Ultimaker

Ultimaker PLA
Technical data sheet

General overview

Chemical composition	See PLA safety data sheet, section 3
Description	Ultimaker PLA filament provides a no-hassle 3D printing experience thanks to its reliability and good surface quality. Our PLA is made from organic and renewable sources. It's safe, easy to print with, and it serves a wide range of applications for both novice and advanced users
Key features	Good tensile strength and surface quality, easy to work with at high print speeds, user-friendly for both home and office environments, PLA allows the creation of high-resolution parts. There is a wide range of color options available
Applications	Household tools, toys, educational projects, show objects, proto-typing, architectural models, as well as lost casting methods to create metal parts
Non-suitable for	Food contact and in vivo applications. Long term outdoor usage or applications where the printed part is exposed to temperatures higher than 59 °C

Filament specifications

	Method (standard)	Value
Diameter	–	2.85 ± 0.10 mm
Max roundness deviation	–	0.10 mm
Net filament weight	–	750 g
Filament length	–	~ 95 m

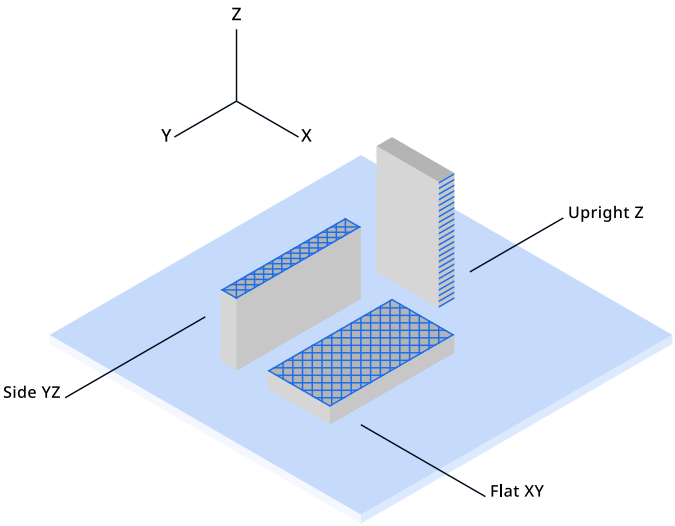
Color information

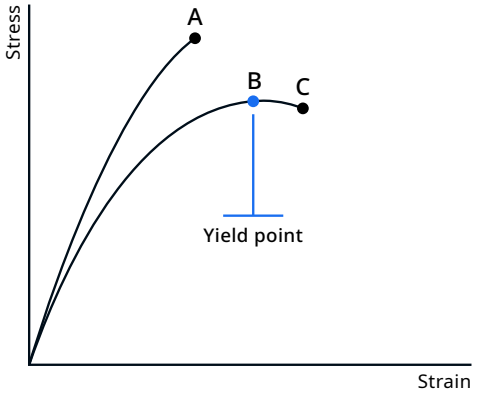
Color	Color code
PLA Green	RAL 6018
PLA Black	RAL 9005
PLA Silver Metallic	RAL 9006
PLA White	RAL 9010
PLA Transparant	N/A
PLA Orange	RAL 2008
PLA Blue	RAL 5002
PLA Magenta	RAL 4010
PLA Red	RAL 3020
PLA Yellow	RAL 1003
PLA Pearl White	RAL 1013

Mechanical properties

All samples were 3D printed. See ‘Notes’ section for details.

	Test method	Typical value		
		XY (Flat)	YZ (Side)	Z (Up)
Tensile (Young’s) modulus	ASTM D3039 (1 mm / min)	3250 ± 119 MPa	3292 ± 101 MPa	3071 ± 181 MPa
Tensile stress at yield	ASTM D3039 (5 mm / min)	52.5 ± 0.9 MPa	59.0 ± 0.7 MPa	No yield
Tensile stress at break	ASTM D3039 (5 mm / min)	45.5 ± 1.1 Mpa	56.0 ± 1.5 MPa	33.1 ± 2.8 MPa
Elongation at yield	ASTM D3039 (5 mm / min)	3.4 ± 0.0%	3.4 ± 0.1%	No yield
Elongation at break	ASTM D3039 (5 mm / min)	7.8 ± 1.2%	4.2 ± 0.7%	2.0 ± 0.2%
Flexural modulus	ISO 178 (1 mm / min)	3019 ± 87 MPa	2894 ± 53 MPa	2740 ± 47 MPa
Flexural strength	ISO 178 (5 mm / min)	96.8 MPa at 2.5% strain	101.3 MPa at 1.1% strain	52.0 MPa at 4.4% strain
Flexural strain at break	ISO 178 (5 mm / min)	4.8 ± 0.2%	No break (>10%)	1.9 ± 0.2%
Charpy impact strength (at 23 °C)	ISO 179-1 / 1eB (notched)	3.9 ± 0.4 kJ/m²	–	–
Hardness	ISO 7619-1 (Durometer, Shore D)	84 Shore D	–	–





A. Tensile stress at break, elongation at break (no yield point)
B. Tensile stress at yield, elongation at yield
C. Tensile stress at break, elongation at break

Print orientation

As the FFF process produces part in a layered structure, mechanical properties of the part vary depending on orientation of the part. In-plane there are differences between walls (following the contours of the part) and infill (layer of 45° lines). These differences can be seen in the the data for XY (printed flat on the build plate - mostly infill) and YZ (printed on its side - mostly walls). Additionally, the upright samples (Z direction) give information on the strength of the interlayer adhesion of the material. Typically the interlayer strength (Z) has the lowest strength in FFF.

Note: All samples are printed with 100% infill - blue lines in the ilustration indicate typical directionality of infill and walls in a printed part.

Tensile properties

Printed parts can yield before they break, where the material is deforming (necking) before it breaks completely. When this is the case, both the yield and break points will be reported. Typical materials that yield before breaking are materials with high toughness like Tough PLA, Nylon and CPE+.

If the material simply breaks without yielding, only the break point will be reported. This is the case for brittle materials like PLA and PC Transparant, as well as elastomers (like TPU).

Thermal properties

Samples marked with an asterisk (*) were 3D printed. See ‘Notes’ section for details.

	Test Method	Typical value
Melt mass-flow rate (MFR)	ISO 1133 (210 °C, 2.16 kg)	6.1 g / 10 min
Heat deflection (HDT) at 0.455 MPa*	ISO 75-2 / B	58.8 ± 0.4 °C
Vicat softening temperature*	ISO 306 / A120	64.5 ± 0.4 °C
Glass transition	ISO 11357 (DSC, 10 °C / min)	59.1 °C
Melting temperature	ISO 11357 (DSC, 10 °C / min)	151.8 °C

Other properties

Specific gravity	ASTM D1505	1.24 g / cm^3

Notes

*3D Printing: all samples were printed using a new spool of material loaded in an Ultimaker S5 Pro bundle with engineering intent profiles using 0.15 mm layer height with AA0.4 printcore and 100% infill, using Ultimaker Cura 4.9. Samples were printed ‘one-at-a-time’. Printed samples were conditioned in room temperature for at least 24h before measuring.

Specimen dimensions (L x W x H):
- Tensile test: 215 x 20 x 4 mm
- Flexural/Vicat/HDT: 80 x 10 x 4 mm
- Charpy: 80 x 10 x 4 mm with printed Notch (Type 1eB)

Disclaimer

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