stratasys

MATERIAL DATA SHEET
FDM

ABS-CF10

Carbon Fiber Filled ABS
FDM Thermoplastic Filament

Overview

Stratasys ABS-CF10 combines standard ABS (acrylonitrile butadiene styrene) material with 10% chopped carbon fiber by weight. The result is a low moisture-sensitive FDM® thermoplastic 50% stiffer and 15% stronger than standard ABS 3D printing material.

Typical applications include manufacturing tools, jigs, fixtures and end effectors that benefit from the combination of increased stiffness and reduced weight.

Contents:

Product Information

Table 1: Printer Compatibility

Printer	Model Tip	Layer Height	Support Material	Support Tip
F170™	F123 T14H Hardened Head	0.127 mm (0.005 in.), 0.178 mm (0.007 in.), 0.254 mm (0.010 in.), 0.330 mm (0.013 in.)	QSR™ Support	F123 Head
F190™CR	F123 T14H Hardened Head	0.127 mm (0.005 in.), 0.178 mm (0.007 in.), 0.254 mm (0.010 in.), 0.330 mm (0.013 in.)	QSR Support	F123 Head
F370™	F123 T14H Hardened Head	0.127 mm (0.005 in.), 0.178 mm (0.007 in.), 0.254 mm (0.010 in.), 0.330 mm (0.013 in.)	QSR Support	F123 Head
F370®CR	F123 T14H Hardened Head	0.127 mm (0.005 in.), 0.178 mm (0.007 in.), 0.254 mm (0.010 in.), 0.330 mm (0.013 in.)	QSR Support	F123 Head

Support Material

- QSR soluble support

Build Tray

- F170 build tray
- F190CR build tray
- F370/F370CR build tray

System Requirements[1]

F123/F123 CR[2]

F123 T14H hardened head (light gray cover, 1,500 hour head life)[3] OR F123 ABS-CF10 non hardened head (green cover, 700 hour head life) OR Standard F123 head (black cover, recommended head life of 700 hours)

[1] Contact your Stratasys representative for ordering information
[2] F170, F190CR, F370, F370CR
[3] Required for Visual Mode; 0.127 mm (0.005 in.) layer height

Table 2: ABS-CF10 Ordering Information

Part Number	Description	System Compatibility
Filament Consumables		
F123 Spools		
333-90310	ABS-CF10, 90 cu. in.	F170, F190CR, F370, F370CR
333-63500	QSR Soluble Support, 60 cu. in. - F123	
Printer Consumables		
F123		
123-00302-S	F170 Build Tray, Standard	F170
123-00303-S	F190CR Build Tray, Standard	F190CR
123-00304	F370/F370CR Build Tray, Standard	F370, F370CR
Print Heads		
F123		
123-00603-S	ABS-CF10 Hardened Head - Recommended (Light Gray Cover)	F170, F190CR, F370, F370CR
123-00601-S	ABS-CF10 Head (Green Cover)	
123-00402-S	Standard Extrusion Head (Black Cover)	

Physical Properties

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.

Values are measured as printed. XY, XZ, and ZX orientations were tested. For full details refer to the Stratasys Materials Test Report. DSC and TMA curves can be found in the Appendix.

