News Fakuma 2006

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Double capacity for Grivory HT

The countdown is running: In January 2007, EMS-GRIVORY will start-up a further production plant for Grivory HT.

With this new plant the company will double its production capacity for the thermoplastic construction material Grivory HT. This investment will secure EMS-GRIVORY, the only manufacturer of PPA in Europe, its position as market leader and offers improved product availability for the plastics processing industry.

Grivory HT is in great demand and belongs to the group of engineering plastics currently showing strong growth. Grivory HT is characterised by a high-performance property profile and is used for the manufacture of high-quality technical injection-moulded components where stiffness and strength are required under high application temperatures. These are found in automotive under-bonnet applications where the materials are in contact with hot media such as water, oils and chemicals.

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PPA for safe direct contact with foodstuffs

Grivory HT is the only polyphthalamide in the world which has been approved by the FDA for unlimited direct contact with drinking water and all foodstuffs.

The FDA (Food and Drug Administration) has classified Grivory HT as physiologically safe and has approved this material as the first and only PPA-based material for use in direct contact with all kinds of foodstuffs. The approval is valid for all application conditions (FCN Nr.: 00380, 07). Naturally, and as primary prerequisite, Grivory HT fulfils all requirements of the EU directive 02/72 for contact with foodstuffs.

The construction material Grivory HT, the polyphthalamide (PPA) manufactured by EMS-GRIVORY, has proven its value for more than a decade as a durable material for technical injection-moulded components. Its resistance to a wide range of chemicals and its excellent thermal-mechanical property profile allow this material to be used in the sensitive application field of food preparation. This means that it is suitable for the manufacture of technical plastic components which require a compulsory FDA approval in additional to the necessary regional approvals. A wide range of glass-fibre reinforced (30 to 60 wgt.%) injection-moulding products in the grades "natural" and "black 9225" is currently available. The FDA-approved Grivory HT grades are designated with the abbreviation FWA (**F**ood and **W**ater **A**pproved).

These materials are also approved by NSF/ANSI according to Standard 51 (Food Equipment Materials) for contact with all kinds of foodstuff at temperatures up to 300 °F (149 °C), and according to Standard 61 (Drinking water system components, Health effects). Further approvals are valid for all application conditions and drinking water (hot water) according to KTW, WRAS, NSF, ACS and correspond to the worksheet W270 (no microbe growth). In addition, these Grivory HT grades also satisfy the following EU directives: 2037/2000/EG (ozone depleting substances), 76/769/EWG (substances which are carcinogenic and toxic to reproduction), 91/157/EWG (batteries and accumulators), 94/62/EG (packagings), 2002/95/EG and 2002/96/EG (electrical equipment). Also fulfilled are the requirements of the ELV directive 2000/53/EC (incl. 2002/525/EG and 2003/138/EG) regarding lead (Pb), cadmium (Cd), mercury (Hg) and

hexavalent chrome (Cr-VI). The Grivory HT ... FWA grades are flame resistant and listed by UL (Unterwriters Laboratories Inc.) under the reference number E 53898.

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Metal replacement in automotive cooling systems

EMS-GRIVORY offers Grivory HT HY grades, especially designed for use under thermally demanding conditions in automotive cooling systems, and allowing replacement of established metal solutions.

Components of a cooling system are particularly stressed by permanent contact with hot cooling media. Technical polymers for this application must satisfy a demanding specification profile. Among other factors, Grivory HT HY grades provide the necessary heat deflection temperatures and also exhibit very high stiffness and strength under application conditions. At the same time, the materials also have excellent resistance to chemicals.

Grivory HT grades for technical injection-moulding components in automotive construction which are in permanent contact with cooling media (water/glycol mixtures) are designated with the abbreviation HY (**Hy**drolysis resistant).

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Ultimate breaking stress (MPa), ISO 527, after storage in monoethylene glycol / water 1:1 at 120°C

