stratasys

MATERIAL DATA SHEET
FDM

FDM Nylon-CF10

Carbon Fiber Filled 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-CF10 is a composite material combining a blended nylon polymer with 10% chopped carbon fiber (by weight), enhancing the material's strength and rigidity. The nylon base polymer also gives FDM Nylon-CF10 good chemical resistance.

Contents:

Ordering Information

Table 1: Printer and Support Material Compatibility

Printer	Model Tip	Layer Height	Support Material	Support Tip
F190™CR	F123CR Hardened Extrusion Head	0.178 mm (0.007 in.), 0.254 mm (0.010 in.), 0.330 mm (0.013 in.)	QSR Support™ (soluble support) SUP4000B™ (breakaway support)	F123 Standard Head
F370®CR	F123CR Hardened Extrusion Head	0.178 mm (0.007 in.), 0.254 mm (0.010 in.), 0.330 mm (0.013 in.)	QSR Support (soluble support) SUP4000B (breakaway support)	F123 Standard Head

Build Tray

- F190CR build tray
- F370CR build tray

System Requirements[1]

F190CR

- F123CR Hardened Head for FDM Nylon-CF10 (white cover, T20H tip)

F370CR

- F123CR Hardened Head for FDM Nylon-CF10 (white cover, T20H tip)

[1]Contact your Stratasys representative for ordering information.

Table 2: FDM Nylon-CF10 Ordering Information

Part Number	Description
Filament Spools	
333-90450	FDM Nylon-CF10 90 cu. in.
333-63500	QSR Support 60 cu. in.
333-60400	SUP4000B 60 cu. in.
Printer Consumables	
123-00602-S	F123CR Hardened Head for FDM Nylon-CF10 (white cover, T20H tip)
123-00402-S	Standard Extrusion Head (Black Cover)
123-00303-S	F190CR Build Tray, Standard
123-00304	F370CR Build Tray, Standard

Physical Properties

Values are measured as printed. XY, XZ, and ZX orientations were tested. For full details refer to the Stratasys Materials Test Report.

Table 3: FDM Nylon-CF10 Physical Properties

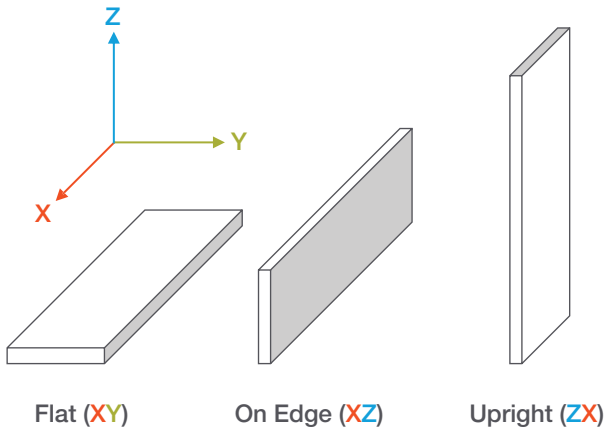
Property	Test Method	Typical Values	
		XY	XZ/ZX
HDT @ 66 psi	ASTM D648 Method B	58 °C (136 °F)	77 °C (171 °F)
HDT @ 264 psi	ASTM D648 Method B	52 °C (126 °F)	62 °C (144 °F)
Molded HDT @ 66 psi	ASTM D648 Method B	109 °C (228 °F)	
Molded HDT @ 264 psi	ASTM D648 Method B	105 °C (221 °F)	
Unidirectional Toolpaths HDT @ 66 psi	ASTM D648 Method B	67 °C (153 °F)	-
Unidirectional Toolpaths HDT @ 264 psi	ASTM D648 Method B	56 °C (133 °F)	-
Tg	ASTM D7426 Inflection Point	109 °C (228 °F)	
CTE (XY)	ASTM E831 (RT to 60 °C)	94 µm/[m*°C]	79 µm/[m*°C]
CTE (Z)	ASTM E831 (RT to 60 °C)	180 µm/[m*°C]	148 µm/[m*°C]
Volume Resistivity	ASTM D257	1.88E+15 Ω*cm	4.25E+13 Ω*cm
Specific Gravity	ASTM D792 @23 °C	1.1411	

Mechanical Properties

FDM Nylon-CF10 samples were printed with a 0.254 mm (0.010 in.) layer height. For full test procedure please see the Stratasys Materials Test Procedure.

