

**Your innovative development partner for cost and weight savings in automotive construction**

**EMS**  
EMS-GRIVORY

## ■ Long-fiber reinforced polyamides

Materials with spine



**GRIVORY®**  
EMS

**Grilamid®**  
EMS

**GRILON®**  
EMS

The LFT-polyamides from EMS-GRIVORY are long-fiber reinforced structural materials based on the tried and proven polyamides Grilamid GV and HT1, Grilamid PA12 and Grilon TS.

- A combination of high stiffness and exceptional notched impact strength
- High temperatures or moisture have little influence on the property values
- Very low creep
- Excellent permanent strength
- Little warpage

## ■ EMS Tape Technology (ETT)

### Reinforcing tapes for lightweight design

Using a special pultrusion process, EMS-GRIVORY has developed endless, fiber-reinforced tapes in which the fibers all lie precisely in the direction of the band. The fibers are just as well impregnated as the granules, which means they have a degree of efficiency at the same level as the maximum achievable fiber properties.

- Less material required due to targeted reinforcement
- Increased stiffness and strength
- Elimination of weak points (weld lines)
- Significantly higher property levels
- Weight and cost reduction



## ■ Grivory HT



### **More performance at higher temperatures**

**GRIVORY®**  
**EMS**

EMS-GRIVORY offers the widest range of polyphthalamides (PPA) available in the world and is market leader in Europe with these high-temperature polyamides.

- Stiffness and strength at high temperatures
- Very good creep resistance
- Property values are influenced very little by absorption of moisture
- High dimensional stability and low warpage
- Good resistance to chemicals and hydrolysis
- Good surface quality
- Efficient and low-cost manufacturing

## ■ Grivory GV



### **The proven material for metal replacement**

**GRIVORY®**  
**EMS**

- High stiffness and strength
- Property values remain unchanged after slight moisture absorption
- High dimensional stability and low warpage
- Good resistance to chemicals
- Good surface quality
- Efficient and low-cost manufacturing

## ■ High-performance polyamides – Our specialty



EMS-GRIVORY is part of the business area High Performance Polymers within the EMS Group. The headquarters are located at Domat/Ems in Switzerland. Further production sites can be found in Germany, China, Taiwan and the USA. Our customers benefit from a close, global cooperation between the organizations of marketing and sales, research and development, application development and production.

### **EMS-GRIVORY – The leading specialist for high-performance polyamides in automotive construction**

EMS-GRIVORY is one of the most efficient companies involved in development and manufacture of high-quality polyamides for use in the automotive industry. EMS-GRIVORY stands for products which open up new application areas with their specific property values. Our products focus on the combination of cost savings, functionality and reliability. Along with high-quality materials, our customers can also benefit from know-how from our own development center. This is the basis for development and applications promising success in the automotive industry.

### **Target achievement together with the customer**

Tailor-made solutions are our target. To achieve this, it is not enough just to supply a suitable material; it also needs to be processed in an optimal way. For this reason, we not only develop the right polymer materials, but also provide support for our customers with component development and mould design as well as with manufacture and testing of prototypes. In this way, our customers receive a complete system solution with comprehensive service and benefit from added value with regard to cost savings, weight reduction and freedom of design. We aim to provide a first class performance in our development work, advice and services.



### **Famous worldwide – Versatile in use**

Our high-performance polymers are well-known worldwide under the brand names Grivory®, Grilamid® and Grilon®. They are delivered to customers in granule form and undergo further processing using injection-moulding and extrusion methods.





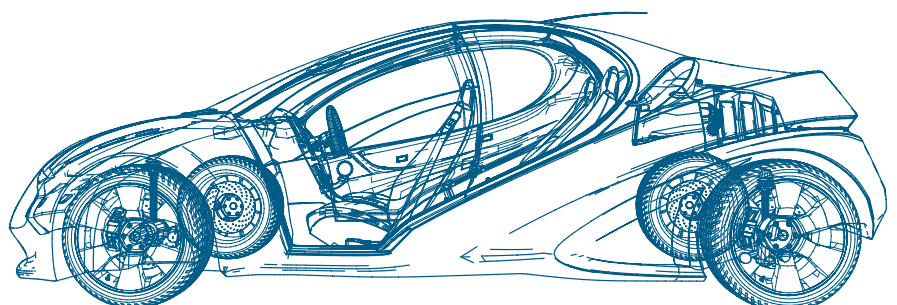
**Weight and cost reduction – our strengths in automotive construction**

For more than 40 years, EMS-GRIVORY has made a decisive contribution towards the development of highest quality modern automotive components. The requirements demanded of our design materials are extremely high. They must ensure a reduction in fuel consumption, weight savings and lower emissions as well as being easy to process and recyclable. These demands must be met – despite the need for increasing comfort and safety requirements.

