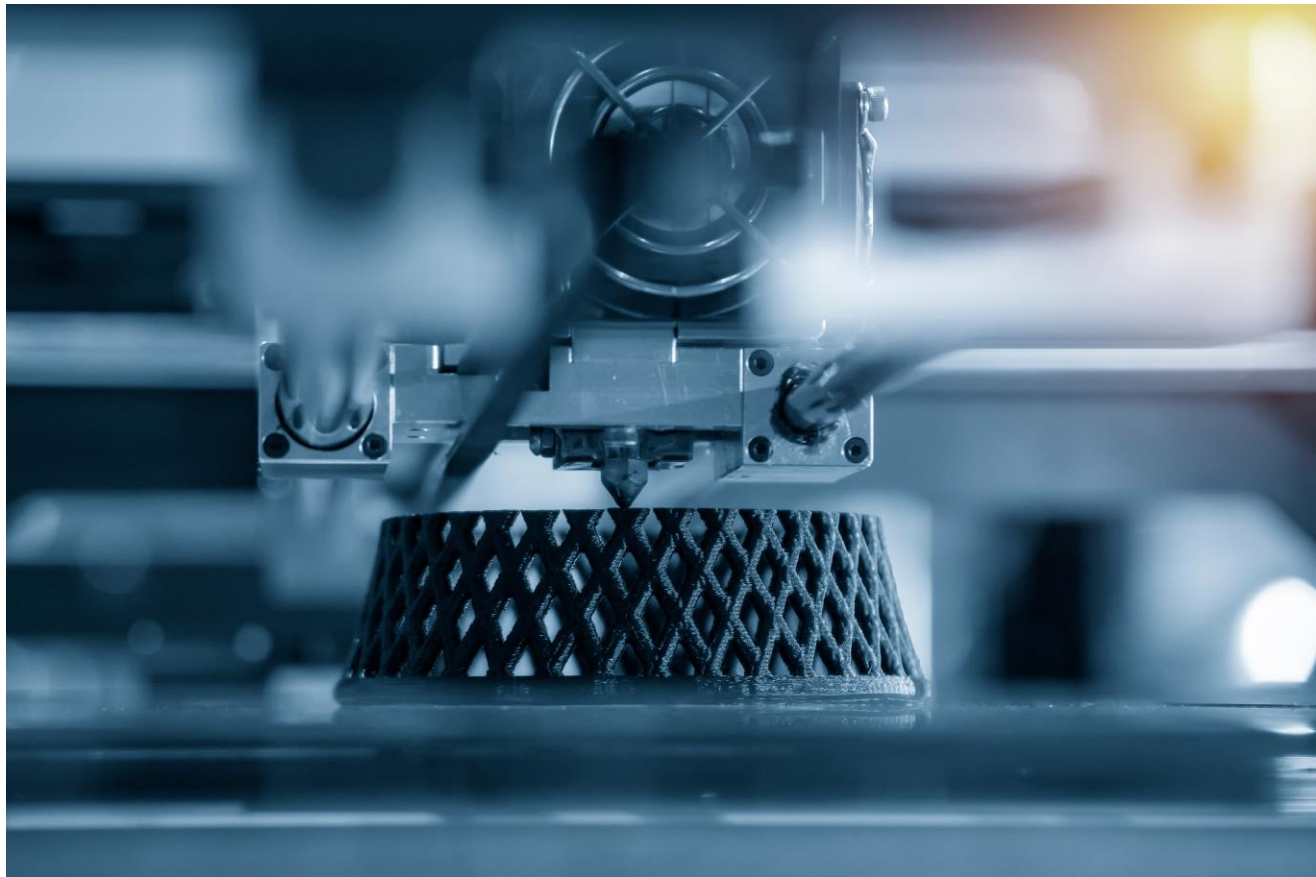
PLASTICS ENGINEERED BY GEHR®

FIL-A-GEHR®

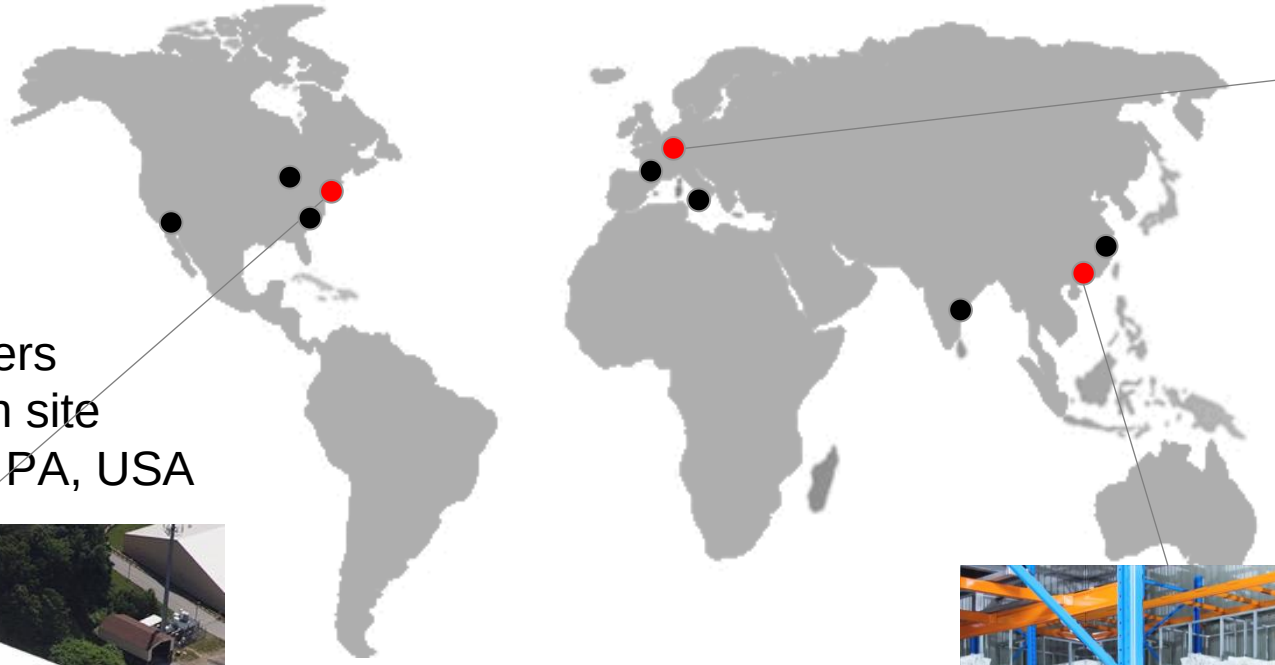
FOR ADDITIVE MANUFACTURING

CONTENT



FAMILY OWNED AND OPERATED COMPANY WITH TRADITION

GEHR – AN INTERNATIONAL COMPANY



- World headquarters and production site **Mannheim**, Germany

- US headquarters and production site **Philadelphia**, PA, USA

- Asia headquarters and warehouse **Hong Kong**

QUALITY AND INNOVATION

TÜV SÜD ISO 14001

TÜV SÜD ISO 45001

TÜV SÜD ISO 9001

TÜV SÜD EN ISO 13485

TÜV SÜD ISO 50001

ISCC International Sustainability & Carbon Certification

MARKET SEGMENTS

STOCK SHAPES

MEDI-GEHR®

CUSTOMIZING

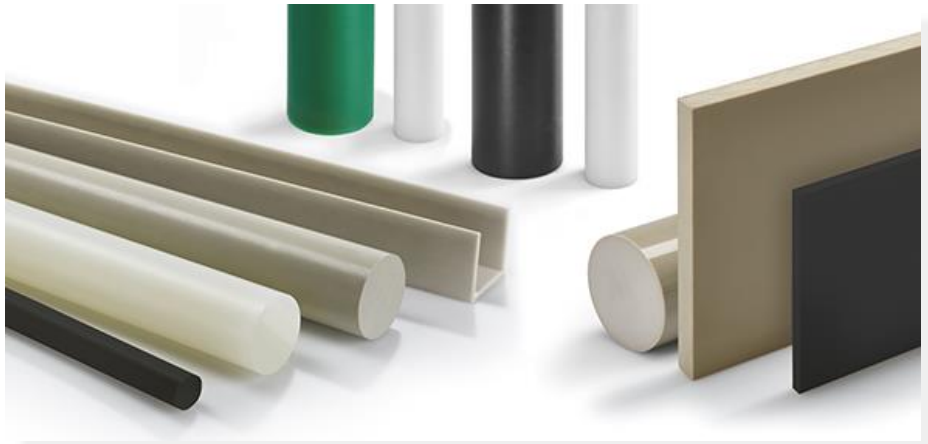
WRITING INSTRUMENTS

COSMETICS

FIL-A-GEHR®

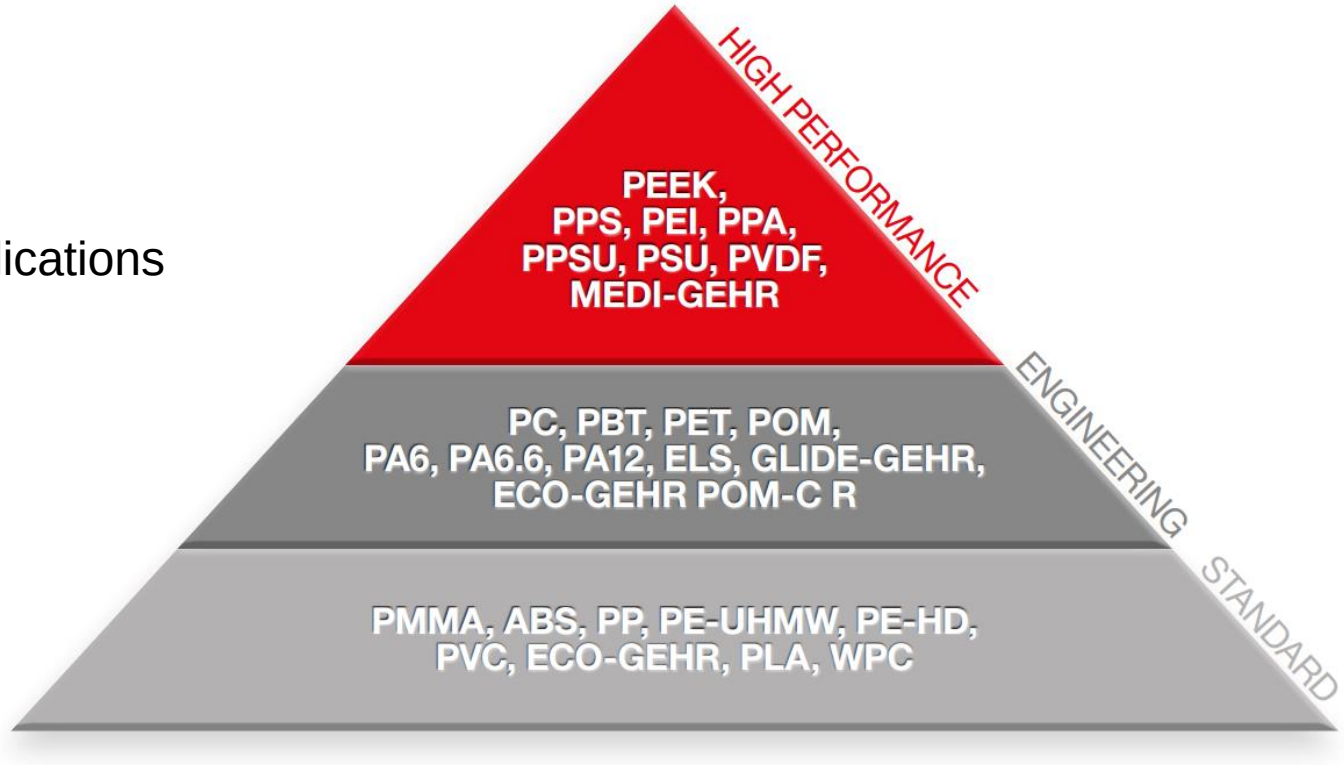
GEHR EXPERTISE

