stratasys

MATERIAL DATA SHEET
FDM

ASA

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

ASA (acrylonitrile styrene acrylate) FDM® filament is a broad-use commodity thermoplastic. It is similar to ABS (acrylonitrile butadiene styrene) but exhibits better UV resistance, mechanical properties and aesthetics than ABS.

ASA is suitable for most general-purpose 3D printing applications involving prototyping, jigs and fixtures and low-volume production parts. ASA filament is available in the most colors of any FDM material.

Contents:

Overview 2

Ordering Information 3

Physical Properties 8

Mechanical Properties 9

UV Aging 14

Appendix 14

Ordering Information

Table 1: Printer and Support Material Compatibility

Printer	Model Tip	Layer Height	Support Material	Support Tip
F170™	F123 Standard 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™ (soluble)	F123 Standard Head
F190™CR	F123 Standard 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 (soluble)	F123 Standard Head
F370™	F123 Standard 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 (soluble)	F123 Standard Head
F370®CR	F123 Standard 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 (soluble)	F123 Standard Head
F770™	F123 Standard Head	0.178 mm (0.007 in.), 0.254 mm (0.010 in.), 0.330 mm (0.013 in.)	SR-30 (soluble)	F123 Standard Head
	T25 Head	0.330 mm (0.013 in.)		
F870™	N14	0.178 mm (0.007 in.) 0.254 mm (0.010 in.) 0.330 mm (0.013 in.)	SR-35 (soluble)	N14
	N25	0.330 mm (0.013 in.)		
Fortus 450mc™	T10 T12 T16 T20	0.127 mm (0.005 in.) 0.178 mm (0.007 in.) 0.254 mm (0.010 in.) 0.330 mm (0.013 in.)	SR-30/SR-35 (soluble)	T12SR30
Fortus 900mc™/ F900®	T10 T12 T16 T20 T40A	0.127 mm (0.005 in.) 0.178 mm (0.007 in.) 0.254 mm (0.010 in.) 0.330 mm (0.013 in.) 0.508 mm (0.020 in.)	SR-30/SR-35 (soluble)	T12SR30 T20B
F3300	N500 N750	0.250 mm (0.010 in.) 0.500 mm (0.020 in.)	SR-35 (soluble)	N410 N750

Build Sheet

F123 Standard Build Trays

F770/F870 Build Sheets
- 0.38 x 762 x 1,041 mm (0.015 x 30 x 41 in.)

Fortus Low Temperature Build Sheets
- 0.51 x 660 x 965 mm (0.02 x 26 x 38 in.)
- 0.51 x 406 x 470 mm (0.02 x 16 x 18.5 in.)

F3300 Low Temperature Build Sheets
- 0.51 x 660 x 711 mm (0.02 x 26 x 28 in.)

Colors

Black
Red
Dark Gray
Light Gray
White
Natural
Dark Blue
Green
Yellow
Orange
Camouflage Tan 686A
Camouflage Green 383

System Requirements[1]

F123/F123 CR

- Standard F123 head - Model and Support (black cover, head life of 1,500 hours)
- No material license required

F770

- Standard F123 head - Model and Support (black cover, head life of 1,500 hours)
- T25 Extrusion head - Model (red cover, head life of 800 hours)
- No material license required

F870

- N14 Extrusion head - Model and Support (dark blue cover, dark blue label)
- N25 Extrusion head - Model (dark blue cover, red label)
- No material license required

Fortus 450mc

- Standard Fortus 450mc head or hardened Fortus 450mc head (requires hardened system upgrade)
- ASA material license (included if new system)
- Fortus FDC™ (enables use of XTEND™ 250 Fortus® Plus spool)

F900

- Standard F900 had or hardened F900 head
- ASA material license (included if new system)
- Fortus FDC™ (enables use of XTEND™ 250 Fortus® Plus spool)

