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run by Mass Additive Manufacturing

Ultrafuse® PAHT CF15

strong | chemical resistant | ESD safe

Extended TDS

Complete Technical Documentation and Testing Summary

Version 1.4

Contents

Technical Data Sheet 3

Mechanical Properties Diagrams 9

Thermal Properties Diagrams 11

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Technical Data Sheet

Advanced heat resistant material with very good processability.

Filament Properties		
Filament Diameter	1.75 mm	2.85 mm
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	black	

Spool Properties					
Spool size	750 g	750 g New Spool	2.0 kg	4.0 kg	8.0 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

Recommended 3D-Print processing parameters		Used for test specimens
Printer	FFF printer	dddrop
Nozzle Temperature[1)]	260 – 280 °C	285 °C
Build Chamber Temperature	-	-
Bed Temperature	100 – 120 °C	110 °C
Bed Material	PEI or Glass	Glass
Nozzle Diameter	≥ 0,6 mm, hardened	≥ 0.6 mm
Print Speed	30 - 80 mm/s	45 mm/s
Max Volumetric Speed[2)]	15 mm^3/s	//

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

[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 0.6 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.

Annealing Recommendations for Performance Enhancement		
Equipment	Use an oven which can heat up to ~100°C.	
Part preparation	Place the parts inside the oven. Fix larger parts to avoid potential deformation during the annealing process.	
Annealing Process[3]	Heating	From room temperature to 90°C in ~60 min (ramp up time).
	Holding the temperature	90°C for 120 min (thicker parts (>10mm) require a longer time).
	Cooling	From 90°C to room temperature in ~180 min (ramp down time).

Further Recommendations	
Drying recommendations to ensure printability and best mechanical properties[4]	80 °C in a hot air dryer or vacuum oven for at least 4 to 16 hours.
Support material compatibility	Single material breakaway, Ultrafuse® BVOH
Warehousing	Ultrafuse® PAHT CF15 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.

General Properties	Standard	Average Values
Filament Density[5]	ISO 1183-1	1203 kg/m^3
Poisson-Number conditioned[6]	ISO 527	0.51
Poisson-Number dry[7]	ISO 527	0.44

[3] The annealing process can lead to a minor deviation in the dimensional accuracy. It is observed for the cross section of DIN EN ISO 527 Type 1A tensile bars minor deviation of up to +2% in thickness (nominal value 4 mm) and -1% in width (nominal value 10 mm).
[4] Please note: To ensure constant material properties the material should always be kept dry.
[5] measured on filament
[6] Samples were conditioned in 336h at 70°C / 62% RH
[7] Samples were dried at 80°C vacuum until weight constancy

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Tensile Properties	Standard	Average Values		
		XY-Direction	XZ-Direction	ZX-Direction
Tensile strength[8] conditioned[6]	ISO 527	62.9 MPa	-	19.1 MPa
Tensile strength[11] dry[7]	ISO 527	103.2 MPa	-	18.2 MPa
Tensile strength[8] conditioned[6] annealed	ISO 527	54 MPa	-	7.9 MPa
Tensile strength[11] dry[7] annealed	ISO 527	80,5 MPa	-	8,14 MPa
Elongation at Break[11] conditioned[6]	ISO 527	2.9 %	-	0.8 %
Elongation at Break[11] dry[7]	ISO 527	1.8 %	-	0.5 %
Elongation at Break[11] conditioned[6] annealed	ISO 527	2,9 %	-	1.8 %
Elongation at Break[11] dry[7] annealed	ISO 527	1,7 %		0,8 %
Young's Modulus[9] conditioned[6]	ISO 527	5052 MPa	-	2455 MPa
Young's Modulus[12] dry[7]	ISO 527	8386 MPa	-	3532 MPa
Young's Modulus[9] conditioned[6] annealed	ISO 527	4102 MPa		795 MPa
Young's Modulus[12] dry[7] annealed	ISO 527	6588 MPa		1320 MPa

[8] Testing speed: 5
[9] Testing speed: 1 mm/min

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

Flexural Properties[10)]	Standard	Average Values		
		XY-Direction	XZ-Direction	ZX-Direction
Flexural Strength conditioned[6)]	ISO 178	125.1 MPa	121.9 MPa	56.0 MPa
Flexural Strength dry[7)]	ISO 178	160.7 MPa	171.8 MPa	50.8 MPa
Flexural Modulus conditioned[6)]	ISO 178	6063 MPa	6260 MPa	2190 MPa
Flexural Modulus dry[7)]	ISO 178	8258 MPa	7669 MPa	2715 MPa
Flexural Elongation at Break conditioned[6)]	ISO 178	No break	3.6 %	4.0 %
Flexural Elongation at Break dry[7)]	ISO 178	2.4 %	2.8 %	1.8 %