In vehicle interiors, our polyamides replace conventional die-cast alloys in functional parts such as arm rests, covers or supporting components for instrument panels. Metal is also replaced in external applications such as door handles, wing mirrors or windscreen wiper systems. In addition, our polyamides are resistant to chemicals, corrosion and weathering and make efficient production of media-carrying pipe lines, such as fuel or cooling water lines, possible.

Our materials are also in particular demand for the production of components used in the engine compartment. For this kind of application we have developed particularly heat-resistant, high-performance polyamides which can be used to make turbo-charged air pipes, charged-air coolers, heat exchangers or throttle body housings. Materials from EMS-GRIVORY are also found in automotive electrical and electronic applications which must work reliably without fail under extreme climate conditions. Our polyamides are also used in chassis and power train applications requiring good resistance to engine oil and hydraulic fluid. Examples of this kind of application are clutch components, braking or steering systems.

Automotive manufacturers throughout the world have faith in the high quality materials from EMS-GRIVORY.



## ■ Weight and cost savings through metal replacement in automotive applications



Good scratch resistance and stiffness  
Suitable for laser welding  
Resistant to chemicals

**CAR KEY**  
**Grivory GV**



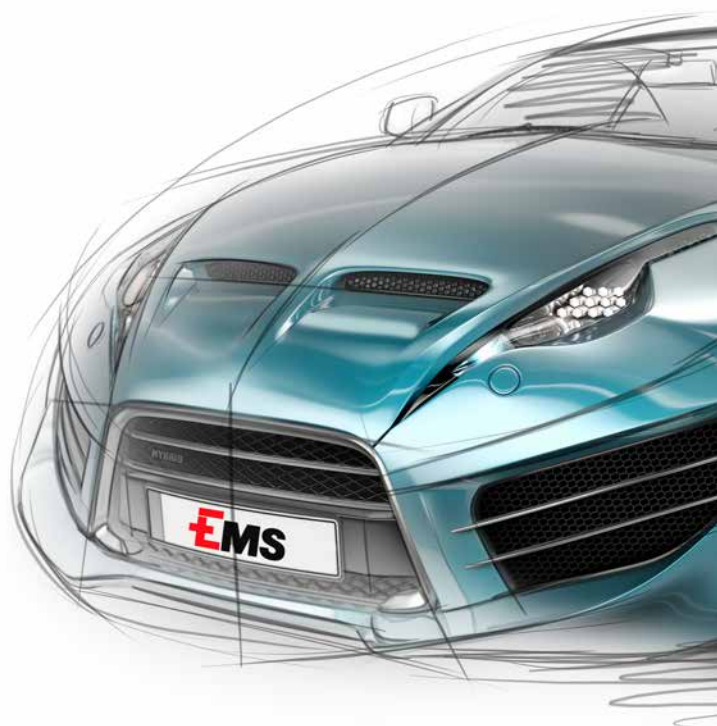
Piano black finish without painting  
Excellent scratch resistance

**AIR VENT**  
**Grilamid TR**



Resistance to chemicals  
Simple colouration  
Excellent surface quality

**STEERING COLUMN GEAR SHIFT**  
**Grivory GV**



High dimensional stability  
Excellent resistance to cooling fluid at high temperatures

**THERMOSTAT HOUSING**  
**Grivory HT**



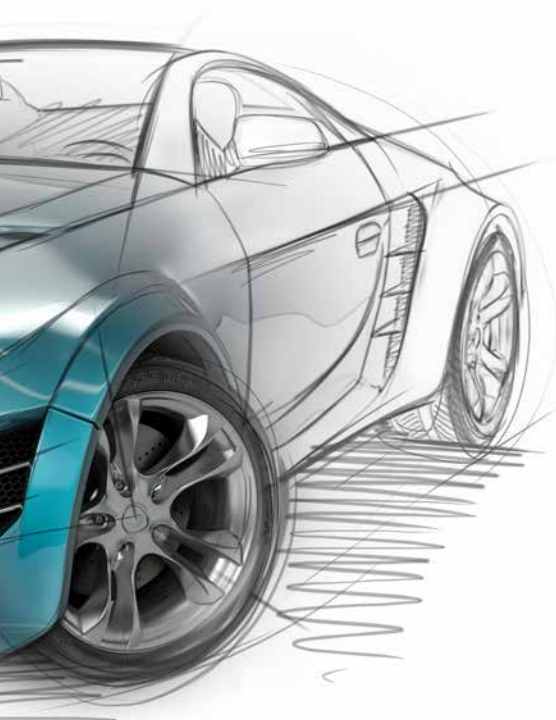
Good stiffness and strength  
High weight savings vs. metal