Print Orientation

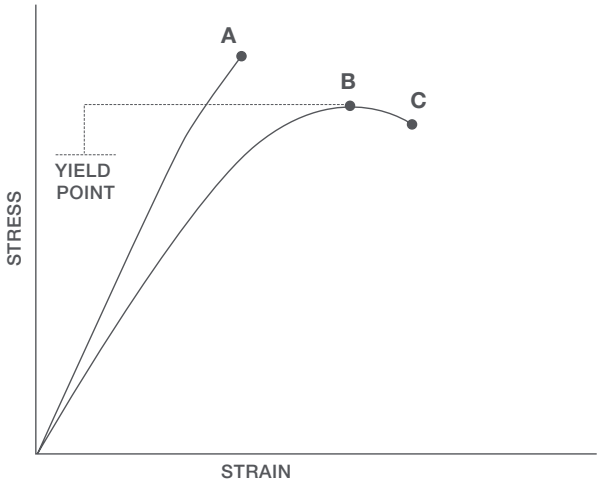
Parts created using FDM are anisotropic as a result of the printing process. Below is a reference of the different orientations used to characterize the material.



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

Table 4: FDM Nylon-CF10 Mechanical Properties with QSR Support

0.254 mm (0.010 in.) Layer Height		XZ Orientation[1]	ZX Orientation[1]
Tensile Properties: ASTM D638			
Yield Strength	MPa	69.1 (3.74)	25.4 (3.61)
	psi	10034 (543)	3684 (524)
Elongation @ Yield	%	4.44 (0.61)	2.52 (0.60)
Strength @ Break	MPa	67.6 (4.12)	24.7 (3.81)
	psi	9809 (598)	3576 (552)
Elongation @ Break	%	4.74 (0.73)	2.41 (0.62)
Modulus (Elastic)	GPa	4.15 (0.12)	1.57 (0.071)
	ksi	602 (16.7)	228 (10.3)
Flexural Properties: ASTM D790, Procedure A			
Strength @ Break	MPa	123.7 (2.74)	39.7 (3.49)
	psi	17940 (398)	5751 (506)
Strain @ Break	%	4.61 (0.24)	3.16 (0.44)
Modulus	GPa	5.37 (0.17)	1.54 (0.101)
	ksi	779 (24.7)	223 (14.7)
Compression Properties: ASTM D695			
Yield Strength	MPa	No Yield	No Yield
	psi	No Yield	No Yield
Peak Strength	MPa	76.1 (40.0)	124.2 (12.15)
	psi	11034 (5801)	18016 (1762)
Modulus	GPa	2.13 (0.041)	1.57 (0.045)
	ksi	309 (5.9)	228 (6.5)
Impact Properties: ASTM D256, ASTM D4812			
Notched	J/m	202.7 (8.6)	36.4 (13.4)
	ft*lb/in	3.79 (0.16)	0.68 (0.25)
Unnotched	J/m	1030.5 (74.3)	117.11 (17.1)
	ft*lb/in	19.27 (1.39)	2.19 (0.32)

[1] Values in parenthesis are standard deviations.