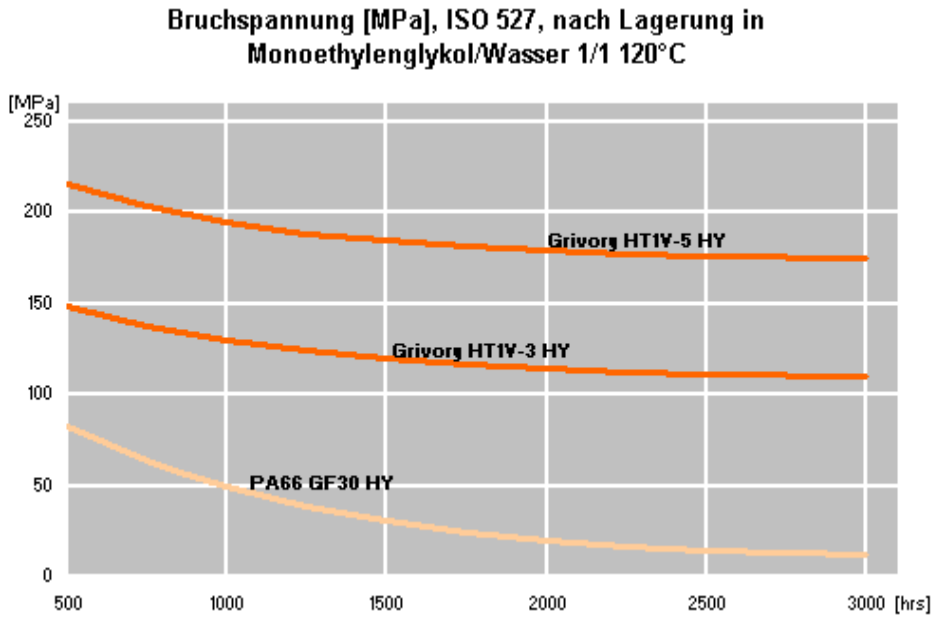

Fig. 1: Ultimate breaking stress values of Grivory HT HY grades are significantly higher that those of a comparable standard, glass-fibre reinforced polyamide.

High-quality metal substitution

With Grivory HT1V-65H, EMS-GRIVORY has come a lot closer to metal. This new material redefines the limits of feasibility for metal replacement and extends the proven Grivory HT product family upwards.

Plastic materials are superior to metals in many respects, the high stiffness values of metal can, however, never be achieved with an injection-moulded plastic and must be compensated for by design. Grivory HT1V-65H is an exceptional construction material with a mechanical property profile which is better than most high-performance plastics. This material is particularly suited for the manufacture of high-performance injection-moulded components which must provide durability and reliability even under extreme application conditions.

With a hardness of 420 MPa (ball indentation hardness as per ISO 2039-1, after water absorption), Grivory HT1V-65H holds a leading position among injection-moulding materials. This is achieved through the combination of an extremely stiff matrix made of polyphthalamide (PPA), in combination with special glass-fibre reinforcement. Parts made of Grivory HT1V-65H exhibit mechanical properties very similar to those of metal and can be manufactured without problem using standard injection-moulding equipment.

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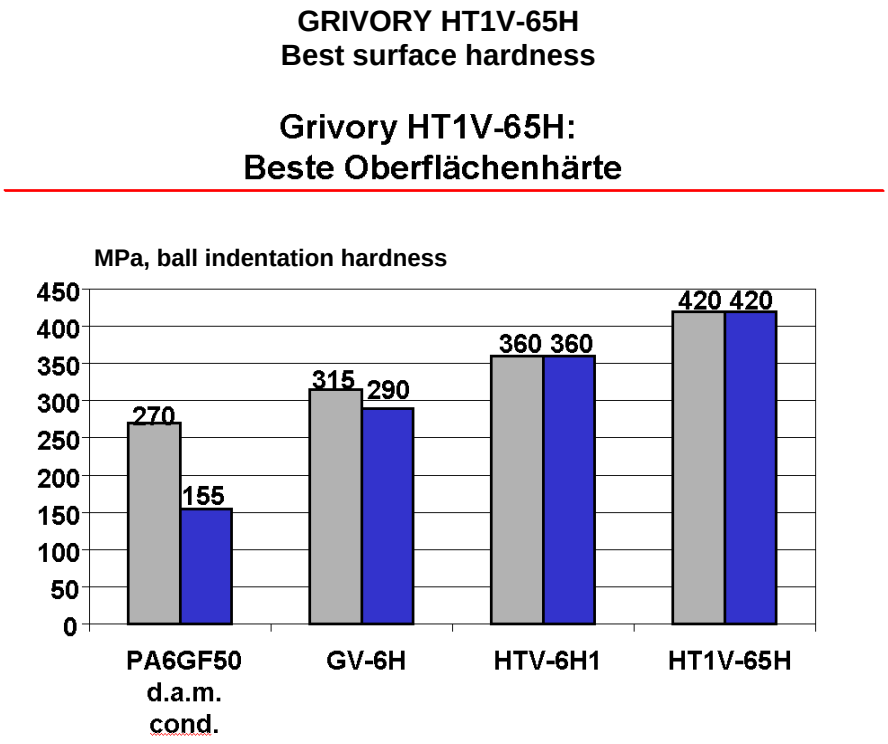

Fig. 1: Surface hardness of Grivory HT1V-65H compared to conventional materials used for metal replacement.