**INSTRUMENT PANEL SUPPORT**  
**Grivory GVL**



Low fogging  
High dimensional stability  
Low warpage

**LENS HOLDER / SUPPORT FRAME**  
**Grivory HT**



Good pressure-cycle resistance  
Permanent heat-ageing resistance at temperatures above 210 °C

**TURBOCHARGED-AIR COOLER – SIDE COMPONENT**  
**Grilon TS**



Stiffness and creep resistance at high temperatures  
Excellent resistance to chemicals (hot oil)

**GEAR SHIFT MODULE**  
**Grivory HT**



High dimensional stability  
Excellent resistance to liquid automotive media

**CLUTCH COMPONENTS**  
**Grivory HT**

## ■ Extrusion blow moulding



### 2D – Conventional blow-moulding technology

- For the manufacture of simple part geometries

### 3D – Blow-moulding technology

- For the manufacture of seamless shaped parts with more complex part geometries
- 3D shaping is carried out either by automated tube manipulation and/or suction blow moulding

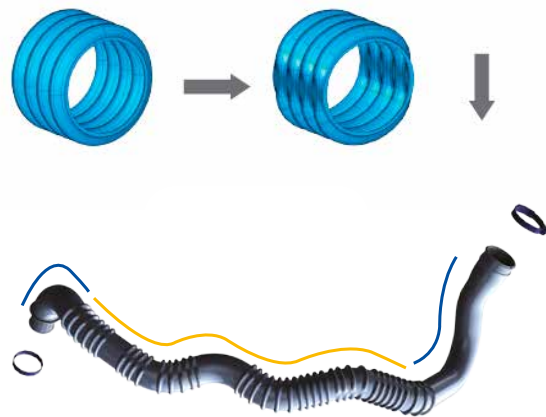
In addition, in blow-moulding processes, inserts similar to those used in injection-moulding (retainers, grommets etc.), can be used in/on the shaped part and fixed by over blowing.

### Sequential co-extrusion technology

- Allows use of two different materials to achieve different part properties (e.g. hard and soft segments)
- High part quality through simple control of the layer thickness and elimination of the pinch-off weld
- High cost-saving potential of up to 30% from a reduction in assembly steps and components

### MOAX® Design

The MOAX design, patented by EMS, provides the unique possibility of combining part properties, such as flexibility, low elongation and stiffness, according to customer requirements. In this way, considerable cost and weight savings can be achieved.



■ Soft material (Grilon ELX-50HNZ)  
■ Hard material (Grilon EB-50H)

Application	Polymer	Material	Filler	Impact strength	Melt strength
Cold side	PA6	Grilon EB 50 H	-	Good	High
		Grilon EB 50 HDZ	-	Very good	High
		Grilon BRZ-350 H	-	Excellent	High
	PA6 Elastomer	Grilon ELX 40 HNZ	-	Excellent	High
		Grilon ELX 50 HNZ	-	Excellent	High
	PA6 + GF	Grilon EBVZ-15 H	15%	Very good	High
		Grilon EBV-15 H	15%	Good	High
Grilon EBV-2H		20%	Good	Very high	
Hot side	PA6 + 66	Grilon XE 3966	-	Good	High
		Grilon XE 4242	15%	Good	High
		Grilon EBGm-20 HX	15% + Nano	Good	Very high
Crankcase vent	PA12	Grilamid L 25 ANZ	-	Excellent	Very high
		Grilamid LV-2 ANZ	20%	Good	Very high





Experienced application experts with technical know-how in the market segments automotive, electro & electronics, industry & consumer goods, optics and packagings, provide support in the development of new applications from the idea right up to serial production.

The services provided by application development include:

- Support during the concept phase and check of requirements
- Feasibility tests and economic analyses for new applications
- Recommendation of the optimal material and individual comparison tests
- Support with component and mould design
- Process optimisation and development of processing methods and subsequent processes
- Advice on component-specific tests and quality features
- Component analysis using CT technology (computer tomography)

### **Computer Assisted Technical Service (CATS)**

EMS-GRIVORY helps customers already in the concept and design phase with realistic simulations. In this way, using finite element analysis methods, the distribution of forces and component deformation can be calculated and optimised. Any weak points in the design can be identified and suitable modifications examined. If the anisotropy of fiber-reinforced plastics or other non-linear geometry and material effects play a significant role in component behaviour, these can be taken into account during the calculations.