EXTRUDED RODS, SHEETS, TUBES, PROFILES AND FILAMENTS



SPECIALTIES:

» Rods up to 700 mm diameter
» Thick plates up to 300 mm thickness
» Decorative precision tubes
» Semi-finished products for medical applications
» Filaments for professional 3D printing



ENVIRONMENTAL PROTECTION AND SUSTAINABILITY

CO_2-NEUTRAL PRODUCTION

- Conversion to green electricity and green gas in Mannheim and Philadelphia.
- Achievement of the implementation packages of Katowice Scope1 and Katowice Scope1 and 2

SINCE 2016: 100% RENEWABLE ELECTRICITY

Since 2016, total electricity requirements covered by renewable energies - mainly from hydropower in Norway.

COOLING PROCESS OPTIMIZED

In order to sustainably conserve water as a resource, we have also made mechanical adjustments to our plants. This has enabled us to significantly reduce the amount of water required in the cooling system as well as the supply of fresh water.

RECYCLING CONCEPT FOR THE AVOIDANCE OF PRODUCTION WASTE

The returned material is sorted, ground, recycled and reused in production wherever possible and permitted.

MOBILITY OF THE FUTURE

In collaboration with TU Munich and Evonik, we are ensuring that the Hyperloop project moves into the next phase. Hyperloop is a new concept for transporting goods and people at almost the speed of sound. The train travels like a maglev train in a low-pressure tube above the earth's surface.
In this team, we produced sheets made of VESTAMID® (PA12 filled with glass fibers) for a 24-m-long test track. After extrusion, these sheets are machined before installation to hold the magnetic coils in position for the train.