F3300

- F3000 Series Extruder Drive
- Standard Hot Ends
- No material license required

[1] Contact your Stratasys representative for ordering information

Table 2: ASA Ordering Information

Part Number	Description	System Compatibility
Filament Consumables		
Filament Plus Canisters (black snout)		
355-02140	ASA (Natural), 92.3 cu in. - Plus	Fortus 450mc, F900, Fortus 900mc (S/N L502 and up)
355-02141	ASA (White), 92.3 cu in. - Plus	
355-02142	ASA (Black), 92.3 cu in. - Plus	
355-02143	ASA (Dark Gray), 92.3 cu in. - Plus	
355-02144	ASA (Red), 92.3 cu in. - Plus	
355-02145	ASA (Blue), 92.3 cu in. - Plus	
355-02146	ASA (Light Gray), 92.3 cu in. - Plus	
355-02147	ASA (Green), 92.3 cu in. - Plus	
355-02148	ASA (Orange), 92.3 cu in. - Plus	
355-02149	ASA (Yellow), 92.3 cu in. - Plus	
355-02151	ASA (Camouflage Tan 686A), 92.3 cu in. - Plus	
355-02150	ASA (Camouflage Green 383), 92.3 cu in. - Plus	
355-03110	SR30 Soluble Support, 92 cu in. (1,510 cc) - Plus	
355-03135	SR35 Soluble Support, 92 cu in. (1,510 cc) - Plus	
XTEND 250 Fortus Plus Spools		
361-00106	ASA (Black), Xtend 250 Fortus Plus	Fortus 450mc and F900 with the Fortus FDC
Fortus Plus Xtend 500 Box		
360-50240	ASA (Natural), Xtend 500 (8,195 cc) - Plus	Fortus 450mc, F900
Fortus Classic Canister (gray snout)		
311-21200	ASA (Black, Fortus Classic), 92 cu in. (1,510 cc)	Fortus 900mc (S/N prior to L502)
311-21500	ASA (Dk Blue, Fortus Classic), 92 cu in. (1,510 cc)	
311-21600	ASA (Dk Gray, Fortus Classic), 92 cu in. (1,510 cc)	
311-21700	ASA (Green, Fortus Classic), 92 cu in. (1,510 cc)	
311-21300	ASA (Lt Gray, Fortus Classic), 92 cu in. (1,510 cc)	
311-21000	ASA (Natural, Fortus Classic), 92 cu in. (1,510 cc)	
311-21800	ASA (Orange, Fortus Classic), 92 cu in. (1,510 cc)	
311-21390	ASA (Red, Fortus Classic), 92 cu in. (1,510 cc)	
311-21100	ASA (White, Fortus Classic), 92 cu in. (1,510 cc)	
311-21900	ASA (Yellow, Fortus Classic), 92 cu in. (1,510 cc)	
311-30200	SR-30 Soluble Support, Fortus Classic, 92 cu in. (1,510 cc)	
311-30235	SR-35 Soluble Support), Fortus Classic), 92 cu in. (1,510 cc)	

Part Number	Description	System Compatibility
F123/F123CR Series Spools		
333-60500	ASA (Natural), 60 cu in. - F123	
333-60501	ASA (Black), 60 cu in. - F123	
333-60502	ASA (White), 60 cu in. - F123	
333-60503	ASA (Red), 60 cu in. - F123	
333-60504	ASA (Blue), 60 cu in. - F123	
333-60505	ASA (Green), 60 cu in. - F123	
333-60506	ASA (Yellow), 60 cu in. - F123	
333-60507	ASA (Orange), 60 cu in. - F123	F170, F190CR, F370, F370CR
333-60508	ASA (Dark Gray), 60 cu in. - F123	
333-60509	ASA (Light Gray), 60 cu in. - F123	
333-90500	ASA (Natural), 90 cu in. - F123	
333-90501	ASA (Black), 90 cu in. - F123	
333-90502	ASA (White, 90 cu in. - F123	
333-90509	ASA (Light Gray), 90 cu in. - F123	
333-63500	QSR Soluble Support, 60 cu. in. - F123	
F770 Boxes		
331-20557	ASA (Black), 200 cu in., long lead - F770	
331-20507	ASA (Natural), 200 cu in., long lead - F770	
331-20517	ASA (Red) 200CI, LONG LEAD	
331-20527	ASA (Yellow) 200CI, LONG LEAD	F770
331-20537	ASA (Light Gray) 200CI, LONG LEAD	
331-20547	ASA (White) 200CI, LONG LEAD	
331-20207	SR-30 Soluble Support, 200CI, LONG LEAD	
F3000 Series / F870 Spools		
363-00100	MTRL, F3000 Series and F870, (M), ASA (NATURAL), 4,100 cc	
363-00105	MTRL, F3000 Series and F870, (M), ASA (RED), 4,100 cc	
363-00106	MTRL, F3000 Series and F870, (M), ASA (BLACK), 4,100 cc	
363-00107	MTRL, F3000 Series and F870, (M), ASA (LT GRAY), 4,100 cc	F870, F3300
363-00108	MTRL, F3000 Series and F870, (M), ASA (WHITE), 4,100 cc	
363-00111	MTRL, F3000 Series and F870, (M), ASA (YELLOW), 4,100 cc	
363-00700	MTRL, F3000 Series and F870, (S), SR-35, 4,100 cc	