Self-extinguishing and containing no halogen

Grivory HT2V...V0 provides a range of construction materials containing no halogen, for flame-resistant applications in the electrical and electronic industry. This material satisfies the currently valid guidelines for disposal of electric waste (RoHs). Components made of this material do not fall under the stipulations of the requirements for separate disposal of waste electrical and electronic equipment (WEEE) containing halogen.

Compared to flame-resistant high-performance polyamides containing halogens previously available in the market, Grivory HT2V..V0 grades also have further advantages other than their lack of halogen: The material has excellent mechanical properties, good electrical values (CTI: 600 V), a low density and outstanding flow behaviour.

The UL listing certifies Grivory HT2V...V0 very good flame resistance. Even at low wall strengths of only 0.35 mm and with 30% glass-fibre reinforcement, the material achieves the flammability rating UL 94V-0 and as such, is an ideal material for injection-moulding of thin-walled components. In this way, very fine components such as coil formers, as well as other components with much higher wall thicknesses, can be manufactured.

EMS-GRIVORY offers grades with 30, 40 and 50 wgt.-% glass-fibre reinforcement, and so provides very stiff, highly reinforced materials which are excellently suited for metal replacement.

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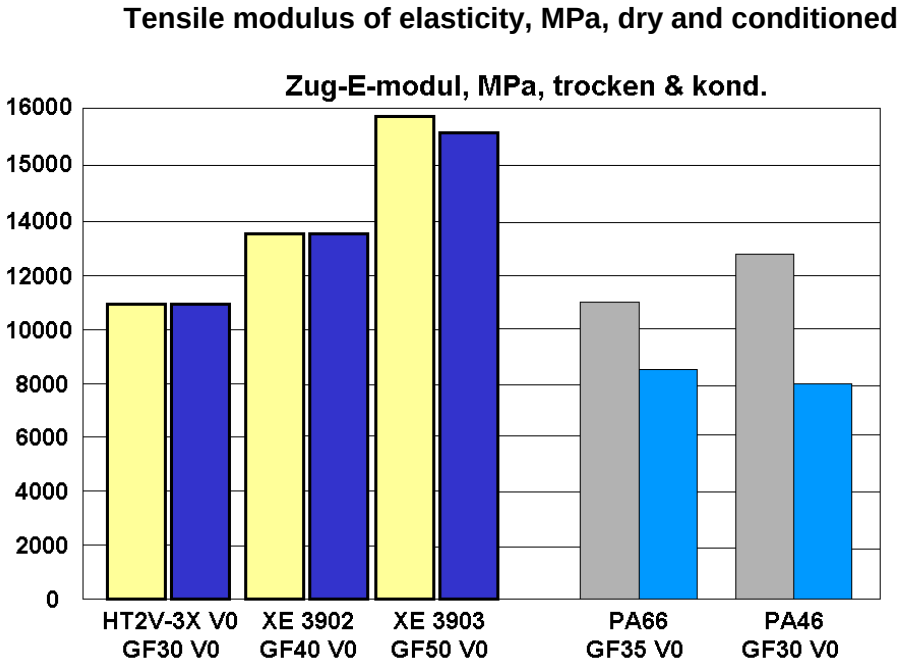

Fig. 1: The tensile modulus of elasticity of Grivory HT2V...V0 compared to other flame-resistant polyamides currently on the market.

Structural material with excellent surface quality

As a rule, reinforcement material necessary to achieve the required mechanical properties, has a negative effect on the surface quality of injection-moulded parts. This does not apply to products made of glass-fibre reinforced Grivory G4V.

Grivory G4V combines high stiffness and strength values with excellent surface quality and flowability. The surfaces of the injection-moulded components manufactured with this material are smooth and without blemishes. Grivory G4V, produced by EMS-GRIVORY, sets new standards for the manufacture of visible components. It is particularly suited for the manufacture of functional parts and housings in mechanical engineering, automotive construction and the electric & electronic and telecommunication industries.