Impact Properties	Standard	Average Values		
		XY-Direction	XZ-Direction	ZX-Direction
Impact Strength Charpy (notched) conditioned[6)]	ISO 179-2	5.1 kJ/m²	5.3 kJ/m²	1.6 kJ/m²
Impact Strength Charpy (notched) dry[7)]	ISO 179-2	4.8 kJ/m²	3.9 kJ/m²	1.3 kJ/m²
Impact Strength Charpy (unnotched) conditioned[6)]	ISO 179-2	21.9 kJ/m²	20.4 kJ/m²	2.8 kJ/m²
Impact Strength Charpy (unnotched) dry[7)]	ISO 179-2	20.6 kJ/m²	19.3 kJ/m²	2.9 kJ/m²
Impact Strength Izod (notched) conditioned[6)]	ISO 180	6.5 J/m	5.8 J/m	-
Impact Strength Izod (notched) dry[7)]	ISO 180	4.9 J/m	5.1 J/m	-
Impact Strength Izod (unnotched) conditioned[6)]	ISO 180	16.3 J/m	15.1 J/m	4.1 J/m
Impact Strength Izod (unnotched) dry[7)]	ISO 180	16.4 J/m	18.1 J/m	2.9 J/m

For the diagrams on mechanical properties see Chapter: Mechanical Properties Diagrams

[10] Testing speed: 2 mm/min

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

Thermal Properties	Standard	Average Values
HDT A at 1.8 MPa conditioned[6)]	ISO 75-2	91 °C
HDT A at 1.8 MPa dry[7)]	ISO 75-2	92 °C
HDT B at 0.45 MPa conditioned[6)]	ISO 75-2	128 °C
HDT B at 0.45 MPa dry[7)]	ISO 75-2	145 °C
Vicat softening point at 50 N conditioned[6)]	ISO 306	192 °C
Vicat softening point at 50 N dry[7)]	ISO 306	205 °C
Vicat softening point at 10 N conditioned[6)]	ISO 306	217 °C
Vicat softening point at 10 N dry[7)]	ISO 306	221 °C
Glass Transition Temperature	ISO 11357-2	70 °C
Crystallization Temperature	ISO 11357-3	180 °C
Melting Temperature	ISO 11357-3	234 °C
Melt Volume-Flow Rate (MVR)	ISO 1133	42.2 cm^3/10 min (275 °C, 5 kg)

For the diagrams on thermal properties see Chapter: Thermal Properties Diagrams.

Electrical Properties[7)]	Standard	Average Values		
		X-Direction	Z-Direction	Y-Direction
Volume Resistivity	IEC 62631-3-1	3.2E+07 Ω cm	-	1.6E+05 Ω cm
Specific Surface resistivity	IEC 62631-3-2	9.7E+05 Ω	-	1.8E+06 Ω

Hardness and Abrasion	Standard	Typical Values
Shore Hardness D (15s)	DIN ISO 7619-1	72