EMS-GRIVORY also offers customers the possibility of simulating injection-moulding processes to optimise production. A rheological simulation makes it possible to evaluate the positioning of sprue and gate systems; filling problems such as weld lines or air inclusions can be recognised in preparation for mould manufacture. Through complex optimisation of material data, EMS-GRIVORY is able to make qualitative and quantitative use of shrinkage and warpage forecasts for initial mould corrections.

### **Technical Customer Service**

EMS-GRIVORY is present with local technical customer service in all main markets. This makes a very quick reaction time for customer contact possible, and ensures that rapid solutions for customer problems are achieved.

Experienced processing experts accompany component production from initial sampling right up to serial production operations.



### **Technical Processing Centre**

At its headquarters in Switzerland, EMS-GRIVORY has a comprehensive processing centre at its disposal, equipped with injection-moulding and extrusion machines.

This is supplemented by further local centres at locations in Asia and the USA.

The injection-moulding equipment covers all standard processes, but special process technology such as multi-component injection moulding, gas-assisted injection moulding or injection compression moulding is also possible. For extrusion applications, EMS-GRIVORY has at its disposal equipment for tube extrusion and injection blow moulding as well as cast and blown film extrusion.

This equipment can be made available to customers for tests, sampling, prototype manufacture and pilot production. Process engineers also work on development and application of new process methods for EMS polymers in the focus segments.

## ■ Grilamid TR

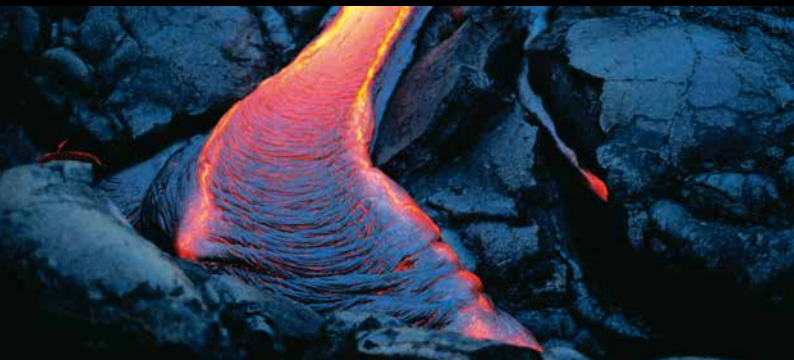


### **Transparent polyamide for the highest requirements**

**Grilamid TR<sup>®</sup>**  
**EMS**

- High transparency
- Clear, neutral inherent colour
- Excellent cyclic bending strength
- Good resistance to chemicals and stress cracking
- Low moisture absorption
- Low specific weight
- Simple processing
- High heat distortion temperature

## ■ Grilon



### **Premium Polyamide**

**GRILON<sup>®</sup>**  
**EMS**

- High strength and stiffness
- High impact strength
- High heat distortion temperature
- Good abrasion and friction properties
- Resistant to many chemicals
- Good electrical properties
- Economic processing

## ■ Grilamid L/S



### **Technical plastics for the highest demands**

**Grilamid®**  
**EMS**

- Very low moisture absorption and very good dimensional stability
- Very good resistance to chemicals and weathering
- Very good hydrolysis resistance
- Lowest density of all polyamides
- High impact strength at temperatures as low as  $-40\text{ }^{\circ}\text{C}$
- Problem-free processing, wide processing window

## ■ Product characterisation



Our material testing department has modern, comprehensively equipped testing laboratories carrying out the following tests:

- Mechanical and thermal tests
- Flammability tests
- Electrical tests
- Rheological tests
- Resistance to the influence of automotive media and environmental conditions
- Burst pressure, creep, cyclic bending, hot-water circulation tests
- Permeation tests
- Thermo-analyses
- Spectroscopy, chromatography and microscopy



## **EMS-GRIVORY worldwide**

[www.emsgrivory.com](http://www.emsgrivory.com)

### **EMS-GRIVORY - The leading manufacturer of high-performance polyamides**

EMS-GRIVORY is the leading manufacturer of high-performance polyamides and the supplier with the widest range of polyamide materials. Our products are well-known throughout the world under the trademarks Grilamid, Grivory and Grilon.

We offer our customers a comprehensive package of high-capacity and high-quality products along with segment-specific advisory competence in distribution and application development. We maintain our market leadership through continual product and application development in all segments.

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