Part Number	Description	System Compatibility
Printer Consumables		
Fortus		
511-10501	T10 tip, 0.005 in. (0.127 mm) layer height	Fortus 450mc, F900, Fortus 900mc
511-10301	T12 tip, 0.007 in. (0.178 mm) layer height	
511-10401	T16 tip, 0.010 in. (0.254 mm) layer height	
511-10701	T20 tip, 0.013 in. (0.330 mm) layer height	
511-10900	T12SR30 support tip, 0.005-0.013 in. layer heights	
511-10750	T40A tip, 0.020 in. (0.508 mm) layer height	F900, Fortus 900mc
511-10710	T20B support tip, 0.020 in. (0.508 mm) layer height	
325-00100	Low Temperature build sheet, 0.02 x 16 x 18.5 in. (0.51 x 406 x 470 mm)	Fortus 450mc, F900, Fortus 900mc
325-00300	Low Temperature build sheet, 0.02 x 26 x 38 in. (0.51 x 660 x 965 mm)	F900, Fortus 900mc
F123/F123CR Series		
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
F770 and F870		
123-50102-S	F770 and F870 build sheet, 0.015 x 30 x 41 in. (0.381 x 762 x 1,041 mm), box of 20	F770, F870
F3000 Series		
533-00500-S	FDM, N500 Hot End (0.25 mm/0.010 in. layer height)	F3300
533-00750-S	FDM, N750 Hot End (0.50 mm/0.020 in. layer height)	
533-00410-S	FDM, N410 Support Hot End (0.25 mm/0.010 in. layer height)	
363-30000-S	F3300 sheet bundle, standard 0.02 x 26 x 28 in., 10	
Print Heads		
Fortus		
821725-XXXX	Standard Fortus 450mc head (silver handle)	Fortus 450mc
380-30300-S	OpenAM Standard Fortus 450mc head (silver handle, additional sticker)	
821726-XXXX	Hardened Fortus 450mc head (blue handle)	
380-30400-S	OpenAM Hardened Fortus 450mc head (blue handle, additional sticker)	
404210-XXXX	Standard F900 head (formed rod handle)	F900
380-63600-S	OpenAM Standard F900 head (formed rod handle, additional sticker)	
325-63500	Hardened F900 head (folded sheet metal handle)	
380-63500-S	OpenAM Hardened F900 head (folded sheet metal handle, additional sticker)	
F123/F123CR Series		
123-00402-S	Standard Extrusion Head (black cover)	F170, F190CR, F370, F370CR

Part Number	Description	System Compatibility
F770		
123-00402-S	F123 Standard Head (all layer heights, black cover)	F770
123-00700-S	F770 Extrusion Head, T25 (0.013 in. layer height, red cover)	
F870		
123-00900-S	Standard Extrusion Head, N14 (model and support, dark blue cover, dark blue label)	F870
123-00902-S	High Speed Extrusion Head, N25 (model, dark blue cover, red label)	
F3000 Series		
533-10000-S	F3000 Series Extruder Drive	F3300

Physical Properties

Values are measured as molded and printed with ASA Black. ASA Natural is used where specified in the table. XY and XZ orientations were tested. For full details refer to the Stratasys Materials Test Procedure. DSC and TMA curves can be found in the Appendix.