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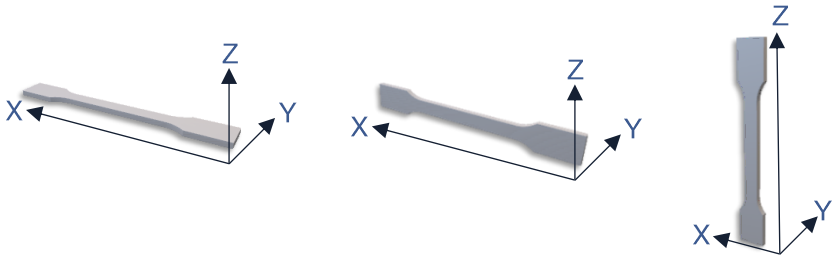
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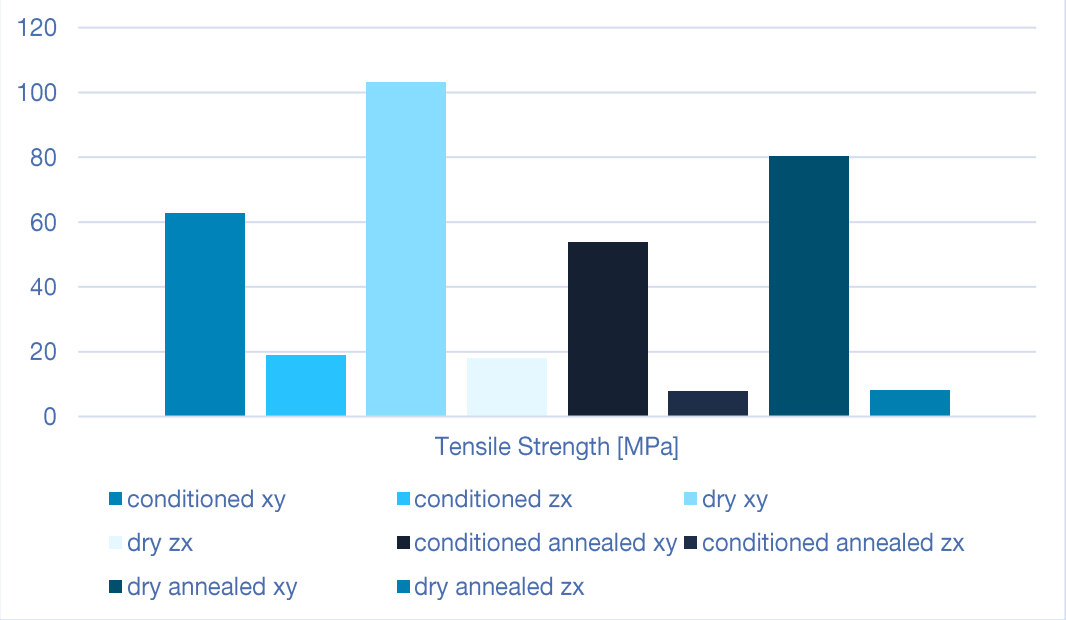
Print direction explanation

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.

