

TECHNICAL DATA SHEET

Grivory GCL-3H anthracite

General product description

Grivory GCL-3H anthracite is based on a combination of a heat stabilised semi-crystalline Polyamide with a partially aromatic Polyamide. The product is reinforced by 30% long carbon fibres.

Grivory GCL-3H anthracite is characterised by the following key-properties:

- very high stiffness and strength even after conditioning and over a wide temperature range
- excellent notched impact resistance also at low temperatures
- low creep
- high heat distortion temperatures
- low moisture absorption
- very good dimensional stability and little warpage
- very little coefficient of thermal expansion
- very low density

The product has been designed for injection moulding of technical parts especially in the area of light weight metal and composite replacement.

Grivory GCL-3H anthracite is used in the following market segments:

- sports & leisure
- automotive
- mechanical engineering

The carbon fibres are aligned in parallel and are just as long as the pellets (usually 10 mm).



PROPERTIES

Mechanical Properties

| | | Standard | Unit | State | Grivory GCL-3H anthracite |
|---------------------------|---------------|-------------|-------------------|-----------|---------------------------|
| Tensile E-Modulus | 1 mm/min | ISO 527 | MPa | dry cond. | 22.500 21.500 |
| Tensile strength at break | 5 mm/min | ISO 527 | MPa | dry cond. | 315 270 |
| Elongation at break | 5 mm/min | ISO 527 | % | dry cond. | 1.6 1.7 |
| Impact strength | Charpy, 23°C | ISO 179/1eU | kJ/m ² | dry cond. | 55 65 |
| Impact strength | Charpy, -30°C | ISO 179/1eU | kJ/m ² | dry cond. | 55 65 |
| Notched impact strength | Charpy, 23°C | ISO 179/1eA | kJ/m ² | dry cond. | 16 16 |
| Notched impact strength | Charpy, -30°C | ISO 179/1eA | kJ/m ² | dry cond. | 20 20 |
| Ball indentation hardness | | ISO 2039-1 | MPa | dry cond. | 320 285 |

Thermal Properties

| | | | | | |
|---------------------------------------|------------|-----------|---------------------|-----|----------|
| Melting point | DSC | ISO 11357 | °C | dry | 260 |
| Heat deflection temperature HDT/A | 1.80 MPa | ISO 75 | °C | dry | 255 |
| Heat deflection temperature HDT/C | 8.00 MPa | ISO 75 | °C | dry | 240 |
| Thermal expansion coefficient long. | 23 - 55°C | ISO 11359 | 10 ⁻⁴ /K | dry | 0.10 |
| Thermal expansion coefficient trans.. | 23 - 55°C | ISO 11359 | 10 ⁻⁴ /K | dry | 0.25 |
| Maximum usage temperature | long term | ISO 2578 | °C | dry | 100 -120 |
| Maximum usage temperature | short term | ISO 2578 | °C | dry | 220 |

Electrical Properties

| | | | | | |
|------------------------------|--|-----------|-----|-----------|----------|
| Specific volume resistivity | | IEC 60093 | Ω m | dry cond. | 30 30 |
| Specific surface resistivity | | IEC 60093 | Ω | cond. | 50 |

General Properties

| | | | | | |
|------------------------|---------------|----------|-------------------|-----|------|
| Density | | ISO 1183 | g/cm ³ | dry | 1.28 |
| Flammability (UL 94) | 0.8 mm | ISO 1210 | grade | | HB |
| Water absorption | 23°C/sat. | ISO 62 | % | | 4,7 |
| Moisture absorption | 23°C/50% r.h. | ISO 62 | % | | 1.5 |
| Linear mould shrinkage | long. | ISO 294 | % | dry | 0.00 |
| Linear mould shrinkage | trans. | ISO 294 | % | dry | 0.10 |

Processing information for the injection moulding of Grivory GCL-3H anthracite

In order to get the best properties out of Grivory GCL-3H anthracite, fibre damage should be avoided as much as possible.

The most important parameters for fibre length preservation are:

- screw speed and back-pressure
- injection speed
- runner and gate geometry

The following processing recommendations will give you some useful hints. For any further questions, please contact our application development experts.

MATERIAL PREPARATION

Storage

Sealed, undamaged bags can be kept over a long period of time in storage facilities which are dry, protected from the influence of weather and where the bags can be protected from damage.

Handling and safety

Detailed information can be obtained from the "Material Safety Data Sheet" (MSDS) which can be requested with every material order.

Handling with a vacuum pneumatic conveying system in general is possible, low transportation speeds are recommended.

