PLA

It is the most economical polymer suitable for 3D printing, largely used for learning how to print and by amateurs to realize small prototypes.

It is considered one of the most eco-friendly polymers suitable for FFF machining because it can be obtained from plants' raw materials.

Hydrolysis products can be disposed of without special precautions. If burned, it leads to the formation of carbon monoxide.

Its workability is limited, as the low melting point makes it difficult to use sandpaper/machining with chip removal/glueing tools. It is compatible with cyano-acrylics, epoxies that cross-link at low temperatures and for long periods.

Ideal for printing purely aesthetic prototypes, even if its mechanical resistance is discreet.

Its greatest handicap lies in its very low chemical and thermal resistance: left in the sun it can soften, and it is easily attacked by acids and bases. It is soluble in organic solvents and halogenated, especially when they are at high temperatures.

It prints with the same support polymers (SSU04) used for ELASTO (soluble in cold water, given the low thermal resistance of PLA).

Suggested use

Prototypes (not functional)	
Food packaging	
Cosmetics	

Compatibilities

Support compatibility	SSU04 (water-soluble)
Material compatibility	ELASTO 85
	ELASTO 95

Easy profiles suggested

Layer	Ø 0.3 mm	Ø 0.4 mm	Ø 0.6mm	Ø 0.8 mm
0.10	**			
0.15	**	*		
0.20	*	**	**	
0.25		**		
0.30		*	**	*
0.40			*	**
0.50				*

** : Recommended
* : Discrete quality

Before printing

Drying	Gentle drying (lower then 40 °C) before the job is recommended
Cleaning	It's suggested to clean the bed with IPA before print
Extruder	NORMAL
Nozzle	Standard
SPFU	Not compatible

General advice

It is possible use PLA as RAFT material, printing it directly on bed plate. But SSU04 is advised for this aim. To improve bed adhesion water soluble PVA glue sticks (UHU, PRITT,...) can be used. Those glues can be washed away from the tray with warm water.

Manual support removal of any structure not related to thin/fragile area. Residual parts can be removed by cold water (40°C max). Ultrasonics or water circulation speeds up process.

*Physical properties**

Propriety	Symbol	Standard	Value
Density	ρ	ISO 1183-1	1.24 g/cm^3
Water absorption	w_w	N/A	N/A

*Thermal properties**

Propriety	Symbol	Standard	Value
Melting temperature	-	ISO 11357	135 °C
Glass transition temperature	T_g	ISO 11357	55 °C
Temperature deflection under load	HDT at 1.80 MPa	ASTM D648 Unannealed	N/A
Vicat softening temperature	VST B50	ASTM D1525 50 °C/min	55 °C
Coefficient of linear thermal expansion	α	N/A	N/A
Flammability		UL94	No

*Electrical properties**

Propriety	Symbol	Standard	Value
Surface resistivity	σ_e	N/A	N/A
Electric strength	E_B	N/A	N/A

* values provided by polymer supplier

Mechanical properties

Based on layer-by-layer deposition, additively manufactured parts, especially with the FDM technique, present a not negligible anisotropy on mechanical properties.

The user must think about the correct displacement of the part in the machine to maximize its mechanical properties.

For this reason, we report the mechanical properties of our specimens considering the three main orientations, by plane x-y (flat), by plane y-z (on edge), and by plane z-x (upright).

All specimens are made with the same printing conditions:

- Infill: 100%
- Nozzle: 0,4 mm
- Layer thickness: 0.2 mm
- Raster angle: 45 °

For more information about the test and specimens' conditions, we suggest checking the ISO references that are reported in the following tables.