Table 3: ABS-CF10 Physical Properties

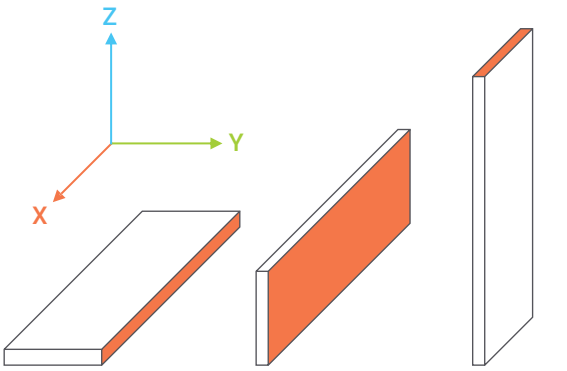
Property	Test Method	Typical Values	
		XY	XZ/ZX
HDT @ 66 psi	ASTM D648 Method B	112.2 °C (234.0 °F)	113.5 °C (236.4 °F)
HDT @ 264 psi	ASTM D648 Method B	111.4 °C (232.6 °F)	112.9 °C (235.2 °F)
Molded HDT @ 66 psi	ASTM D648 Method B	100 °C (212 °F)	
Molded HDT @ 264 psi	ASTM D648 Method B	99 °C (210 °F)	
Tg	ASTM D7426 Inflection Point	104 °C (219 °F)	
Mean CTE	ASTM E831 (-50 °C to 100 °C)	19 µm/[m*°C] (11 µin/[in*°F])	76 µm/[m*°C] (42 µin/[in*°F])
Volume Resistivity	ASTM D257	4.6×10^{12} Ω*cm	
Specific Gravity	ASTM D792 @23 °C	1.0972	
Dielectric Constant	ASTM D150 1 kHz test condition	2.26	11.1
Dielectric Constant	ASTM D150 2 MHz test condition	2.16	-0.001
Dissipation Factor	ASTM D150 1 kHz test condition	0.000	-0.011
Dissipation Factor	ASTM D150 2 MHz test condition	10.18	-0.014

Mechanical Properties

ABS-CF10 samples were printed with a 0.254 mm (0.010 in.) layer height on the F370 using the Standard Extrusion Head. For the full test procedure please see the Stratasys Materials Test Procedure.

Print Orientation

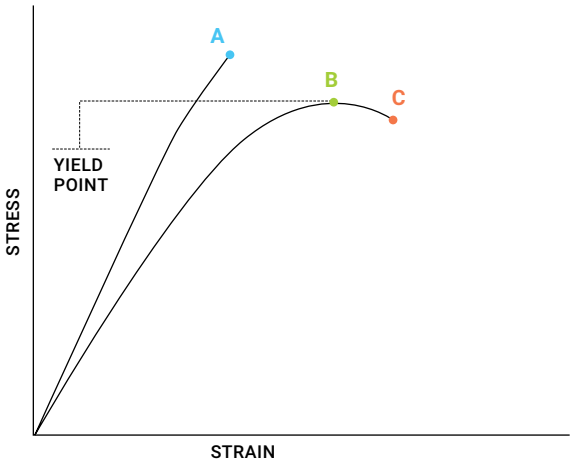
Parts created using FDM are anisotropic as a result of the printing process. Below is a reference of the different orientations used to characterize the material.



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: ABS-CF10 Mechanical Properties - F370CR - Hardened Head

0.254 mm (0.010 in.) Layer Height		XZ Orientation[1]	ZX Orientation[1]
Tensile Properties: ASTM D638			
Yield Strength	MPa	39.4 (0.45)	19.6 (1.2)
	psi	5,720 (65)	2,840 (170)
Elongation @ Yield	%	1.6 (0.052)	1.1 (0.092)
Strength @ Break	MPa	39.4 (0.41)	19.7 (1.1)
	psi	5,720 (60)	2,850 (160)
Elongation @ Break	%	1.6 (0.06)	1.1 (0.086)
Modulus (Elastic)	GPa	3.8 (0.049)	2.27 (0.039)
	ksi	551 (7.1)	330 (5.7)
Flexural Properties: ASTM D790, Procedure A			
Strength @ Break	MPa	74.5 (1.3)	27.6 (2.5)
	psi	10,800 (190)	4,000 (360)
Strain @ Break	%	2.4 (0.12)	1.5 (0.13)
Modulus	GPa	4.19 (0.12)	1.85 (0.12)
	ksi	608 (18)	269 (17)
Compression Properties: ASTM D695			
Peak Strength	MPa	68.9 (1.5)	102 (1.4)
	psi	10,000 (220)	14,800 (200)
Modulus	GPa	2 (0.11)	1.92 (0.027)
	ksi	289 (17)	279 (3.9)
Impact Properties: ASTM D256, ASTM D4812			
Notched	J/m	49 (1.4)	19.6 (4)
	ft*lb/in	0.918 (0.027)	0.367 (0.074)
Unnotched	J/m	162 (11)	45.7 (11)
	ft*lb/in	3.04 (0.2)	0.857 (0.2)

[1]Values in parentheses are standard deviations.

