The Design to Manufacturing Co.

MATERIAL

NYLON 12

OVERVIEW

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FDM Nylon 12

FDM Thermoplastic Filament

The information presented are typical values intended for reference and comparison purposes only.
They should not be used for design specifications or quality control purposes.

Overview

FDM® Nylon 12 filament is the 3D printing equivalent of standard industrial PA12 (polyamide 12) material. A strong engineering thermoplastic, it exhibits toughness and high impact strength, without being brittle. Its excellent fatigue properties make it a good option for repetitive-flex applications such as snap-fit clips and closures and press-fit inserts.

Other applications include jigs, fixtures and low-volume production parts, as well as accurate prototyping of nylon 12 high-volume injection molded parts. FDM Nylon 12 is available in black.

Contents:

Ordering Information

Table 1. Printer and Support Material Compatibility

Printer	Model Tip (Slice)	Support Material	Support Tip
Fortus 450mc™	T12 (7 slice) T16 (10 slice) T20 (13 slice)	SR-110 (soluble)	T12SR100
Fortus 900mc™/F900™	T12 (7 slice) T16 (10 slice) T20 (13 slice)	SR-110 (soluble)	T12SR100

Build Sheet

Nylon

- 0.02 x 26 x 38 in. (0.51 x 660 x 965 mm)
- 0.02 x 16 x 18.5 in. (0.51 x 406 x 470 mm)

Table 2. FDM Nylon 12 Ordering Information

Part Number	Description
Filament Canisters [1] [2]	
355-02230	Nylon 12, 92.3 cu in. - Plus
310-21800	Nylon 12, 92.3 cu in. - Classic
355-03130	SR-110 soluble support, 92.3 cu in. - Plus
310-32200	SR-110 soluble support, 92.3 cu in. - Classic
Printer Consumables	
511-10301	T12 tip
511-10401	T16 tip
511-10701	T20 tip
511-10100	T12SR-100 tip
355-00750-S	Nylon build sheet, 0.02x16x18.5 in. (0.51x406x470 mm)
310-00450-S	Nylon build sheet, 0.03x16x18.5 in. (0.76x406x470 mm)
325-00650-S	Nylon build sheet, 0.02x26x38 in. (0.51x660x965 mm)
325-00750-S	Nylon build sheet, 0.02x14x16.5 in. (0.51x356x420mm)

[1] Classic canisters are compatible with all Fortus 900mc™ printers prior to s/n L502.

[2] Plus canisters are compatible with all Fortus 450mc™, all Stratasys F900™, and Fortus 900mc™ printers s/n L502 and up.

Physical Properties

Values are measured as printed. XY, XZ, and ZX orientations were tested.

Table 3. FDM Nylon 12 Physical Properties

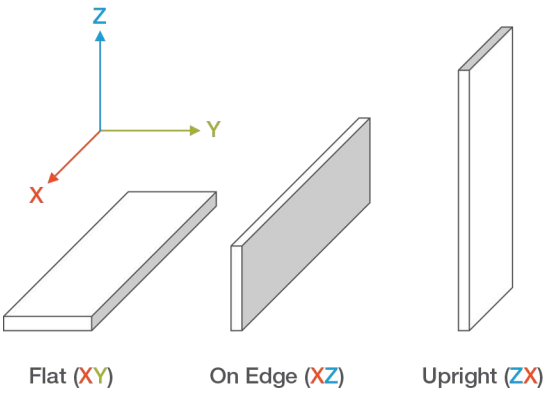
Property	Test Method	Typical Values	
		XY	XZ/ZX
HDT @ 66 psi	ASTM D648 Method B	94.7 C (202.5 F)	91.9 C (197.5 F)
HDT @ 264 psi	ASTM D648 Method B	84.3 C (183.8 F)	75.3 C (167.5 F)
Tg	ASTM D7426 Inflection Point	34.03 C (92.25 F)	
Mean CTE	ASTM E831 (-50 °C to 10 °C)	84.35 µm/[m*°C] 46.86 µin/[in*°F]	85.56 µm/[m*°C] 47.53 µin/[in*°F]
Mean CTE	ASTM E831 (10 °C to 45 °C)	89.12 µm/[m*°C] 49.51 µin/[in*°F]	-
Mean CTE	ASTM E831 (45 °C to 70 °C)	98.23 µm/[m*°C] 55.83 µin/[in*°F]	-
Mean CTE	ASTM E831 (70 °C to 95 °C)	60.08 µm/[m*°C] (33.38 µin/[in*°F])	-
Mean CTE	ASTM E831 (10C to 50C)	-	97.08 µm/[m*°C] 53.93 µin/[in*°F]
Mean CTE	ASTM E831 (50C to 70C)	-	102.8 µm/[m*°C] 57.11 µin/[in*°F]
Volume Resistivity	ASTM D257	> 6.87*10^13 Ω*cm	
Dielectric Constant	ASTM D150 1 kHz test condition	3.11	2.78
Dielectric Constant	ASTM D150 2 MHz test condition	2.48	2.52
Dissipation Factor	ASTM D150 1 kHz test condition	0.066	0.009
Dissipation Factor	ASTM D150 2 MHz test condition	0.014	0.008
Specific Gravity	ASTM D257 @23 °C	1.01	