This is made possible by a newly developed base of partially aromatic copolyamide. Grivory G4V is comparable to glass-fibre reinforced PA MXD6, but has better toughness. The decisive properties for metal replacement: stiffness, strength and impact strength remain practically constant even after water absorption. This differentiates Grivory G4V and the other Grivory GV products from polyamides such as PA 6 or PA 66.

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Efficient protection for cosmetics

In order to achieve success in the cosmetics market, not only the product, but also the packaging must be of exceptional quality. This has a decisive effect on sales success. Suitable packaging materials are characterised by excellent optical properties and, equally important, very good mechanical properties

Grivory G, from the range of amorphous polyamides available from EMS-GRIVORY, sets new standards in this field. This product family is characterised by very good barrier properties and very good resistance to oils, waxes and solvents. The Grivory G grades are clearly superior when compared to traditional products. Thanks to the excellent barrier properties of Grivory G, companies such as L'Oréal use this material to make their mascara containers. Essences and other sensitive constituents are provided with efficient protection against oxygen and evaporation.

Transparent Grivory G also allows complete freedom of design. An increasing number of renowned companies from the cosmetic industry are protecting their products with Grivory G. Whether gels, make-up or lotions, the high gloss, easily printing and excellent scratch resistance of Grivory G grades make them excellently suited as material for high-performance packagings.

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Improved protection for foodstuffs

Grivory HB sets new standards as packaging material in the foodstuff industry thanks to excellent barrier properties for flavourings, oxygen and carbonic acid.

The foodstuff industry shows an increasing demand for high barrier properties and improved transparency of flexible and rigid packaging. Plastics such as the amorphous polyamide Grivory HB are superior to glass in a variety of ways. Grivory HB exhibits excellent barrier properties to flavourings, oxygen and carbonic acid and maintains these values even after retorting and sterilisation processes. This is made possible by the exceptionally low sensibility to moisture which protects this product from the effects of the confectioning process – a capability which differentiates Grivory HB from other materials. As a result, an increasing number of renowned companies from the foodstuff industry use Grivory HB for their products as a barrier in combination with other packaging materials.

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High-quality functional components for under-bonnet applications

Compact designs continue to limit under-bonnet space but also have the effect of increasing temperatures and the demands on the specification profiles of the polyamides used. The Grilon TSG W series closes the gap between conventional polyamides and the high-performance plastics Grivory GV and Grivory HT.

Grilon TSG W is available in three standard black grades with different amounts of glass-fibre reinforcement (30, 35 and 50 wgt.-%). All these grades are well suited for applications such as turbo-charged air cooling parts, hot oil pans, components in heating, cooling and climate control systems as well as for classical under-bonnet functional parts. This is made possible by a new form of heat stabilisation.

Parallel to the high heat deformation temperature, this material impresses with an excellent resistance to automotive fluids such as hot oil (engine and gear oil) and cooling water (glycol/water mixtures). At the same time, the Grilon TSG W grades have very high stiffness and strength values even at temperatures up to 210 °C, in combination with excellent resistance to heat ageing. The continuous working temperature is up to 150 °C. Extensive heat ageing testing has been carried out, the results of which show clearly improved dynamic and mechanical strength values compared to conventionally stabilised polyamides.

The good flow behaviour of the material ensures easy processing and allows the manufacture of complex design components with a high degree of integrated functionality.

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The polyamide for short cycle times

The trend in injection moulding is increasingly towards large-area components with long flow paths. Reinforced materials in particular must have good flowability in order to guarantee short cycle times and low warpage of the finished article. The FC grades (Fast Cycle) of the Grilon B family can make full use of their capabilities here.

At the Fakuma 2006, EMS-GRIVORY is presenting new PA 6 grades of the Grilon B product range, which have been developed especially for rapid cycle times. According to the application, cycle times can be reduced by more than 10% compared to the Grilon B standard grades. At the same time, the FC grades show an exceptionally low tendency to warp. These polyamides with the "FC" designation have shown themselves to be problem solvers, in particular for large-area components with long flow paths such as housings and claddings.

The three basic grades in the FC family are available with 15, 30 or 50 wgt.-% glass-fibre reinforcement. In addition, EMS-GRIVORY offers FC grades for applications with more demanding requirements. These include the high impact strength modified grade Grilon BZ 1 FC. The product range is rounded off by the hybrid-modification Grilon BGM-40 FC which is reinforced with a combination of glass fibres and minerals. The products are available in natural and black and can also be pigmented according to customer requirements.

