forward am
run by Mass Additive Manufacturing

Ultrafuse® PP

Chemical resistant | biocompatible | low density

Extended TDS

Complete Technical Documentation and Testing Summary

Version 1.3

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Are you looking for an updated TDS version? Check out the latest online version here.

Technical Data Sheet

High-performance thermoplastic with low density, high elasticity and high resistance to fatigue.

Filament Properties		
Filament Diameter	1.75 mm	2.85 mm
Average diameter Tolerance	±0.050 mm	±0.1 mm
Average ovality	<0.050 mm	<0.050 mm
Available Spool size	750 g	750 g
Available colors	natural	

Spool Properties					
Spool size	750 g	750 g New Spool	2.5 kg	4.5 kg	8.5 kg
Outer diameter	200 mm	200 mm	300 mm	350 mm	355 mm
Inner diameter	50.5 mm	52 mm	51.5 mm	51.7 mm	36 mm
Width	55 mm	68 mm	103 mm	103 mm	167 mm

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Please contact us for further product information, like for example REACH, RoHS, FCS.

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Process materials in a well-ventilated room, or use professional extraction systems.

Recommended 3D-Print processing parameters		Used for test specimens
Printer	FFF printer	Ultimaker S5
Nozzle Temperature[1)]	220 – 240°C	240 °C
Build Chamber Temperature	-	-
Bed Temperature	60 – 80°C	80°C
Bed Material	PP adhesive or tape	Glass + magigoo PP
Nozzle Diameter	≥ 0.4 mm	0.4 mm
Print Speed	20 - 50 mm/s	40 mm/s
Max Volumetric Speed[2)]	8 mm^3/s	//

Please check your standard and/or high speed print profile availability for an easy start at www.forward-am.com.

Further Recommendations	
Drying recommendations to ensure printability and best mechanical properties[3)]	Ultrafuse® PP is in a printable condition, drying is not necessary.
Warehousing	Ultrafuse® PP filament should be stored at 15 - 25°C in its originally sealed package in a clean and dry environment. If the recommended storage conditions are observed the products will have a minimum shelf life of 12 months.

[1] Fast printing might require an additional increase of the nozzle temperature; the stated printing speed is based on current validations. As equipment and technology continues to evolve, it is possible that even higher printing speeds may be attainable in the future.
[2] Based on Bambu Lab X1C with a nozzle diameter of 0.4 mm
[3] Please note: To ensure constant material properties the material should always be kept dry.

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General Properties	Standard	Average Values
Filament Density[4]	ISO 1183-1	901 kg/m³

Tensile Properties[5]	Standard	Average Values		
		XY-Direction	XZ-Direction	ZX-Direction
Tensile strength[6]	ISO 527	15.5 MPa	-	9.0 MPa
Elongation at Break[6]	ISO 527	118.6 %	-	5.4 %
Young's Modulus[7]	ISO 527	541 MPa	-	435 MPa

Flexural Properties[6] [8]	Standard	Average Values		
		XY-Direction	XZ-Direction	ZX-Direction
Flexural Strength	ISO 178	22.9 MPa	21.4 MPa	15.6 MPa
Flexural Modulus	ISO 178	575 MPa	494 MPa	380 MPa
Flexural Elongation at Break	ISO 178	9.4 %	8.8 %	7.9 %

Impact Properties[6]	Standard	Average Values		
		XY-Direction	XZ-Direction	ZX-Direction
Impact Strength Charpy (notched)	ISO 179-2	5.3 kJ/m²	8.3 kJ/m²	2.5 kJ/m²
Impact Strength Charpy (unnotched)	ISO 179-2	41.8 kJ/m²	62.3 kJ/m²	13.6 kJ/m²
Impact Strength Izod (notched)	ISO 180	5.3 J/m	10.6 J/m	2.3 J/m
Impact Strength Izod (unnotched)	ISO 180	37.7 J/m	37.6 J/m	11.6 J/m

[4] measured on filament
[5] Samples were conditioned in standard climate (23°C, 50% RH 72h)
[6] Testing speed: 5 mm/min
[7] Testing speed: 1 mm/min
[8] Testing speed: 2 mm/min

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Thermal Properties[6)]	Standard	Average Values
HDT A at 1.8 MPa	ISO 75-2	49 °C
HDT B at 0.45 MPa	ISO 75-2	69 °C
Vicat softening point at 50 N	ISO 306	61 °C
Vicat softening point at 10 N	ISO 306	106 °C
Crystallization Temperature	ISO 11357-3	83 °C
Melting Temperature	ISO 11357-3	131 °C
Melt Volume-Flow Rate (MVR)	ISO 1133	6.7 cm^3/10 min (230 °C, 2.16 kg)
Melt Mass-Flow Rate (MFR)	ISO 1133	4.8 g/10 min (230 °C, 2.16 kg)

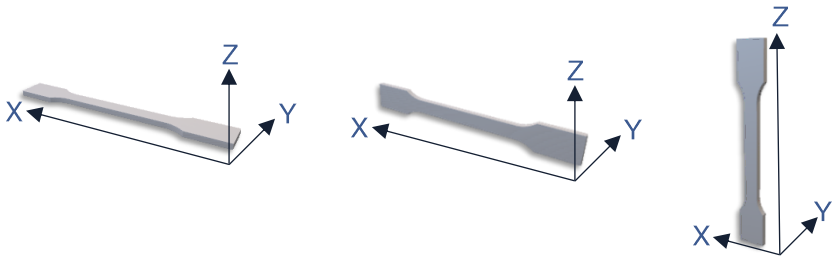
Hardness and Abrasion	Standard	Typical Values
Shore Hardness D (15s)	DIN ISO 7619-1	52

Biocompatibility	Standard	Typical Values
Cytotoxicity - Neutral Red	ISO 10993-5 (2009)	PASS
In Vivo Sensitization - Local Lymph Node Assay	ISO 10993-10 (2013)	PASS
In Vitro Skin Irritation	ISO 10993-10 (2013)	PASS

For the statement on Biocompatibility data see Chapter Biocompatibility.

Print direction explanation

The orientation of the 3D printed part in the printer is always aligned with the longest axis first. The print direction is consistently along the Z-axis.



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Biocompatibility

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Biocompatibility product Information

Product: Ultrafuse® PP
Revision: 12/3/2014

Version: 1.4

Contact:
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Ultrafuse® PP material is 3D printed as test specimens and successfully passed the requirements of the stated tests below:

- **Cytotoxicity XTT Test - Neutral red** (ISO 10993-5:2009)
  The extract of the product Ultrafuse® PP resulted in a cell vitality of more than 70% in comparison to the negative control and can therefore be considered to be not cytotoxic.
- **Skin Irritation Test** (ISO10993-10:2013)
  All 10 volunteers exhibited no dermal changes in the test zone at 24h, 48h and 72h when exposed to Ultrafuse® PP.
- **Skin Sensitisation Test - Local Lymph Node Assay KretinoSens** (ISO10993-10:2020)
  The extracts of the product Ultrafuse® PP resulted in an induction of the luciferase activity of less than 1.5 times compared to the DMSO control and is therefore assessed as non-sensitizing.

The performed biocompatibility tests were recorded on test specimen of the above referenced product to show compatibility of the material in general. The biocompatibility tests listed are not part of any continuous production protocol. The test assessments reflect only the test specimen and have to be retested on the final product. It remains the responsibility of the device manufacturers and/or end-users to determine the suitability of all printed parts for their respective application.

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