Mechanical Properties

Nylon 12 samples were printed with a 0.010 in. (0.254 mm) layer height on the F900.

Print Orientation

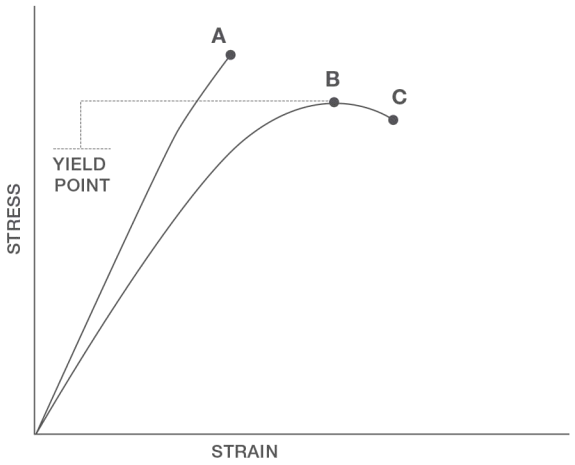
Parts created using FDM are anisotropic as a result of the printing process. Below is a reference of the different orientations used to characterize the material.



Flat (XY) On Edge (XZ) Upright (ZX)

Tensile Curves

Due to the anisotropic nature of FDM, tensile curves look different depending on orientation. Below is a guide of the two types of curves seen when printing tensile samples and what reported values mean.



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

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Table 4. FDM Nylon 12 Mechanical Properties (F900 - T16 Tip)

		XZ Orientation[1]	ZX Orientation[1]
Tensile Properties: ASTM D638			
Yield Strength	MPa	49.3 (0.48)	41.8 (0.67)
	psi	7140 (70)	6060 (97)
Elongation @ Yield	%	6.1 (0.068)	5.8 (0.16)
Strength @ Break	MPa	33.4 (1.7)	41.2 (0.72)
	psi	4840 (240)	5890 (100)
Elongation @ Break	%	30 (23)	6.5 (0.39)
Modulus (Elastic)	GPa	1.51 (0.087)	1.25 (0.12)
	ksi	218 (13)	181 (18)
Flexural Properties: ASTM D790, Procedure A			
Strength @ Break	MPa	No break	No break
	psi	No break	No break
Strength @ 5% Strain	MPa	56.5 (5.0)	54.5 (4.7)
	psi	8190 (720)	7900 (690)
Strain @ Break	%	No break	No break
Modulus	GPa	1.26 (0.13)	1.20 (0.12)
	ksi	182 (18)	174 (17)
Compression Properties: ASTM D695			
Yield Strength	MPa	327 (33)	557 (48)
	psi	47400 (4700)	80700 (7000)
Modulus	GPa	1.48 (0.069)	1.65 (0.091)
	ksi	215 (9.9)	240 (13)
Impact Properties: ASTM D256, ASTM D4812			
Notched	J/m	138 (22)	71.0 (14)
	ft*lb/in.	2.58 (0.41)	1.33 (0.27)
Unnotched	J/m	1800 (240)	322 (130)
	ft*lb/in.	33.8 (4.6)	6.03 (2.4)

[1] Values in parenthesis are standard deviations.

Appendix

Figure 1. 2nd heating scan DSC data for the Nylon 12 Flat (XY) sample.