Mechanical Performance with Unidirectional Toolpaths

ABS-CF10 samples were printed with a 0.254 mm (0.010 in.) layer height on the F370CR using the T14H Hardened Extrusion Head. The Stratasys typical testing procedure follows our default “45/-45” raster toolpath generation where the first raster layer is 45° in the XY plane and the next layer is perpendicular to that (-45°). The data in this section has unidirectional toolpaths, where all toolpaths are aligned in the XY plane and along the axis for the mechanical test. This method of optimizing toolpaths is appropriate to show the maximum strength for filled materials, but should be used with caution as it is not representative of typical part toolpaths and strength. For further information on this test method, refer to the Stratasys Materials Testing Procedure and the Unidirectional Material Testing May Mislead Manufacturing white paper.

Table 5: Mechanical Performance of ABS-CF10 with Unidirectional Toolpaths

0.010 in layer height		XY Orientation
Tensile Properties: ASTM D638		
Yield Strength	MPa	44.9
	psi	6,500
Elongation @ Yield	%	1.2
Strength @ Break	MPa	44.6
	psi	6,470
Elongation @ Break	%	1.2
Modulus (Elastic)	GPa	5.22
	ksi	756
Flexural Properties: ASTM D790, Procedure A		
Strength @ Break	MPa	89.3
	psi	31.0
Strain @ Break	%	2.6
Modulus	GPa	4.96
	ksi	719
Impact Properties: ASTM D256, ASTM D4812		
Notched	J/m	79.2
	ft*lb/in	1.48
Heat Deflection Temperature: ASTM D648, Method B		
HDT @ 66 psi	°C	117
	°F	242
HDT @ 264 psi	°C	112
	°F	233

UV Aging

ABS-CF10 samples were printed with a 0.254 mm (0.010 in.) layer height on the F370 using the Standard Extrusion Head. ABS-CF10 was tested before and after UV exposure. Ten ASTM D638 upright (ZX) dogbones were tested in tensile after UV exposure and an additional 10 ASTM D638 ZX dogbones were the control (no UV Exposure). The UV exposed samples were cycled in the QUV chamber per ASTM G154 (Standard Practice for Operation Fluorescent Light Apparatus for UV exposure of Nonmetallic Materials) for 1,000 hours, alternating for 8 hours at 60°C (140°F) and 4 hours at 50°C (122°F) with humidity and condensation. The increase in stress in break is from the control samples. For more information see the Impact of UV Exposure on FDM Materials white paper.

Table 6: ABS-CF10 UV Exposure Test Results

Material	Conditioning	Yield Strength		Stress at Break		Elongation at Break	Increase in Stress at Break	Modulus	
		(psi)	(MPa)	(psi)	(MPa)	%	%	(ksi)	(GPa)
ABS-CF10	No UV Exposure	3,150	21.7	3,140	21.7	1.5		284	1.96
	UV Exposure	301	20.8	2,990	20.6	1.3	-4.90	295	2.03

Appendix

Figure 1: DSC data for the ABS-CF10 sample.