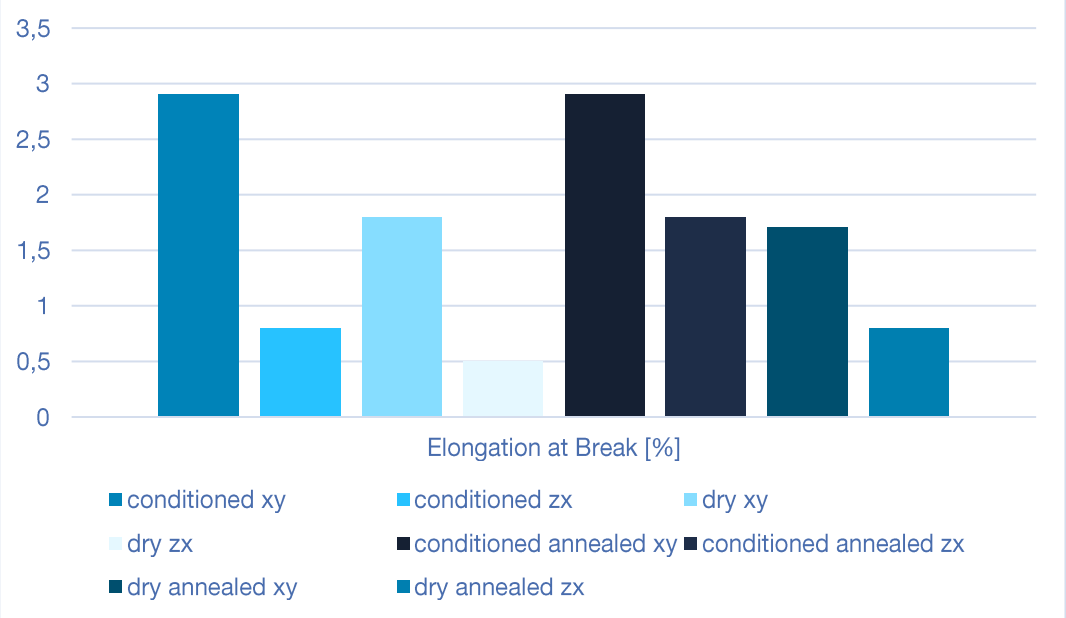


Mechanical Properties Diagrams

Tensile Strength

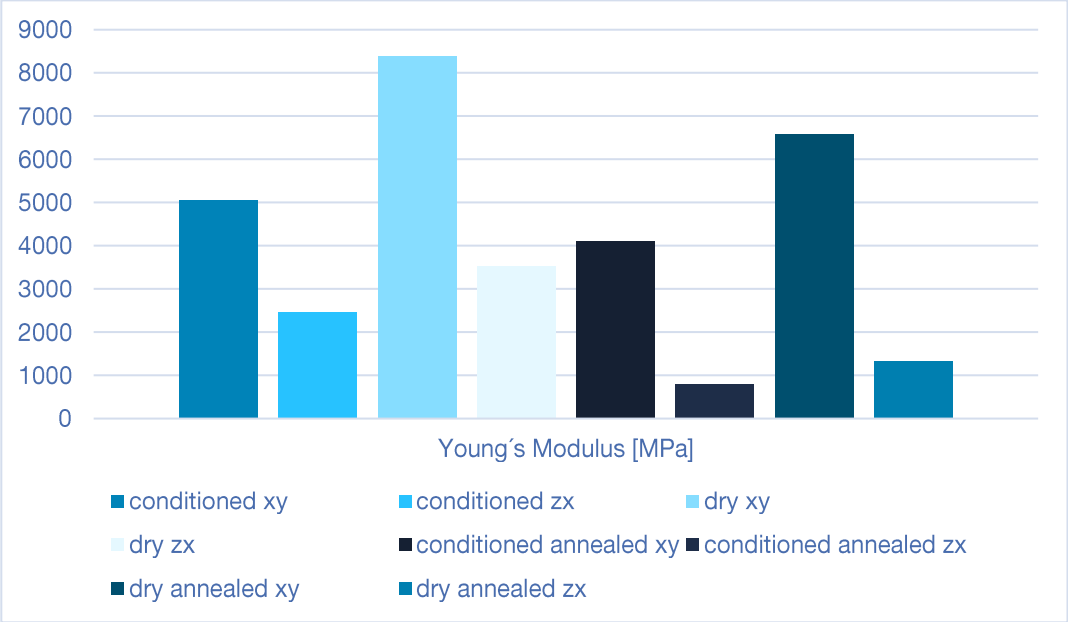


Tensile strength comparison Ultrafuse® PAHT CF15 conditioned, dry and annealed



Elongation at Break comparison Ultrafuse® PAHT CF15 conditioned, dry and annealed

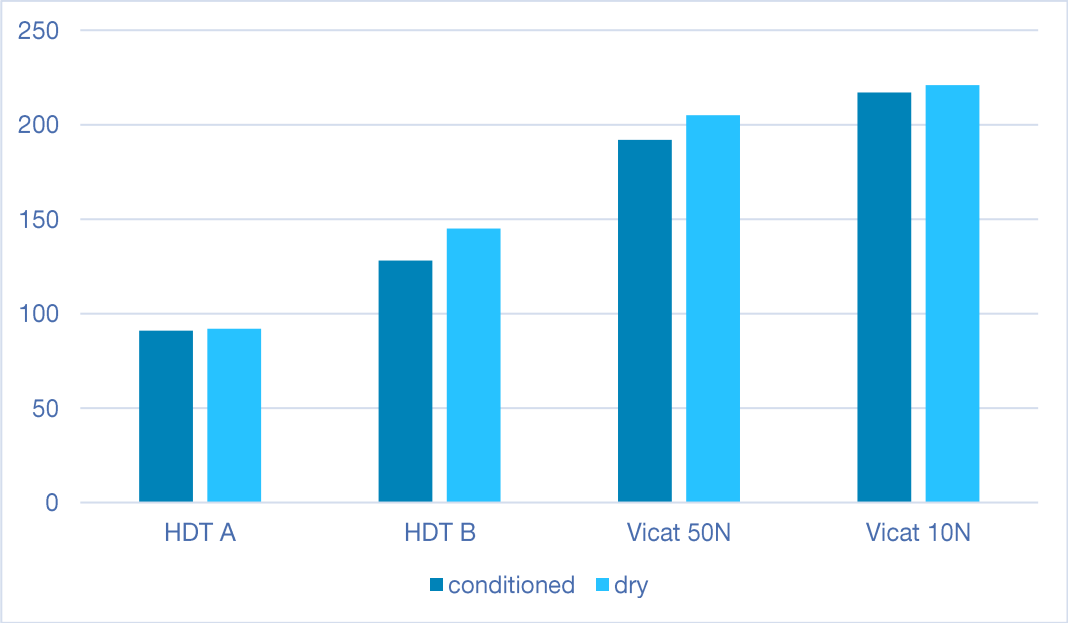
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Young´s Modulus comparison Ultrafuse® PAHT CF15 conditioned, dry and annealed

Thermal Properties Diagrams

HDT and Vicat



Heat resistance of Ultrafuse® PAHT CF15