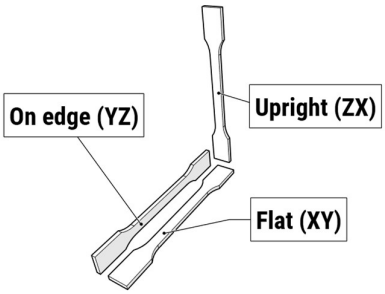


Figure 1: specimen displacement to determine tensile properties (ref. ISO 527-2)

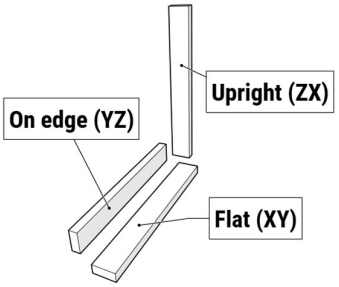
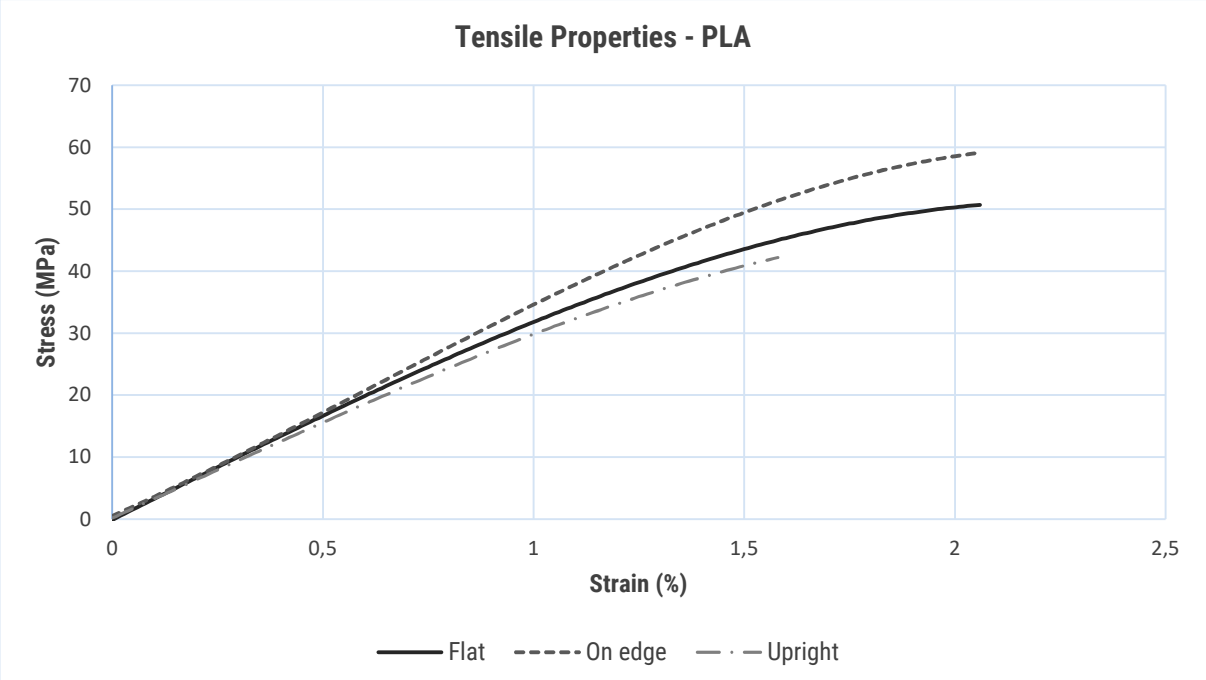


Figure 2: specimen displacement to determine flexural and impact properties (ref. ISO 178 and 179-1)