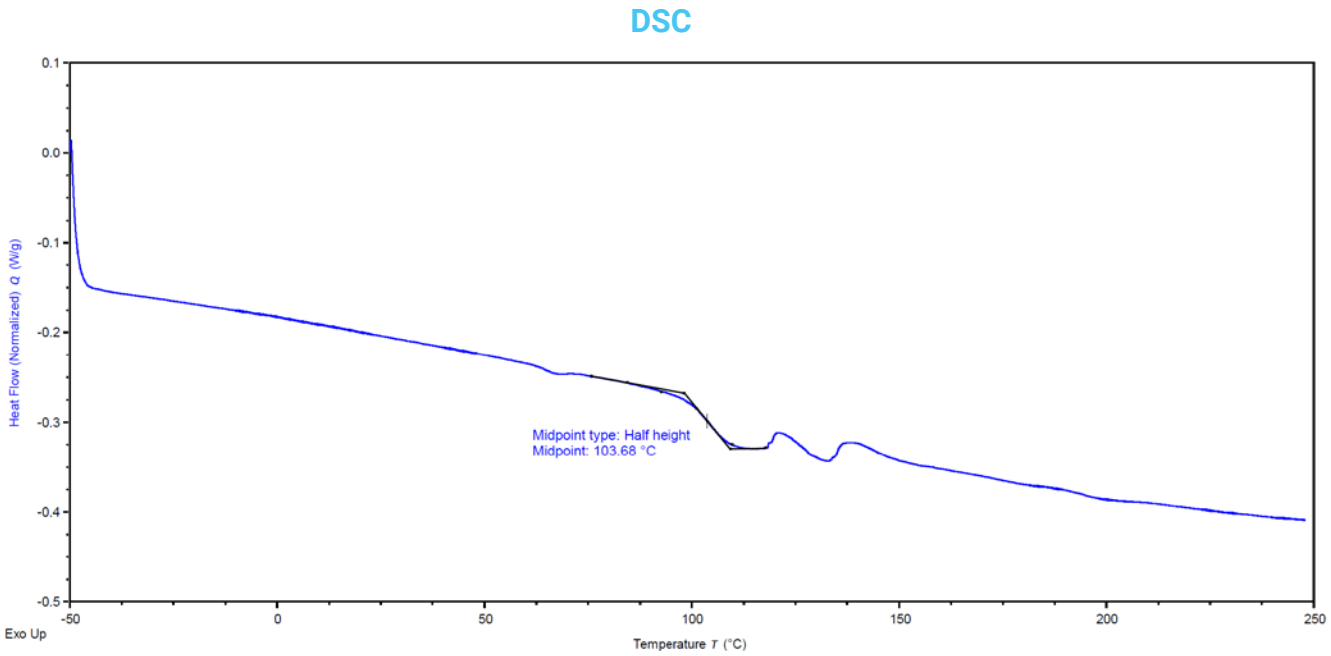


Figure 2: Dimension change data as a function of temperature for ABS-CF10 Flat (XY) sample.