PLASTICS ENGINEERED BY GEHR®

EVONIK
Leading Beyond Chemistry

GENERAL INFORMATION ABOUT FIL-A-GEHR®

» Extremely close tolerances

» Filaments made of high-quality raw materials

» Compatible with all standard 3D printers

» Low-emission and odour free

» Shrinkage-free

» Good layer adhesion

» Optimal flow behavior while printing

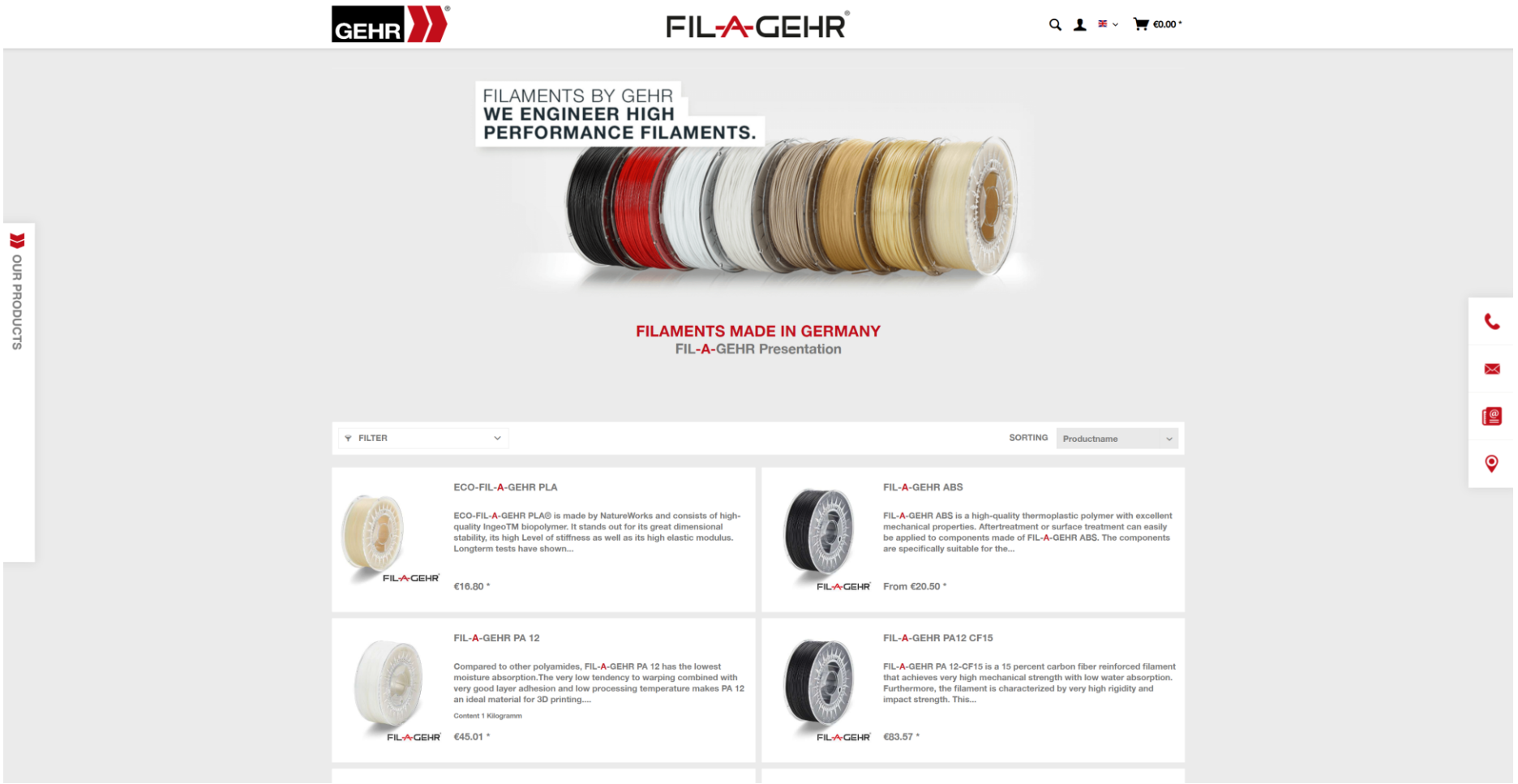
» Carefully spooled and packed in easy to use re-sealable zip bags

PRODUCT RANGE:

» Diameter: 1,75 and 2,85 mm (1,80 mm on request)

» Spools from 200g up to 10kg (Standard: 1kg)

FIL-A-GEHR® SHOP



[Filament | FIL-A-GEHR SHOP (filagehr.com)]

TECHNICAL DATASHEETS FIL-A-GEHR®

PLASTICS ENGINEERED BY GEHR

FIL-A-GEHR®

Filaments for professional 3D printing

PEEK

PLASTICS ENGINEERED BY GEHR

The semi-crystalline polyether ether ketone **FIL-A-GEHR PEEK®** offers outstanding mechanical, thermal and chemical resistance. Thanks to its well-balanced property profile, PEEK is one of the most capable high-performance thermoplastics available.