Table 5: FDM Nylon-CF10 Mechanical Properties with SUP4000B Support

0.254 mm (0.010 in.) Layer Height		XZ Orientation[1]	ZX Orientation[1]
Tensile Properties: ASTM D638			
Yield Strength	MPa	75.2 (2.0)	35.8 (1.1)
	psi	10900 (280)	5190 (160)
Elongation @ Yield	%	5.0 (0.29)	3.7 (0.33)
Strength @ Break	MPa	74.3 (2.1)	35.7 (1.1)
	psi	10800 (300)	5170 (160)
Elongation @ Break	%	5.4 (0.59)	3.7 (0.33)
Modulus (Elastic)	GPa	4.20 (0.086)	1.73 (0.031)
	ksi	609 (12)	251 (4.4)
Flexural Properties: ASTM D790, Procedure A			
Strength @ Break	MPa	132 (2.1)	57.7 (1.7)
	psi	19100 (310)	8370 (250)
Strain @ Break	%	4.7 (0.16)	4.6 (0.20)
Modulus	GPa	5.24 (0.084)	1.67 (0.039)
	ksi	760. (120)	243 (5.6)
Compression Properties: ASTM D695			
Peak Strength	MPa	80.6 (2.7)	139 (1.7)
	psi	11700 (390)	20100 (250)
Modulus	GPa	1.85 (0.036)	1.43 (0.034)
	ksi	268 (5.2)	208 (4.9)
Impact Properties: ASTM D256, ASTM D4812			
Notched	J/m	187 (7.2)	41.2 (6.3)
	ft*lb/in	3.50 (0.13)	0.772 (0.12)
Unnotched	J/m	1030 (73)	145 (15)
	ft*lb/in	19.4 (1.4)	2.71 (0.28)

Values in parenthesis are standard deviation.

Nylon-CF10 was tested using unidirectional toolpaths to showcase the increased mechanical properties this method of printing yields compared to the standard 45°/-45° toolpaths.

For further details read the Unidirectional Material Testing May Mislead Manufacturing White Paper

Table 6: FDM Nylon-CF10 Mechanical Properties with Unidirectional Toolpaths and QSR Support

0.254 mm (0.010 in.) Layer Height		XY Orientation[1]
Tensile Properties: ASTM D638		
Yield Strength	MPa	68.1 (1.1)
	psi	9880 (160)
Elongation @ Yield	%	4.8 (0.48)
Strength @ Break	MPa	64.4 (0.73)
	psi	9330 (110)
Elongation @ Break	%	5.1 (0.91)
Modulus (Elastic)	GPa	6.03 (0.15)
	ksi	875 (22)
Flexural Properties: ASTM D790, Procedure B		
Strength @ Break	MPa	138 (0.034)
	psi	20000 (720)
Strain @ Break	%	3.4 (0.25)
Modulus	GPa	6.96 (0.16)
	ksi	1010 (24)
Impact Properties: ASTM D256		
Notched	J/m	272 (7.5)
	ft*lb/in	5.1 (0.14)

[1] Values in parenthesis are standard deviation.

Chemical Resistance

Nylon-CF10 coupons were built on the F370CR with 0.254 mm (0.010 in.) layer height and QSR support material. The coupons were tested for resistance to chemical exposure by soaking in reagents for 72 hours. Afterwards the coupons were tensile tested following ASTM D638. Chemicals tested and percent change from control is listed below.

Table 6: Change in Mechanical Properties - 72 hour Chemical Exposure

	Reagent	XZ	ZX
Tensile Strength	30% Nitric Acid	-32%	-43%
	30% Sulfuric Acid	-24%	-23%
	40% Sodium Hydroxide	-1%	-5%
	Concentrated Ammonia	-33%	-34%
% Elongation @ break	30% Nitric Acid	132%	-33%
	30% Sulfuric Acid	59%	-9%
	40% Sodium Hydroxide	-9%	-20%
	Concentrated Ammonia	90%	-1%
Tensile Modulus	30% Nitric Acid	-21%	6%
	30% Sulfuric Acid	3%	13%
	40% Sodium Hydroxide	17%	38%
	Concentrated Ammonia	2%	-12%

stratasys

stratasys.com
ISO 9001:2015
Certified

Stratasys Headquarters
7665 Commerce Way,
Eden Prairie, MN 55344
+1 800 801 6491 (US Toll Free)
+1 952 937-3000 (Intl)
+1 952 937-0070 (Fax)

1 Holtzman St., Science Park,
PO Box 2496
Rehovot 76124, Israel
+972 74 745 4000
+972 74 745 5000 (Fax)