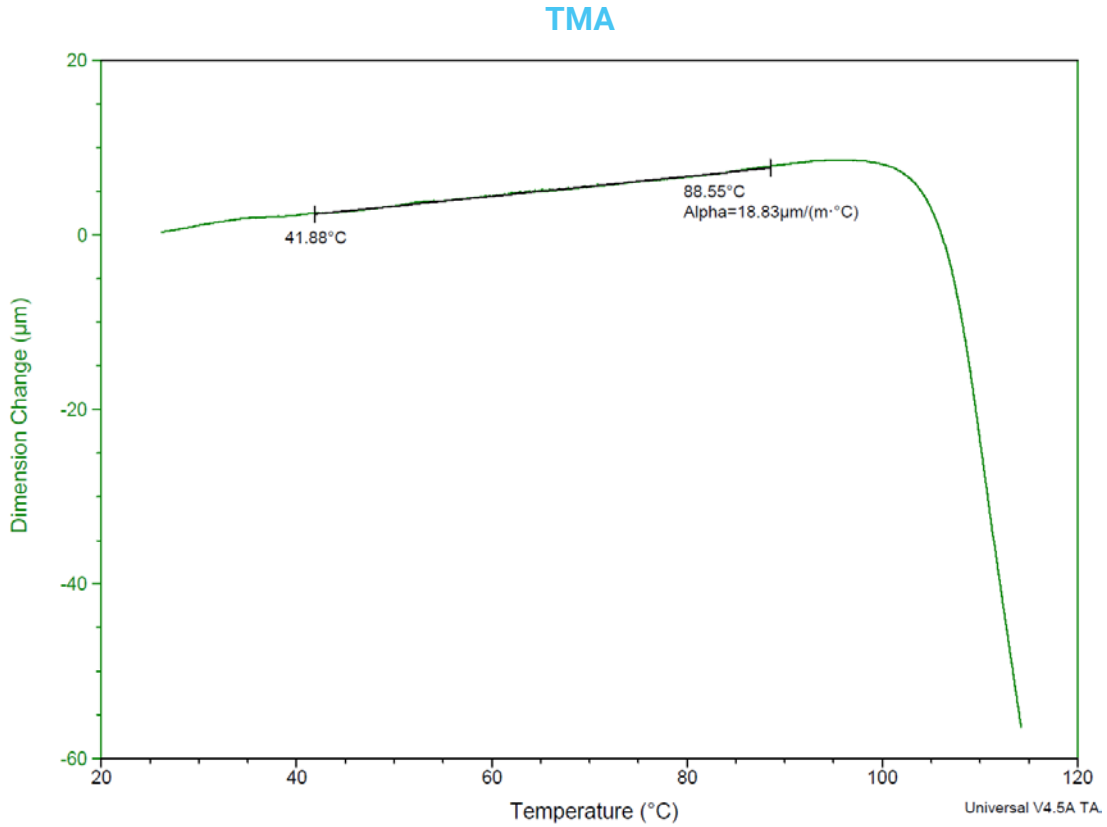
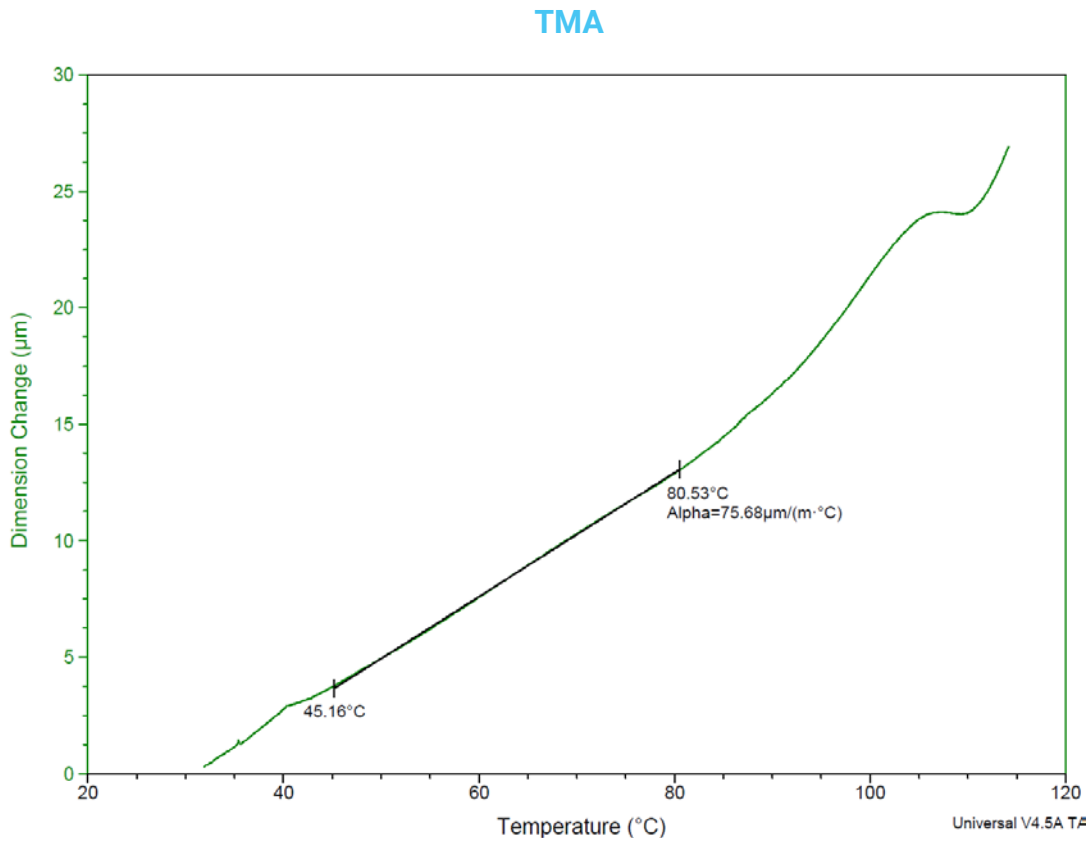


Figure 3: Dimension change data as a function of temperature for ABS-CF10 On Edge (XZ) sample.



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