FEATURES FIL-A-GEHR

» Highest precision in diameter and roundness
» Filaments made of high-quality raw materials
» Compatible with all open-system 3D printers
» Low-emission and odour free
» Void-free
» Good layer adhesion
» Ideal flow behaviour while printing
» Carefully spooled and packed in easy to use aluminium-laminated resealable zip bags

PRODUCT RANGE

diameter	1 kg spool (~2,2 lbs)
1.75 mm 0.07''	●

Colours: ● natural

DISTINCTIVE FEATURES FIL-A-GEHR PEEK®

» Excellent combination of strength, stiffness and toughness
» Low moisture absorption
» Exceptional chemical resistance
» Maximum continuous operating temperature 260 °C
» Excellent sterilisation and hydrolysis resistance
» Self-extinguishing, low smoke emission
» Pressure nozzle temperature 375°C, printing plate temperature 180°C
» Printing room temperatur 180°C

TYPICAL APPLICATIONS

» Aviation
» Transport
» Oil and gas (supporting rings and supply lines)

GEHR, Specialist In Plastics – Premium Quality Since 1932

We extrude thermoplastic semi-finished materials and rank amongst the global leading producers of technical semi-finished products. FIL-A-GEHR® expands our product range with plastic filaments for 3D printers. GEHR produces the filaments in Mannheim and has been representing innovation and premium quality since 1932.

PLASTICS ENGINEERED BY GEHR

TECHNICAL DATA FIL-A-GEHR PEEK®

Properties	Parameters	Units	Values
General Properties			
Specific gravity (ρ)	ISO 1183	g/cm³	1.32
Water absorption	ISO 62	%	0.
Moisture	ISO 62	%	0.07
Maximum permissible service temperature	UL746B	°C	260
Lower permissible service temperature	UL746B	°C	-40
Mechanical Properties			
Tensile strength at yield (σ_S)	ISO 527	MPa	115
Elongation at yield (ε_S)	ISO 527	%	7
Tensile strength at break (σ_R)	ISO 527	MPa	67
Elongation at break (ε_R)	ISO 527	%	16
Impact strength (a_n)	ISO 179	kJ/m²	no break
Notch impact strength (a_k)	ISO 179	kJ/m²	4
Ball indentation (H_k) / Rockwell hardness	ISO 2039-1	N/mm²	250 / M 99
Shore-D	ISO 868		90
Flexural strength ($\sigma_{B\,3.5\,\%}$)	ISO 178	MPa	170
Modulus of elasticity (E_t)	ISO 527	MPa	4210
Thermal Properties			
Vicat-softening point (VST/B/50)	ISO 306	°C	250
Heat deflection temperature (HDT/B)	ISO 75	°C	240
Coef. of linear thermal expansion (α)	ISO 11359	$K^{-1}*10^{-4}$	0.47
Thermal conductivity at 20 °C (λ)	ISO 22007-4	W/(m*K)	0.25
Glass transition temperature (T_G)	ISO 3146	°C	143
Melting temperature (T_m)	ISO 3146	°C	340
Printing Properties			
Pressure nozzle temperature		°C	370-410
Printing plate temperature		°C	130-140
Build chamber temperature		°C	>80
Nozzle diameter	(hardend steel)	mm	0.40
Print speed		mm/s	50
Fan speed	(activated on layer 4)	%	50
Predrying temperature		°C	120
Predrying time		h	8

All properties are measured under laboratory conditions using the analytical method shown. The limits in these specifications apply only to data obtained using the specified test methods. Different analysis methods or analysis conditions can lead to different values.