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Carbon fibre reinforcement for special cases

For some components, standard grades with classical reinforcing materials are well below the requirement levels of new applications. One example of this is the combination of high strength with low component weight. In cases like this the carbon fibre reinforcement of Grilon TSC provides good service.

At the Fakuma 2006 EMS-GRIVORY presents Grilon TSC, a PA6-based polyamide which is superior to conventional glass-fibre polyamides not only due to its significantly higher strength. This material also has greatly improved heat conductivity and is self-lubricating. Characteristic for this polyamide is its lower density in comparison to glass-fibre reinforced polyamides. This allows clear weight reductions to be achieved and is ideal for lightweight construction design solutions.

Carbon-fibre reinforced Grilon TS grades also have special electrical properties. Components made of this material are antistatic or even electrically conductive. In this way, electrostatic potentials created through friction can be discharged or prevented.

Grilon TSC-30/4 LF 15 with PTFE/silicon modification for sliding bearings, completes the product portfolio. This product was developed especially for sliding bearings and due to its good heat conductivity it reduces the temperature in the sliding gap and gives the material its high strength. The PTFE content reduces frictional forces permanently after a short phase-in time and the silicon compound prevents start-up blocking and ensures perfect functioning already with the first movements.

The Grilon TSC standard grades are available with 10, 20, 30 or 40 wgt.-% carbon fibre reinforcement. In addition, an impact strength modified special grade with 15 wgt.-% CF has been developed. All grades are characterised by good flowability in combination with the simple processing capabilities of Grilon TS. The products are available in the colours black and dark grey.

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Extreme heat resistance through nano-technology

Through use of nano-size fillers, Grilon EBGM, a special alloy of PA6 and PA66 manufactured by EMS-GRIVORY, withstands temperatures of up to 200 °C and represents an alternative to metal for extremely critical components in automotive air charging systems.

The term nano means 'dwarf'. At the same time, the minute nano fillers in special high-viscosity polyamides such as Grilon EBGM have a very large effect and greatly improve key properties. Temperature requirements of up to 200°C present absolutely no problem for Grilon EBGM from EMS-GRIVORY, and this allows the material to be used as metal replacement – with the connected advantages of e.g. weight reduction and high functional integration.

The high-viscosity grade Grilon EBGM-20HX (previously XE 3861), is recommended for e.g. charged air pipes made using blow-moulding processes. For injection-moulded components which are welded directly onto the blow-moulded parts, the injection-moulding product Grilon EBGM-30HX (previously XE 3932) is particularly well suited. Components made of these materials withstand the high requirements of the automotive industry such as 1 million cycles in a repeated pressure test at 1.3 bar +/- 1.2 bar, 205 °C internal and 125 °C under-bonnet temperature.

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Picture 1: High temperature air duct VW Golf

Modern flame-proofing for electro & electronics

The flame-proofed polyamides in the Grilong TS family provide WEEE and RoHS conform flame protection without halogen or red phosphorus and without loss of performance with mechanical properties. The product line was recently supplemented with a particularly easy-flowing grade.

In addition to the Grilon grade TSG-30/4 V0, EMS-GRIVORY also offers a easy-flowing modification for thin-walled and complex design components. Both grades are characterised by first class electrical properties (CTI: 600 V) and high flame resistance (flammability rating UL 94 V0 at 0.8 mm, for all colours) as well as an IEC GWIT of 775 °C. The reinforcement with 30% glass fibres is a guarantee for high stiffness and strength – all with a high elongation at break of 4.5% in a conditioned state.

Due to the fact that it contains no halogen or phosphorous flame-proofing, Grilon TS is not subject to any limiting of pigmentation (as would be the case with red phosphorus for example) but is also available in light colours. This eliminates any problem of laser printing of components – a factor of increasing importance in the electric industry. An excellent contrast is already possible with the standard black grades.

At the same time, the materials satisfy the guidelines and prohibitions applying to disposal of electric waste (WEEE and RoHS) valid since August 2005, and do not fall under the regulations governing separate disposal of components containing halogen. These new Grilon TS polyamides are particularly well suited for use in the electro and electronic industry. Their basis of PA66 and PA6 continues to ensure excellent and easy processing.

Grilon TSG-30/4 FR X (UL 94 V2) exhibits a CTI value of 600 V and has a flammability rating of UL 94 V2 at 0.8mm and V0 at 3 mm for all colours. The elongation at break (with 30 wgt.-% glass-fibre reinforcement) is 20 % in a conditioned state and represents a fourfold higher stability than other products.

