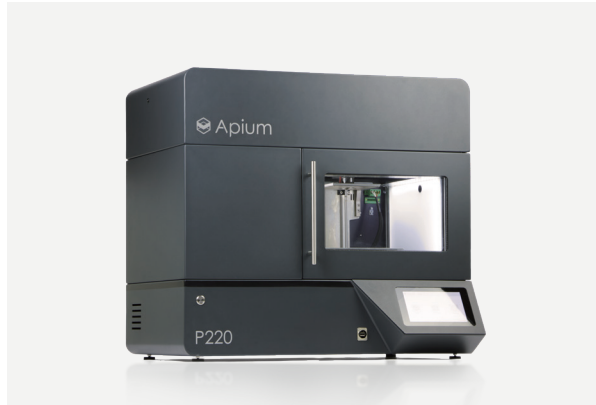


## About Apium

Apium Additive Technologies GmbH is a 3D-Printer manufacturing company located in Karlsruhe, Germany. Apium's products focus on filament processing of high performance, technical and compounded thermoplastic polymers by using material extrusion technology. Besides the technical applications, Apium also offers material and machines to create medical products, while complying with restrictions and requirements needed to do so.



## Description of Apium P220

The Apium P220 is a material extrusion based 3D-Printer designed to process high performance materials such as PEEK. The patented local heating technology allows the machine to process semi-crystalline polymers to a fully stable state. This means the part will result in a state of minimized inner stresses and highest possible amount of crystallinity. Thereby the printed part will exhibit the same properties as it is already known for from conventional methods.

Another advantage the machine offers is the high material flexibility. Materials can be changed with little effort and the user is free to use his material of choice without being restrained machine wise.

The Apium P220 monitors the process parameters during the print and creates a report document once the printing is finished. Due to the closed loop motors, the integrated camera for build up surveillance and integrated security features, the printer offers high repeatability and process stability.

### Evonik Specialty Chemicals (Shanghai) Co., Ltd.

Wang Yaodi  
Tel: +86 21 6119-1099  
Mobile Phone No.: +86 138 1704-6372  
Email: yaodi.wang@evonik.com  
68 Chundong Road, Xinzhuang Industrial Zone,  
Shanghai

### Apium Additive Technologies GmbH

Tel: +49 721 13 20 95 0  
Fax: +49 721 13 20 95 77  
E-Mail: info@apiumtec.com  
Technologiezentrum Karlsruhe  
Siemensallee 84  
76187 Karlsruhe - Germany

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## Evonik & Apium

### 3D Printing of Industrial Grade PEEK Filament Integrated Solutions White Paper



11/2021

## INFINAM® PEEK 9359 F

Evonik, one of the world leaders in specialty chemicals, has over 40 years of experience in the development and production of high-performance polymers. Its diversified product portfolio covers the solutions to almost all industrial applications. With its new 3D printing material brand INFINAM®, Evonik converges 20 years of experience, highest quality standards and innovation ability, so as to turn high-performance polymers and additives into ready-to-use 3D printing materials.

INFINAM® PEEK 9359 F is a high-performance, industrial grade PEEK filament that is easy to process in FFF (FDM) printers. Its unique properties make it suitable for fields of aerospace, transportation, oil and gas, etc. to manufacture lightweight and high-performance parts.

PEEK produced by Evonik is distinguished with the following properties:

- Excellent performance in heat resistance and chemical resistance
- Good warpage resistance
- Unique crystallization which gives significantly improved adhesion between layers in the vertical direction
- Compared to 3D printed stainless-steel parts, it is 80% lighter in weight and 30% tougher with excellent fatigue resistance making it an ideal substitution to 3D printing metal
- Superior wear resistance and low sliding friction which makes it suitable for producing lightweight structural parts
- Long-term temperature resistance at 250 °C and short-term temperature resistance at or above 300 °C
- Resists most organic and inorganic chemicals and only dissolves in concentrated sulfuric acid and nitric acid
- Inherently flame retardant with low smoke and toxicity
- Resistant to gamma radiation, 250C steam and hydrolysis
- Excellent wave transmission performance than metal does



### Test Data Summary (Filament: INFINAM® PEEK 9359F; Printer: Apium P220)

Properties	Testing Method	Unit	Test Result
<b>Thermal properties</b>			
Melting temperature DSC, 2nd heating	ISO 11357-1/-3	°C	340
Glass transition temperature	ISO 11357-1/-2	°C	154
Temp. of deflection under load A, 1.80MPa	ISO 75-1/-2	°C	154
Temp. of deflection under load A, 0.45MPa	ISO 75-1/-2	°C	237
<b>Mechanical properties<sup>1)</sup></b>			
Tensile modulus	ISO 527 -1BA	MPa	3500
Yield stress	ISO 527 -1BA	MPa	93
Yield strain	ISO 527 -1BA	%	5.1
Stress at break	ISO 527 -1BA	MPa	83
Strain at break	ISO 527 -1BA	%	7.2
Tensile modulus	ISO 527 -1A	MPa	3550
Yield stress	ISO 527 -1A	MPa	95
Yield strain	ISO 527 -1A	%	4.9
Stress at break	ISO 527 -1A	MPa	90
Strain at break	ISO 527 -1A	%	6.2
Flexural Modulus	ISO 178	MPa	3260
Max. flexural stress	ISO 178	MPa	148
Max. flexural strain	ISO 178	%	6.8
CHARPY impact strength, 23 °C	ISO 179/1eU	kJ/m <sup>2</sup>	123C <sup>2)</sup>
CHARPY impact strength, -30 °C	ISO 179/1eU	kJ/m <sup>2</sup>	83C
CHARPY notched impact strength, 23 °C	ISO 179/1eA	kJ/m <sup>2</sup>	9C
CHARPY notched impact strength, -30 °C	ISO 179/1eA	kJ/m <sup>2</sup>	8C

Test data shown in above table were obtained from specimens printed on Apium P220 printer by using optimized parameters for INFINAM® PEEK 9359F.

1) Specimens printed in XY axis  
2) C = Complete break, incl. hinge break H