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FIL-A-GEHR® MATERIALS

- » ECO-FIL-A-GEHR PLA ®
- » FIL-A-GEHR PLA ®
- » FIL-A-GEHR PETG ®
- » FIL-A-GEHR ABS ®
- » FIL-A-GEHR PA 12 ®
- » FIL-A-GEHR PA12 – CF15 ®
- » FIL-A-GEHR PC / ABS ®
- » FIL-A-GEHR PC ®
- » FIL-A-GEHR PPSU ®
- » FIL-A-GEHR PEEK ®
- » ULTEM™ AM1010F FILAMENT (PEI)
- » ULTEM™ 9085 FILAMENT (PEI)
- » MEDI-FIL-A-GEHR PEEK MG ®
- » MEDI-FIL-A-GEHR PPSU MG ®
- » MEDI-FIL-A-GEHR PC MG ®
- » MEDI-FIL-A-GEHR PET MG ®

Support filaments:

- » ML9085 SUPPORT for ULTEM™ FILAMENT
- » FIL-A-GEHR VXL 90 and VXL 130 ®

ULTEM is a registred trademark of Saudi Basic Industries Corporation (SABIC)

FIL-A-GEHR® FOOD CONTACT SUITABLE

Material	EU 10/2011	FDA
FIL-A-GEHR PEEK ®	✓	✓
FIL-A-GEHR PPSU ®	✓	✓
FIL-A-GEHR PA 12 ®	✓	✓
FIL-A-GEHR PA12 – CF15 ®	–	–
FIL-A-GEHR PC / ABS ®	–	–
FIL-A-GEHR PC	–	–
ECO-FIL-A-GEHR PLA ®	✓	–
FIL-A-GEHR PLA ® (except black)	✓	–
FIL-A-GEHR PETG ®	✓	✓
FIL-A-GEHR ABS ®	✓	✓ 1)

Material	EU 10/2011	FDA
MEDI-FIL-A-GEHR PEEK MG ®	✓	✓
MEDI-FIL-A-GEHR PPSU MG ®	✓	✓
MEDI-FIL-A-GEHR PC MG ®	✓	✓
MEDI-FIL-A-GEHR PET MG ®	✓	✓
ULTEM™ AM1010F FILAMENT (PEI)	✓	✓
ULTEM™ 9085 FILAMENT (PEI)	–	–

1) Only for white and blue.

All certifications exist for the raw material. Certifications for filaments are available upon request.
ULTEM is a registred trademark of Saudi Basic Industries Corporation (SABIC)

ECO-FIL-A-GEHR PLA ®

» ECO-FIL-A-GEHR PLA® sheets based on renewable raw materials consist of 90% PLA.

PROPERTIES:
» High dimensional stability
» Very good layer adhesion
» No embrittlement on the spool (Long term flexural test)
» High stiff ness / high modulus of elasticity
» Pressure nozzle temperature 223°C, printing plate temperature 65°C

APPLICATION:
» High precision temporary parts
» Dimensionally stable products
e.g. molds for cast-bronze
» Very large products

PRODUCT RANGE:
» Colour: Natural
» Diameter: 1,75 mm and 2,85 mm
» Size: 1 kg

FIL-A-GEHR PLA®

FIL-A-GEHR PLA® is made from NatureWorks Ingeo™ biopolymer for precise, failure-free and extreme robust / stable 3D printing.

» High dimensional stability
» Very good layer adhesion
» No embrittlement on the spool (Long term flexural test)
» High stiff ness / high modulus of elasticity
» Pressure nozzle temperature 223°C, printing plate temperature 65°C

APPLICATIONS:

» High precision temporary parts
» Dimensionally stable products e.g. molds for cast-bronze
» Very large products

PRODUCT RANGE:

» Colours: Black, blue, red, white, yellow, green transparent
» Diameter: 1,75 and 2,85 mm
» 1 kg Spools

FIL-A-GEHR ABS®

FIL-A-GEHR ABS® for precise, failure-free 3D printing with excellent mechanical properties.

» Compliant to European Toy Safety Norm EN71-3
» Raw material has food contact and medical approval
» High stability and impact strength
» Heat resistant up to approx. 100 °C (212 °F)
» Easy post-processing / surface treatment
» Pressure nozzle temperature 245°C, printing plate temperature 110°C

APPLICATIONS:

» Thermostable parts, e.g. model making
» Functional prototypes
» Small and medium-sized objects

PRODUCT RANGE:

» Colours: Black, blue, red, white, yellow
» Diameter: 1,75 and 2,85 mm
» 1 kg Spools

FIL-A-GEHR PETG®

FIL-A-GEHR PETG® is characterized by high impact strength and easy printability. Due to its very good melt strength, small, detailed parts and also large parts can be printed with low warpage. The good self-bonding ability ensures excellent layer adhesion. Compared to PLA, **FIL-A-GEHR PETG®** is less prone to moisture retention, is significantly more weather-resistant and more resistant to UV light. It also shows a good chemical resistance.