Drying

During its manufacturing process Grivory GCL-3H anthracite is packed with a moisture content of ≤ 0.10 %. Should the packaging be damaged or the material is left open too long, the material must be dried. A too high moisture content can show by a foaming melt and silver streaks on the moulded part.

Drying recommendations:

Desiccant dryer

| | |
|-------------------------|--------------|
| Temperature: | max. 80°C |
| Time: | 4 - 12 hours |
| Dew point of the dryer: | -25°C |

Vacuum oven

| | |
|--------------|--------------|
| Temperature: | max. 100°C |
| Time: | 4 - 12 hours |

Drying time

The moisture content for processing Grivory GCL-3H anthracite must be lower than 0,1% .

In case of long residual times in the machine hopper (more than 1 hour), a hopper heating or hopper dryer is useful.

MACHINE REQUIREMENTS

Grivory GCL-3H anthracite can be processed on standard injection moulding machines. However, excessive fibre damage has to be avoided to preserve the characteristics of long fibre reinforced materials.

Screw

| | |
|-----------------------------|-------------|
| Standard polyamide screw | |
| Diameter: | > 30 mm |
| Length: | 18 D - 22 D |
| Feed zone length: | 60 % |
| Compression ratio: | 2 - 2.5 |
| Flight depth metering zone: | > 2 mm |

Processing the material on smaller screws is possible, however a higher fibre damage may occur.

Shot volume

The metering stroke (without decompression stroke) must be longer than the length of the back flow valve.

Selecting the barrel size

$$\text{Shot volume} = 0.5 - 0.8 \times (\text{max. shot volume})$$

Heating

At least three separately controllable heating zones are required for cylinder temperatures up to 350°C. A separate nozzle heating is necessary. The feed opening temperature must be controllable (cooling).

Nozzle

Shut off nozzle may damage the fibres, it is recommended to use open nozzles with an appropriate diameter.

Clamping Force

As a rule of thumb, the clamping force can be estimated using the following formula:

Clamping Force

$$7.5 \text{ kN}^{1)} \times \text{projected area [cm}^2\text{]}$$

1) average cavity pressure of 750 bar

TOOLING

To avoid fibre damage in the tool, large flow cross-sections are recommended. Furthermore, sharp edges and corners should be avoided. The tool steel should be wear and corrosion protected as for any other reinforced polyamide. In areas of high flow speeds (tunnel gate, hot runner) we recommend additional care for wear protection. Special precautions due to the long fibres are not necessary.

Gate and runner

To avoid damage of the fibres it is strictly recommended to use sufficient gate diameters. Sharp edges and corners should be avoided in the runner.

The gating itself should not be located in areas of high stresses, as the fibres will show a random orientation around the injection gate.

Gate diameter

0.8 x thickest wall section of the injection moulding part

Runner diameter

1.4 x thickest wall section of the injection moulding part (min. 4 mm)

Hot runner systems are well suited for processing of Grivory GCL-3H as long as they do not have sharp corners or very small diameters. Open nozzles are preferred.

Venting

In order to prevent burn marks and to improve weld line strength, adequate venting of the mould cavity should be provided (venting channels on the parting surface dimensions: Depth 0.02 mm, width 2 - 5 mm).

PROCESSING

Basic machine settings

For the processing Grivory GCL-3H anthracite, following machine settings are recommended:

Temperatures

| | |
|--------|-------------|
| Feed | 80°C |
| Zone 1 | 280°C |
| Zone 2 | 290°C |
| Zone 3 | 300°C |
| Nozzle | 290°C |
| Tool | 80 - 120°C |
| Melt | 280 - 300°C |

Pressures / Speeds

| | |
|--------------------------|---------------|
| Injection speed | low to medium |
| Hold-on pressure (spec.) | 300 - 800 bar |
| Dynamic pressure (spec.) | 20-60 bar |
| Screw speed | 4 - 10 m/min |

Experience has shown, that especially the injection speed has a strong influence on the final part properties. In many cases, slow injection speeds showed better results.

In order to reduce fibre damage, the material should be plasticised as gentle as possible. The available cooling time should fully be used as dosing time.

CUSTOMER SERVICES

EMS-GRIVORY is a specialist for polyamide synthesis and polyamide-processing. Our customer services are not only concerned with the manufacturing and supply of engineering thermoplastics but also provide a full of technical support program:

- Computer simulations
- Prototype tooling
- Material selection
- Processing support
- Specific part tests
- Mould and component design

We are happy to support you. Simply call one of our sales offices.

The recommendations and data given are based on our experience to date, however, no liability can be assumed in connection with their usage and processing.

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