Grilon TSM-30/4 V0 also exhibits high flame resistance (corresponding to UL 94 V0 at 0.8 mm) and very good electrical properties (CTI: 550 V). With 30 % mineral reinforcement, an elongation at break of 9 % in a conditioned state is achieved.

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Perfect substitution of high-performance polymers

The new, highly transparent and amorphous grade Grilamid TR 60 supplements the established Grilamid TR product range with a further exceptional material which, with its excellent mechanical property profile, is recommended for demanding applications in the fields of foodstuffs and medical technology.

In these fields, particularly high requirements are demanded of hygienic marginal conditions. Grilamid TR 60 can be sterilised repeatedly and exhibits excellent stability to chemicals and hydrolysis; even after 3000 cycles in superheated steam at 134 °C, **3 bar and 7 minutes** this polyamide shows no sign of embrittlement. Grilamid TR 60 also withstands sterilisation processes with ethylene oxide, gamma rays or dry heat without suffering material fatigue.

In addition, this amorphous polyamides material exhibits above-average resistance to microwaves. This allows the manufacture of e.g. baby bottles, soda bottles or other containers for domestic use in direct contact with foodstuffs and drinking water, to be easily manufactured using ISBM (injection stretch blow moulding) or IBM (injection blow moulding) processes as well as numerous 2C shaped parts as a composite with liquid silicon or TPE.

Further characteristics are excellent strength values and stress-cracking resistance. These make Grilamid TR 60 an ideal replacement material for polysulphone, HT polycarbonate and other transparent high-performance polymers. In this way the new polyamide grade closes the ranks in an inexpensive way as, due to a lack of cheaper and yet high-performance alternatives, components continue to be manufactured of over-specified materials. Using Grilamid TR 60, material replacement is possible allowing cost savings to be achieved while still maintaining the component property characteristics.

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Perfect laser marking on polyamide

Through utilisation of special, laser-sensitive additives, transparent Grilamid TR can be marked with excellent contrast and no reduction in the transparency.

EMS-GRIVORY has developed a special laser-marking Grilamid TR material especially for use with the Nd:YAG laser (1064 nm) which is most frequently used by industry for laser marking of components. For the Fakuma, the range of laser marking Grilamid TR grades will be supplemented with bright colours on a black substrate. In this way, coloured markings can be applied to the components in a permanent way.

Due to the nano-sized additives, the designations achieve high edge definition and marking depth while maintaining the smoothness of the component surface. The edge definition of the laser markings is comparable to the quality of tampon or laser printing

Using laser markings, abrasion resistant and forgery-proof markings of all kinds, e.g. data matrix codes, can be applied to even the smallest of components.

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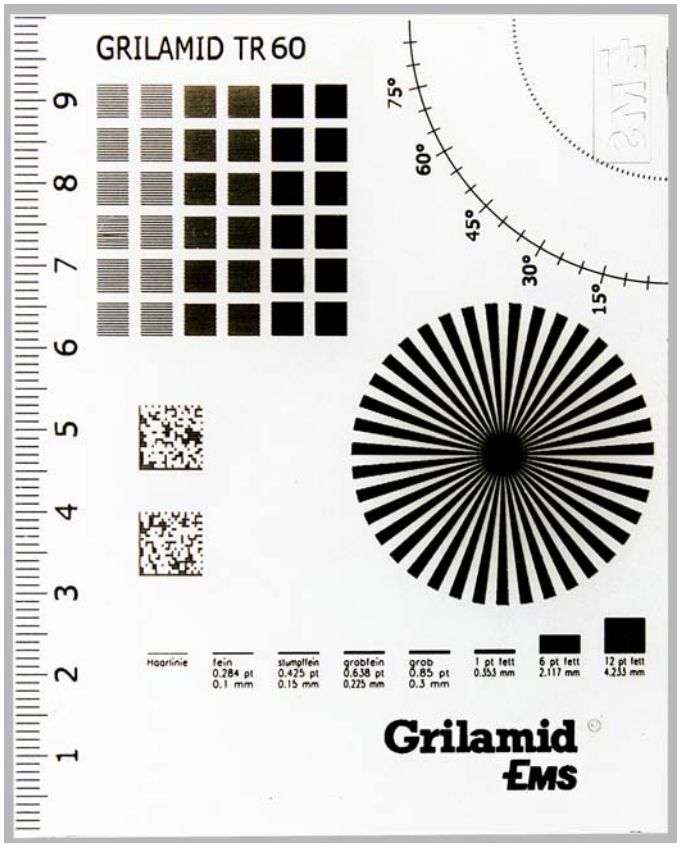

Fig. 1: Sample plate made of the high-performance polyamide Grilamid TR 60 showing the high-quality laser markings possible according to different requirements.

