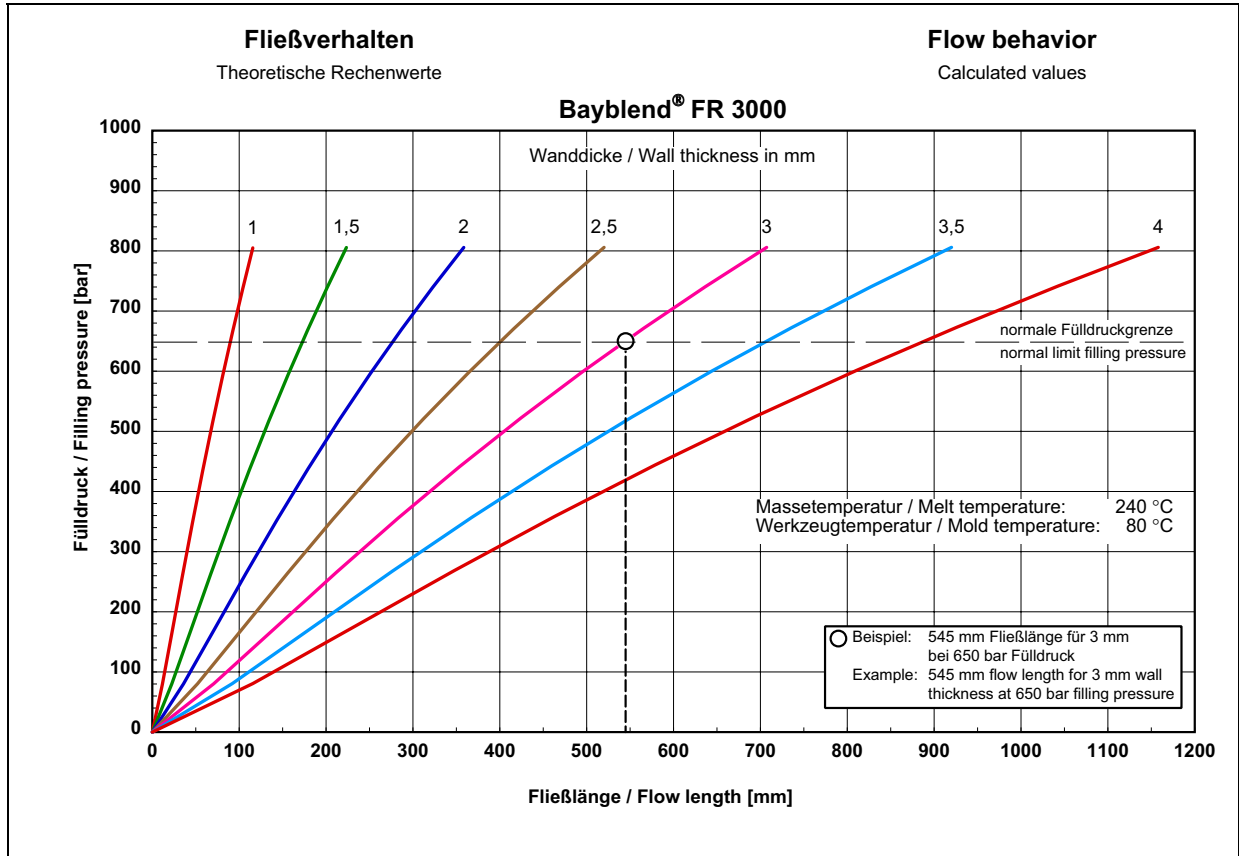
Brochure: "Bayblend® - Properties and Processing", Order No.: KU13002 e.

Brochure: "Bayblend® - Applications in data systems", Order No.: KU13003 e.

Brochure: "Bayblend® - Applications in the automotive industry", Order No.: KU13005 e.

## Special advice

The information provided in Safety Data Sheet No. 903381 should be observed. The Safety Data Sheet will be supplied on request.