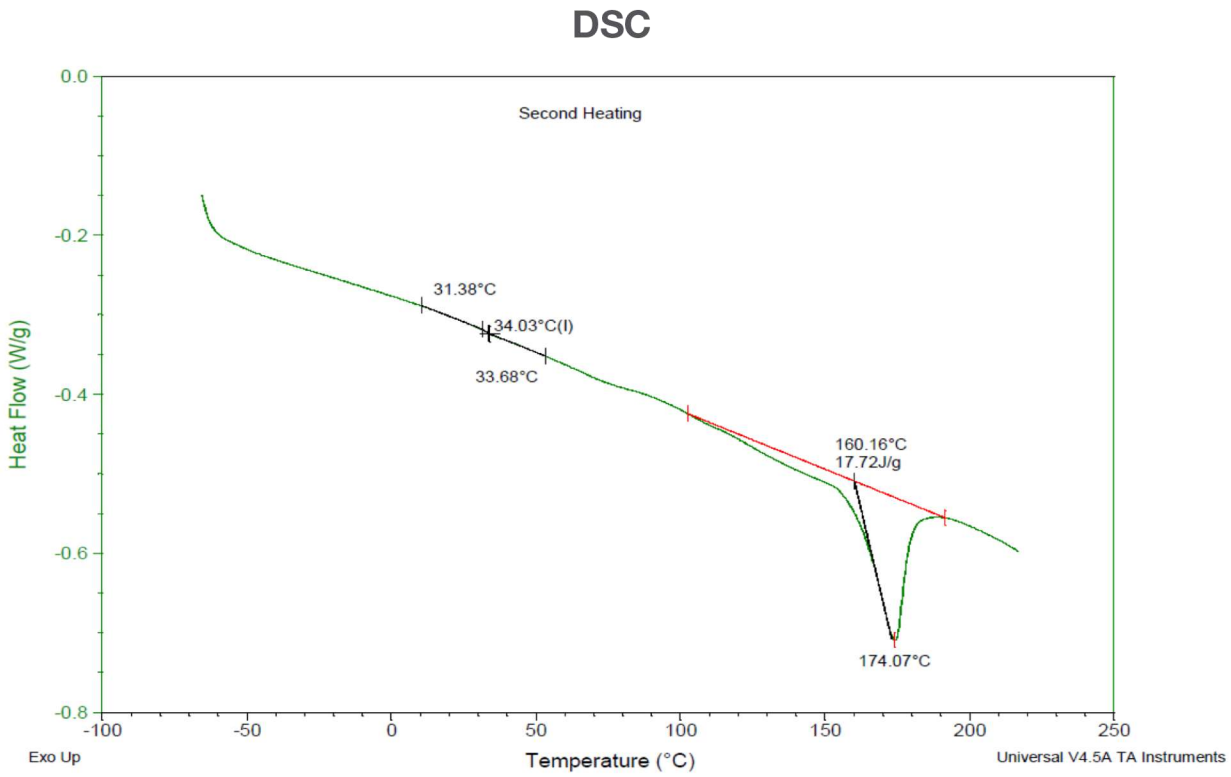

Figure 2. Dimension change data as a function of temperature for the Nylon 12 Flat (XY) sample.