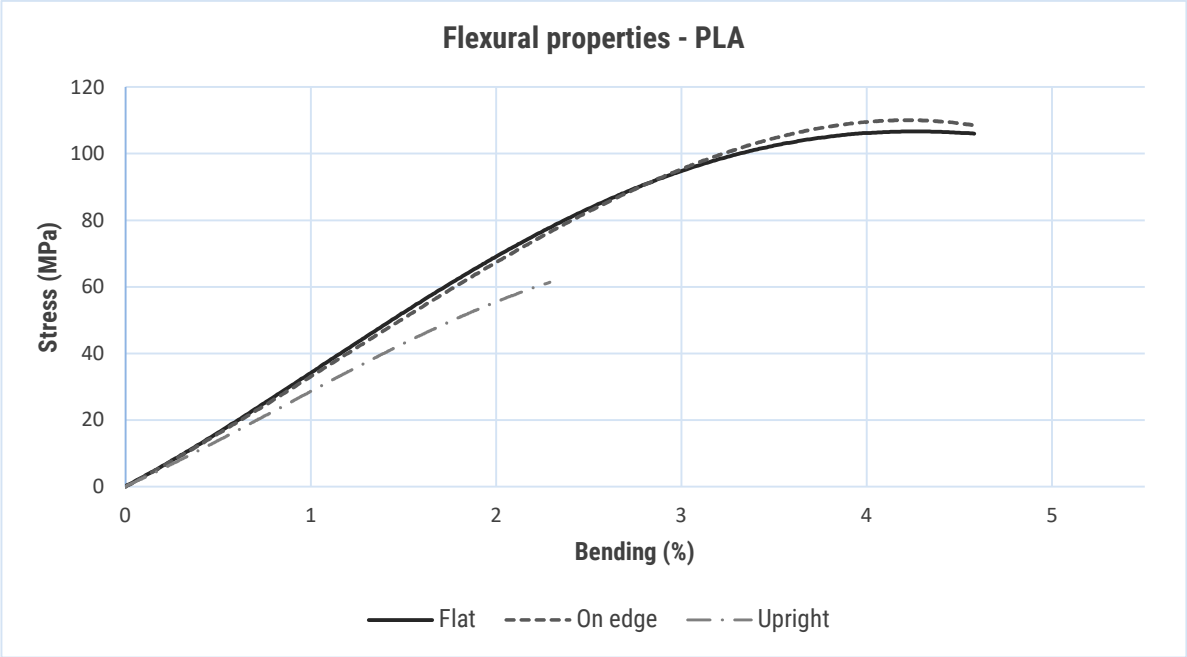
Tensile properties

Propriety	Symbol	Standard	Specimens build direction	Value
Tensile modulus	E_t	ISO 527-2	Flat	3260 MPa
			On edge	3480 MPa
			Upright	3100 MPa
Yield stress	σ_y		Flat	52 MPa
			On Edge	60 MPa
			Upright	No yield
Yield strain	ε_y		Flat	2.1 %
			On Edge	2.1 %
			Upright	No yield
Strength at break	σ_b		Flat	50 MPa
			On Edge	58 MPa
			Upright	41 MPa
Strain at break	ε_b		Flat	2.2 %
			On Edge	2.1 %
			Upright	1.6 %



Flexural properties

Propriety	Symbol	Standard	Specimens build direction	Value
Flexural modulus	E_f	ISO 178	Flat	3210 MPa
			On edge	3090 MPa
			Upright	2720 MPa
Flexural strength	σ_{fC}		Flat	102 MPa
			On Edge	104 MPa
			Upright[1]	64 MPa



Impact properties

Propriety	Symbol	Standard	Specimens build direction	Value
Charpy unnotched impact strength	a_{cu}	ISO 179	Flat	17 kJ/m^2
			On edge	26 kJ/m^2
			Upright	6 kJ/m^2
Type of failure	ToF		Flat	Comp. Break
			On Edge	Comp. Break
			Upright	Comp. Break

[1] It refers to the breaking point, at about 2.6 %.

The fine print

The information and values listed into this document are provided in good faith, based on specimens printed with 3ntr machines according to the latest version of SSI print parameters valid at the date of issuance.

3ntr provides you with this information for your guidance to select the correct polymer and setup but user is responsible for determining that 3ntr material is safe, technically correct and legal for the selected application.

The values listed in this documents are not meant for design specification or quality control guidelines: is it user responsibility to design parts with appropriate safety margins to comply with any material variation due part design, production, test conditions, use conditions.

The user has also the responsibility to assess the suitability of the product to the selected use, built with part(s) made with 3ntr materials and/or technologies.

3ntr is not responsible for any warranty about suitability, merchantability or fitness of any part manufactured with 3ntr materials and/or technologies.

3ntr is not responsible for any patent infringement from use of any part printed with 3ntr materials and/or technologies.

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