» High impact strength
» Easy processing
» High self-bonding ability
» High melt strength
» Very good self-linking capabilities
» High strength and durability of the printed parts
» 100 % recyclable
» Pressure nozzle temperature 230°C – 250°C, printing plate temperature 70°C - 90°C
» Moisture: ≤ 0.3 %

APPLICATIONS:

» 3D printing applications where easy processing and high toughness are key
» Detailed and multiple parts even in small designs

PRODUCT RANGE:

» Colours: Black, red, white
» Diameter: 1,75 and 2,85 mm
» 1 kg Spools

FIL-A-GEHR PC/ABS®

FIL-A-GEHR PC/ABS® combines the properties of two exceptional FDM thermoplastics: the high impact strength and heat deflection temperature of PC with the high toughness at low temperatures and the good processability of ABS.

» Optimized flow behavior
» Heat deflection temperature between 110 °C and 135 °C
» High notch impact strength values over wide temperature range
» High dimensional stability
» Low susceptibility to warping
» Surface is ideal for painting and adhesive bonding
» Pressure nozzle temperature 280°C, printing plate temperature 90-110°C

APPLICATIONS:
» Housing components
» Power tools prototypes
» Automotive industry
» Connectors and switches

PRODUCT RANGE:
» Colour: Black
» Diameter: 1,75 and 2,85 mm
» 1 kg Spools

FIL-A-GEHR PC®

FIL-A-GEHR PC® is a polycarbonate filament with high heat resistance and high impact strength. The polycarbonate has been optimized for the 3D printing process.

» Heat deflection temperature approx. 135°C
» High mechanical strength
» High dimensional stability
» Low water absorption
» High notch impact strength values
» Post-processing possible (e.g. drilling, sawing, …)
» Pressure nozzle temperature 260°C, printing plate temperature 90-110°C

APPLICATIONS:

» protective covers
» tool handles
» lamps housing

PRODUCT RANGE:

» Colour: Natural
» Diameter: 1,75 and 2,85 mm
» 1 kg Spools

FIL-A-GEHR PA 12®

FIL-A-GEHR PA 12® (Nylon) in combination with the high impact strength of the material and a low moisture absorption, the filament is beneficial for failure-free 3D printing.

» Excellent chemical resistance, in particular against fuels and antifreeze agents
» Low moisture absorption
» High degree of dimensional stability / High elongation at break
» Low wear/ excellent sliding friction
» High impact strength
» High continuous operating temperature of 85°C
» Low susceptibility to distortion
» Pressure nozzle temperature 250-260°C, printing plate temperature 100°C

APPLICATIONS:

» Cooling water systems
» Fuel pipes
» Snap connectors

PRODUCT RANGE:

» Colour: Natural / white
» Diameter: 1,75 mm
» 1 kg Spools

FIL-A-GEHR PA 12 – CF15®

FIL-A-GEHR PA 12 – CF15® is a filament strengthened by carbon fiber (15%), which has a very high mechanical strength with low water absorption.

» Low water absorption
» Very high stiffness
» High impact strength
» Good chemical resistance
» Good abrasion and sliding properties
» High resistance to weathering
» Pressure nozzle temperature 250-260°C
» Printing plate temperature 100°C

APPLICATIONS:
» Construction components
» Transportation

PRODUCT RANGE:
» Colour: Black
» Diameter: 1,75 and 2,85 mm
» 500 g Spools

FIL-A-GEHR PPSU®

FIL-A-GEHR PPSU® is an amorphous material, with improved impact and hydrolysis resistance compared to PSU and PEI. The extremely high notch impact strength remains also after a heat aging.

» High strength and rigidity
» Very high toughness (also at low temperatures)
» Very good dimensional stability
» Very high chemical resistance
» High operating temperature (approx. +170 °C)
» Very good sterilizability
» Pressure nozzle temperature 390-410°C, printing plate temperature 220°C
» Printing room temperatur 170-210°C

APPLICATIONS:

» Instruments for microinvasive surgery
» Pump impellers, pump parts
» Sterilization cassettes
» Valves

PRODUCT RANGE:

» Colours: Black, natural
» Diameter: 1,75 mm
» 1 kg Spools

FIL-A-GEHR PEEK®

The semi-crystalline polyether ether ketone **FIL-A-GEHR PEEK®** offers outstanding mechanical, thermal and chemical resistance. Thanks to its well-balanced property profile, PEEK is one of the most capable high-performance thermoplastics available.