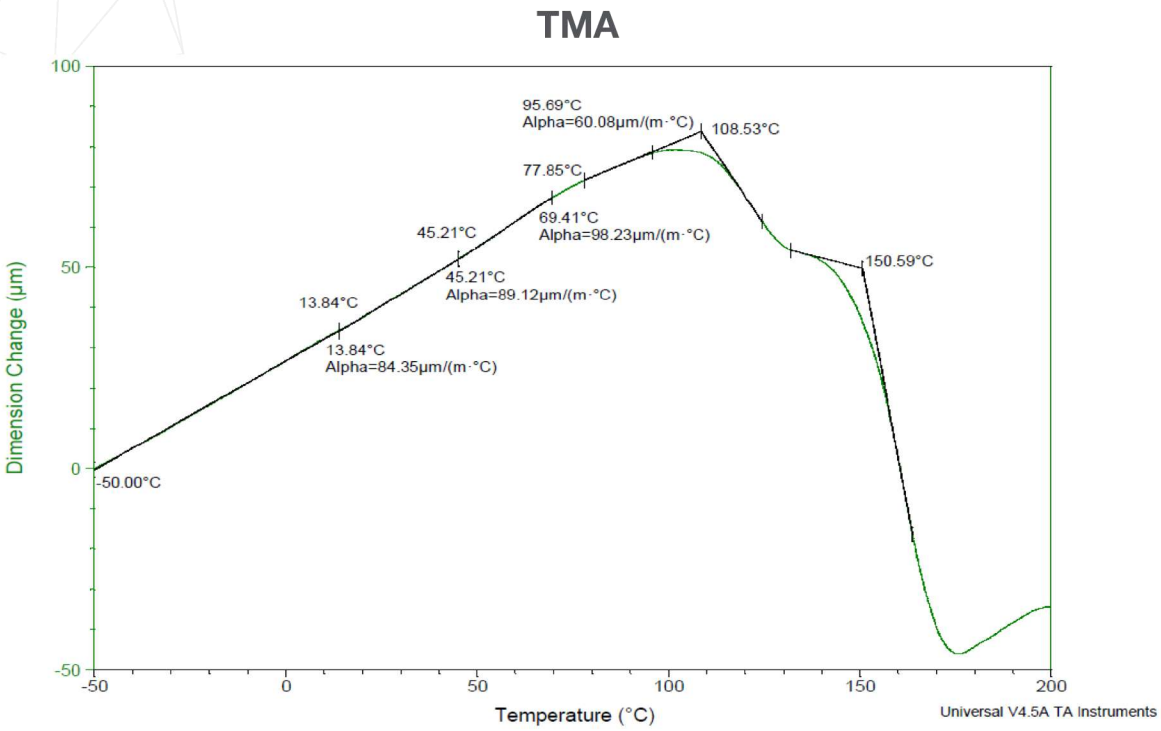

Figure 3. Dimension change data as a function of temperature for the Nylon 12 On Edge (XZ) sample.

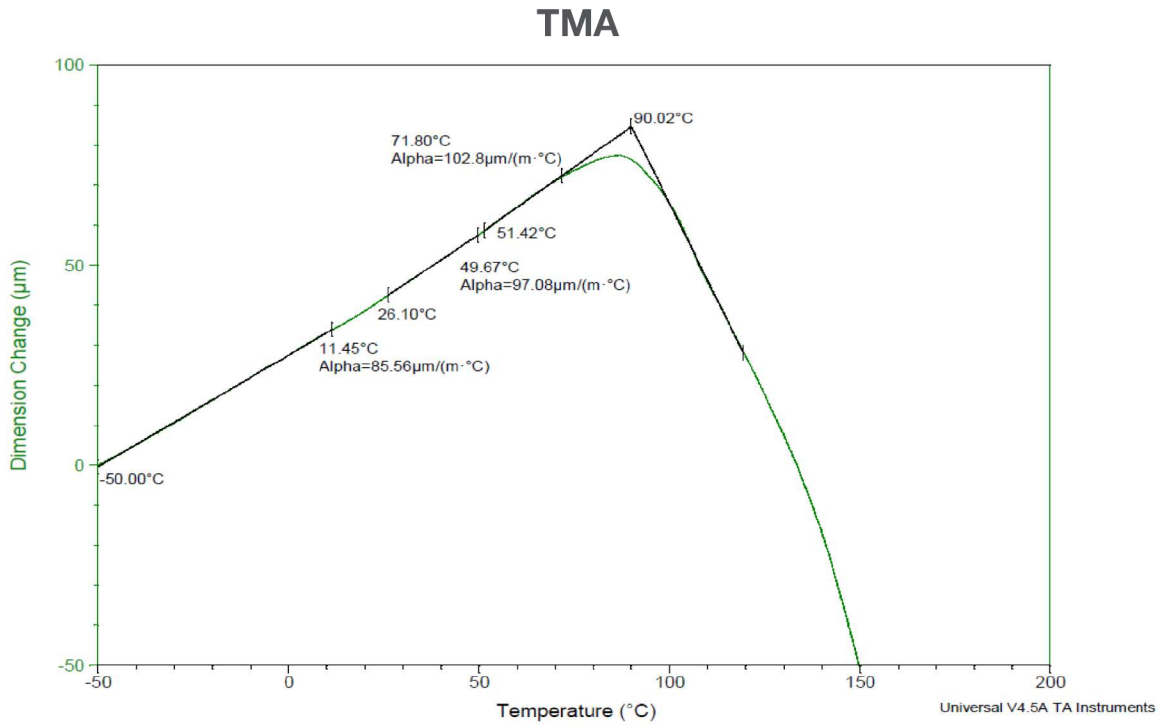

Figure 4. Overlay of the dimension change data for the Flat (XY) and On Edge (XZ) Nylon 12 samples.