PA12 with record stiffness

High-stiffness Grilamid SST (super stiff and tough) allows the manufacture of extremely stiff, high precision and impact resistant structural components of PA12 and establishes itself as replacement for metal and high-performance polymers such as PSU or PEI.

With an E-tensile modulus of 18.000 MPa (cond.) Grilamid SST XE3925 is the PA12 with the highest stiffness values in the market. At the same time, with elongation at break of 3.5% and higher impact strength, it is tougher than any other highly reinforced thermoplastic material. This material also exhibits the well known and established properties of PA12 such as low water uptake, dimensional stability and very good resistance to chemicals, weathering and hydrolysis. The simple processing and extremely good surface quality which can be achieved make this material extremely well suited for demanding design components - not least thanks to its unlimited colourability.

Grilamid SST is the perfect material solution for parts in sport/leisure, mechanical engineering or medical technology which are exposed to high stress. Using two-component injection moulding, a soft plastic material such as Grilamid ELY or TPU, or also a transparent plastic such as Grilamid TR, can be directly injected. Simple processing, a wide processing window and low mould temperatures allow super-stiff, complex geometries requiring different slide bars and cores to be manufactured in water-cooled moulds.

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Comprehensive approvals for contact with water

With the PA12 products Grilamid LV-5H WA and Grilamid LV-3H WA, EMS-GRIVORY presents a new product range with comprehensive approvals for contact with drinking water.

Accordingly, Grilamid WA products are especially well suited for the manufacture of plastic components where drinking water approvals are specifically required. Thanks to the combination of stiffness, toughness and elongation at break, Grilamid WA provides the ideal solution for replacement of increasingly expensive brass alloys in sanitary applications.

In applications in permanent contact with water, this material shows excellent long-term behaviour due to the PA12-typical properties such as low water uptake and extremely good resistance to chemicals. Along with dimensional stability and resistance to stress cracking and hydrolysis, Grilamid WA also gains points with a very wide processing window compared to high-performance polymers.

Products available are Grilamid LV-3H WA with 30 wgt.-% and Grilamid LV-5H WA with 50 wgt.-% glass-fibre reinforcement in the colours natural and black. Customer-specific colours are also available on request.

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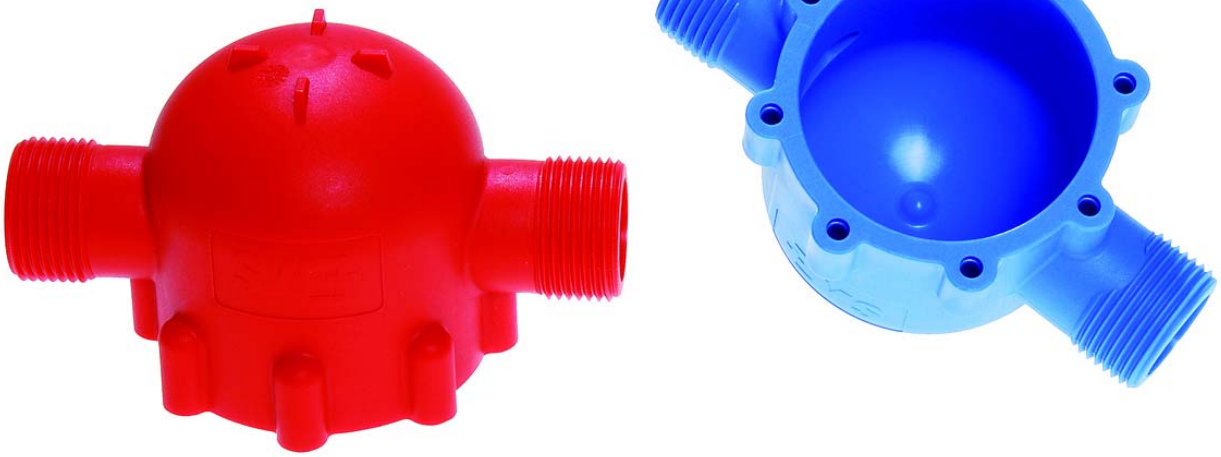

Non-damaging transport of foodstuffs

Flexible pipes are often required for screw conveyor systems in the foodstuff and pharmaceutical industries, which allow delicate products to be transported without damage. The extrusion grade Grilamid XE 3841 from EMS-GRIVORY fulfils the specification profile for this application field.