Table 3: ASA Physical Properties

Physical Properties - Printed			
Property	**Test Method**	**Typical Values**	
		XY	**XZ**
HDT at 66 psi	ASTM D648 Method B	103 °C (217 °F)	102 °C (216 °F)
HDT at 264 psi	ASTM D648 Method B	98.2 °C (209 °F)	97.6 °C (208 °F)
Mean CTE	ASTM E831 (-50 °C to 90 °C)	69.38 µm/[m*°C] (38.54 µin/[in*°F])	63.55 µm/[m*°C] (35.31 µin/[in*°F])
Dielectric Constant	ASTM D150 1 kHz test condition	3.14	4.74
	ASTM D150 2 MHz test condition	2.82	2.83
Dissipation Factor	ASTM D150 1 MHz test condition	0.009	0.009
	ASTM D150 2 MHz test condition	0.022	0.024
Physical Properties - Non Printed			
Property	**Test Method**	**Molded Plaques**	
Tg	ASTM D7426 Inflection Point	0.022	
Volume Resistivity	ASTM D257	> $6.89*10^{14}$ Ω*cm	

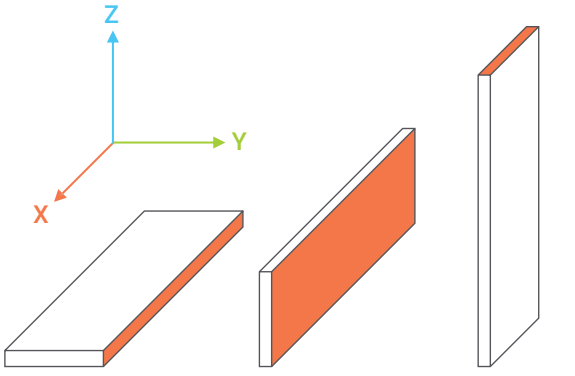
Property	Test Method	Molded Plaques
Thermal Conductivity (Natural)	ASTM E1952 at 0 °C	0.1685 W/[m*K] (0.0974 BTU/[hr*ft*°F])
	ASTM E1952 at 30 °C	0.1642 W/[m*K] (0.0949 BTU/[hr*ft*°F])
	ASTM E1952 at 60 °C	0.1622 W/[m*K] (0.0937 BTU/[hr*ft*°F])
	ASTM E1952 at 90 °C	0.1563 W/[m*K] (0.0903 BTU/[hr*ft*°F])
Thermal Diffusivity (Natural)	ASTM E1952 at 0 °C	0.108 mm^2/s ($1.67*10^{-4}$ in^2/s)
	ASTM E1952 at 30 °C	0.096 mm^2/s ($1.49*10^{-4}$ in^2/s)
	ASTM E1952 at 60 °C	0.087 mm^2/s ($1.35*10^{-4}$ in^2/s)
	ASTM E1952 at 90 °C	0.077 mm^2/s ($1.19*10^{-4}$ in^2/s)
Specific Gravity	ASTM D792 at 23 °C	1.080

Mechanical Properties

ASA samples were printed with 0.25 mm (0.010 in.) and 0.33 (0.013 in.) layer heights on the F900, F3300, and F770. For the full test procedure please see Stratasys Materials Test Procedure.

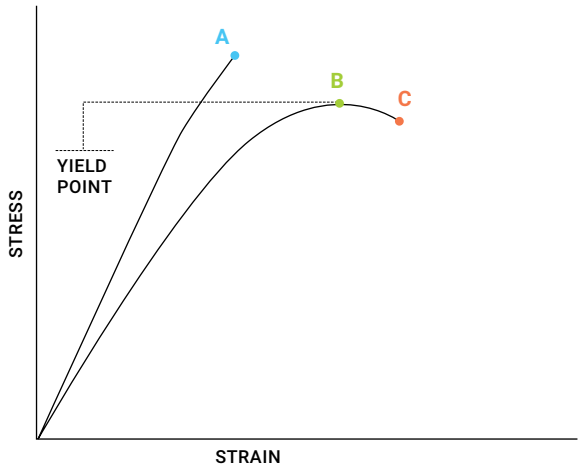
Print Orientation

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.