» Excellent combination of strength, stiffness and toughness
» Low moisture absorption
» Exceptional chemical resistance
» Maximum continuous operating temperature 260 °C
» Excellent sterilisation and hydrolysis resistance
» Self-extinguishing, low smoke emission
» Pressure nozzle temperature 375°C, printing plate temperature 180°C
» Printing room temperatur 180°C

APPLICATIONS:

» Aviation
» Transport
» Oil and gas (supporting rings and supply lines)

PRODUCT RANGE:

» Colour: Natural
» Diameter: 1,75 mm
» 1 kg Spools

MEDI-FIL-A-GEHR®

MEDI-FIL-A-GEHR products are suitable for medical and pharmaceutical applications with direct body contact with tissue, bone, skin and mucosa for up to 24 hours. All materials meet the same requirements as the semi-finished products. Especially for our certificates and approvals:

FDA*, EU 10/2011*, ISO 10993-1, -5, -12, -18 and USP Class VI

* only for raw material

MATERIALS:

» MEDI-FIL-A-GEHR PET MG (white and transparent)
» MEDI-FIL-A-GEHR PC MG
» MEDI-FIL-A-GEHR PPSU MG
» MEDI-FIL-A-GEHR PEEK MG

MEDI-FIL-A-GEHR PPSU MG
Arthroscope prototype

MEDI-FIL-A-GEHR PEEK MG
Instrument holder prototype

ULTEM™ AM1010F FILAMENT (PEI)

ULTEM™ AM1010F FILAMENT (PEI) is a polyetherimide product for 3D printing applications manufactured from ULTEM™ 1010 resin.

» Excellent combination of high heat resistance and dimensional stability
» High mechanical strength
» Continuous service temperature 170 °C
» High heat resistance
» Inherently flame retardant (UL94-V0)
» Print nozzle temperature 370-390°C
» Pressure plate temperature 150°C
» Pressure chamber temperature 90°C

PRODUCT RANGE:

» Colour: Natural
» Diameter: 1,75 mm
» 1 kg Spools

APPROVALS OF THE RAW MATERIAL:

» Aerospace FAR25.853

ISCC International Sustainability & Carbon Certification

ULTEM™ 9085 FILAMENT (PEI)

ULTEM™ 9085 FILAMENT (PEI) is a high-performance filament based on the well-known rawmaterial ULTEM™ 9085.

» Excellent combination of high heat resistance and mechanical strength.
» High dimensional stability
» Continuous service temperature 170 °C
» Resistant to high-energy radiation
» Inherently flame retardant (UL94-V0)
» Print nozzle temperature 360°C
» Pressure plate temperature 160°C
» Pressure chamber temperature 90°C

APPLICATIONS:

» Rail
» Aerospace
» Automotive

PRODUCT RANGE:

» Colour: Natural and black
» Diameter: 1,75 mm
» 1 kg Spools

APPROVALS OF THE RAW MATERIAL:

» Aerospace FAR25.853 and OSU55/55
» Rail EN45545 R6-HL3

ISCC International Sustainability & Carbon Certification

ML9085 SUPPORT for ULTEM™ FILAMENT

ML9085 SUPPORT for ULTEM™ FILAMENT is SABIC's breakaway support filament for use with ULTEM™ AM9085F filament. The material maintains rigidity during printing and provides exceptional pliability during post processing to help enable easier removal of structural supports at room temperature, which can reduce the time required to produce finished parts. AMS31F and ULTEM™ 9085 PEI filaments are compatible with Stratasys® Fortus® Classic printers and open format industrial printers, subject to user testing.

» Print nozzle temperature 380-420°C
» Pressure plate temperature 160-185°C
» Pressure chamber temperature 90-110°C

PRODUCT RANGE:
» Colour: Natural
» Diameter: 1,75 mm
» 1 kg Spools

FIL-A-GEHR VXL® Products

GEHR® produces for **Xioneer®** soluble support materials for professional printing. There is also an environmentally friendly, mild detergent.

FIL-A-GEHR VXL 90® and FIL-A-GEHR VXL 130®

» Polymer made by **Xioneer®** in Germany
» Filamente made by **GEHR®** in Germany
» Soluble support materials
» Print effortlessly
» VXL 90 suitable for PETG, PA, ABS
» VXL 130 suitable for PEEK, PEKK, PC-ABS
» Unlike PVA or BVOH, our support material will not degrade in your nozzle.
» Less sensitive to humidity

FIL-A-GEHR VXL-EX

» Safe, mild detergent specially formulated to dissolve VXL safely
» VXL-EX is very economical. Only as much as you used VXL support material is needed; the correct amount of VXL-X in water is 2,4%

FURTHER INFORMATION

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