## Typical Values

| Typical Properties | Test Conditions | Units | Standards | Bayblend®<br>FR 3000 |
|--------------------|-----------------|-------|-----------|----------------------|
|--------------------|-----------------|-------|-----------|----------------------|

### Rheological properties

|                                |  |                           |               |           |
|--------------------------------|--|---------------------------|---------------|-----------|
| Spiral flow length             | 260 °C; 2 x 8.7 mm                       | mm                        | Bayer test    | 440       |
| <b>C</b> Melt volume-flow rate | 240 °C; 5 kg                             | cm <sup>3</sup> /(10 min) | ISO 1133      | 20        |
| Molding shrinkage, parallel    | 150x105x3; 240 °C / MT 80 °C;<br>500 bar | %                         | acc. ISO 2577 | 0.5 - 0.7 |
| Molding shrinkage, normal      | 150x105x3; 240 °C / MT 80 °C;<br>500 bar | %                         | acc. ISO 2577 | 0.5 - 0.7 |

### Mechanical properties (23 °C/50 % r. h.)

|                              |           |                   |                   |      |
|------------------------------|-----------|-------------------|-------------------|------|
| <b>C</b> Tensile modulus     | 1 mm/min  | MPa               | ISO 527-1,-2      | 2700 |
| <b>C</b> Yield stress        | 50 mm/min | MPa               | ISO 527-1,-2      | 60   |
| <b>C</b> 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 | %                 | acc. ISO 527-1,-2 | > 40 |
| Izod impact strength         | 23 °C     | kJ/m <sup>2</sup> | ISO 180-1U        | N    |
| Izod notched impact strength | 23 °C     | kJ/m <sup>2</sup> | ISO 180-1A        | 35   |
| Izod notched impact strength | -30 °C    | kJ/m <sup>2</sup> | ISO 180-1A        | 10   |

### Thermal properties

|  |                |                     |                |      |
|--|----------------|---------------------|----------------|------|
| <b>C</b> Temperature of deflection under load                | 1.80 MPa       | °C                  | ISO 75-1,-2    | 82   |
| <b>C</b> Temperature of deflection under load                | 0.45 MPa       | °C                  | ISO 75-1,-2    | 92   |
| <b>C</b> Vicat softening temperature                         | 50 N; 50 °C/h  | °C                  | ISO 306        | 95   |
| Vicat softening temperature                                  | 50 N; 120 °C/h | °C                  | ISO 306        | 97   |
| <b>C</b> Coefficient of linear thermal expansion, parallel   | 23 to 55 °C    | 10 <sup>-4</sup> /K | ISO 11359-1,-2 | 0.76 |
| <b>C</b> Coefficient of linear thermal expansion, transverse | 23 to 55 °C    | 10 <sup>-4</sup> /K | ISO 11359-1,-2 | 0.8  |
| <b>C</b> Burning behavior UL 94 (1.6 mm)                     | 1.5 mm         | Class               | UL 94          | V-0  |
| <b>C</b> 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.)

|   |            |                  |             |      |
|---|------------|------------------|-------------|------|
| <b>C</b> Relative permittivity          | 100 Hz     | -                | IEC 60250   | 3.2  |
| <b>C</b> Relative permittivity          | 1 MHz      | -                | IEC 60250   | 3.1  |
| <b>C</b> Dissipation factor             | 100 Hz     | 10 <sup>-4</sup> | IEC 60250   | 50   |
| <b>C</b> Dissipation factor             | 1 MHz      | 10 <sup>-4</sup> | IEC 60250   | 60   |
| <b>C</b> Volume resistivity             |            | Ohm·m            | IEC 60093   | 1E14 |
| <b>C</b> Surface resistivity            |            | Ohm              | IEC 60093   | 1E16 |
| <b>C</b> Electric strength              | 1 mm       | kV/mm            | IEC 60243-1 | 35   |
| <b>C</b> Comparative tracking index CTI | Solution A | Rating           | IEC 60112   | 300  |

### Other properties (23 °C)

|   |                   |                   |          |      |
|---|-------------------|-------------------|----------|------|
| <b>C</b> Water absorption (saturation value)  | Water at 23 °C    | %                 | ISO 62   | 0.5  |
| <b>C</b> Water absorption (equilibrium value) | 23 °C; 50 % r. h. | %                 | ISO 62   | 0.2  |
| <b>C</b> Density                              | -                 | kg/m <sup>3</sup> | ISO 1183 | 1180 |

### Processing conditions for test specimens

|   |   |      |         |     |
|---|---|------|---------|-----|
| <b>C</b> Injection molding-Melt temperature   | - | °C   | ISO 294 | 240 |
| <b>C</b> Injection molding-Mold temperature   | - | °C   | ISO 294 | 80  |
| <b>C</b> 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 (Plastics Acquisition and Presentation of Comparable Single-Point Data, 1993).

N = non-break



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Unless specified to the contrary, the values given have been established on standardised test specimens at room temperature. The figures should be regarded as guide values only and not as binding minimum values. Kindly 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 the coloring.

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