Grilamid XE 3841 has good slide properties and high resistance to abrasion. This ensures uninterrupted operation of the metal screw conveyor inside the polyamide pipe. At the same time, transport of abrasive products is also possible without problem. The translucent and tough material based on PA12, is supple and optimised for use where optimum flexibility is required.

The excellent resistance to chemicals and weathering provide an excellent basis for applications in direct contact with foodstuffs. Grilamid XE 3841 contains absolutely no plasticiser and satisfies the EU guideline 2002/72 governing repeated contact with foodstuffs. These are all reasons why Grialmid XE 3841 is a the material preferred by many foodstuff manufacturers for direct, short-term contact with foodstuffs and non-alcoholic beverages. Further advantages of this material are good dimensional stability, high cold impact strength and the simple and economic pipe extrusion well known for Grilamid PA12.

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Maximum imaging accuracy for microstructures

EMS-GRIVORY has developed two reinforced PA12 grades with maximum imaging accuracy for precision injection-moulding of technical components.

Grilamid LBV-25H and Grilamid LBVK-35H are optimised and modified for accurate imaging of surface structures in the micro-range. The high surface hardness provides the required excellent resistance to scratching of the imaged structures. Further advantages are the very low water uptake, good dimensional stability, simple processing and economical lamination to Grilamid ELY (PA12 elastomer), Grilamid TR (transparent PA) and other polymers using multi-component injection-moulding. Both grades exhibit very good resistance to chemicals and weathering.

Grilamid LBVK-35H exhibits very low and quite isotropic shrinkage, Grilamid LBV-25H is characterised by high strength values. Due to their light inherent colour, Grilamid LBV-25H and Grilamid LBVK-35H are well suited for pigmentation. Laser marking systems in black are available for both grades.

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Lasting protection for optical fibres

The new extrusion grade Grilamid XE 3891 from EMS-GRIVORY offers maxium protection for optical fibres, particularly through clearly reduced thermal expansion of the material.

For many years now Grilamid PA12 has proven reliable as protection for optical fibres made of glass and polymer. The newly developed grade Grilamid XE 3891 exhibits clearly reduced thermal expansion values as well as higher stiffness and surface hardness compared to previously available PA12 fibre cladding grades. The reduced processing shrinkage in the sheathing process rounds off the positive property profile.

Stress affecting the optical fibres e.g. from shrinkage or thermal expansion, which would interrupt the transmission of signals are significantly reduced when using Grilamid XE 3891 compared to conventional PA12 grades. As a dimensionally stable jacket for tight and semi-tight fibres, Grilamid XE 3891 provides optimal protection over a wide temperature range. These advantages of the material are supplemented by the simple and economic extrudability. The excellent resistance to chemicals and good weatherability of Grilamid PA12 are of course, maintained.

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PA elastomers for highly flexible applications

Under the trade name Grilflex, EMS-GRIVORY has launched a new series of highly flexible polyamides for extrusion applications. Grilflex products are based on polyamide elastomers, contain no plasticisers and thus maintain their high levels of flexibility over their entire life expectancy, even at high temperatures.

For many years now, polyamide has proven to be a durable material for technical pipe applications. The high thermal-mechanical property profile is decisive for use of polyamides in robot and automation technology. Highly flexible Grilflex enables long-term use at temperatures of up to 100 °C (50% of the remaining tensile strength values after 20,000 hours were taken as limiting value). In addition, Grilflex exhibits excellent resistance to chemicals and weathering. This polyamide also has excellent mechanical properties and is easy to process. Particularly good fatigue behaviour and high impact strength at temperatures to -40°C round off the property profile of Grilflex.

Thermoplastic polyurethane is often used as an alternative to polyamide. However, this material is limited in its resistance to chemicals and often already becomes brittle at application temperatures of above 60 °C. Grilflex can be extruded at extrusion speeds which are 2 - 3 times higher than for conventional TPU and its very low density of 1.0 also adds to the cost-effectiveness of this product.

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Picture 1: Grilflex XE 3921; corrugated hose for cable protection tubes DN21x1mm

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Picture. 2: Grilflex Logo

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