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: ASA Black Mechanical Properties - F900 - T16 Tip

0.25 mm (0.010 in.) Layer Height		XZ Orientation[1]	ZX Orientation[1]
Tensile Properties: ASTM D638			
Yield Strength	MPa	32.8 (1.0)	No yield
	psi	4,750 (150)	No yield
Elongation @ Yield	%	2.5 (0.085)	No yield
Strength @ Break	MPa	31.9 (0.98)	28.3 (2.1)
	psi	4,630 (140)	4,110 (310)
Elongation @ Break	%	5.9 (0.76)	1.8 (0.31)
Modulus (Elastic)	GPa	2.14 (0.072)	2.05 (0.20)
	ksi	311 (10)	298 (29)
Flexural Properties: ASTM D790, Procedure A			
Strength @ Break	MPa	No break	51.0 (1.4)
	psi	No break	7,390 (200)
Strength @ 5% Strain	MPa	61.5 (1.1)	-
	psi	8,930 (150)	-
Strain @ Break	%	No break	3.93 (0.25)
Modulus	GPa	1.98 (0.045)	1.76 (0.033)
	ksi	287 (6.5)	255 (4.8)
Compression Properties: ASTM D695			
Yield Strength	MPa	75.4 (3.8)	188 (28)
	psi	10,900 (540)	27,200 (4,100)
Modulus	GPa	2.05 (0.060)	2.42 (0.26)
	ksi	297 (8.7)	351 (38)
Impact Properties: ASTM D256, ASTM D4812			
Notched	J/m	43.1 (3.8)	23.8 (3.8)
	ft*lb/in	0.808 (0.071)	0.445 (0.052)
Unnotched	J/m	285 (61)	91.1 (18)
	ft*lb/in	5.33 (1.1)	1.71 (0.34)

[1] Values in parentheses are standard deviations.

Table 5: ASA Natural Mechanical Properties - F3300 - N500 Hot End

0.25 mm (0.010 in.) Layer Height		XZ Orientation[1]	ZX Orientation[1]
Tensile Properties: ASTM D638			
Yield Strength	MPa	37.2 (0.72)	25.8 (2.7)
	psi	5,400 (110)	3,750 (390)
Elongation @ Yield	%	2.9 (0.061)	1.8 (0.24)
Strength @ Break	MPa	34.9 (1.1)	25.6 (2.6)
	psi	5,060 (160)	3,710 (370)
Elongation @ Break	%	10 (1.7)	1.8 (0.24)
Modulus (Elastic)	GPa	1.94 (0.032)	1.77 (0.038)
	ksi	281 (4.7)	256 (5.6)
Flexural Properties: ASTM D790, Procedure A			
Strength @ Break	MPa	70.6 (2.6)	45 (5.3)
	psi	10,200 (380)	6,520 (770)
Strain @ Break	%	3.8 (1)	3.1 (0.36)
Modulus	GPa	2.11 (0.051)	1.65 (0.1)
	ksi	306 (7.4)	240 (15)
Compression Properties: ASTM 695			
Peak Strength	MPa	93.2 (9.1)	123 (22)
	psi	13,500 (1,300)	17,800 (3,200)
Modulus	GPa	1.6 (0.029)	1.5 (0.052)
	ksi	233 (4.3)	217 (7.5)
Impact Properties: ASTM D256, ASTM D4812			
Notched	J/m	54.4 (3.3)	29.3 (29)
	ft*lb/in	1.02 (0.061)	0.548 (0.55)
Unnotched	J/m	1,000 (130)	71.4 (14)
	ft*lb/in	18.8 (2.5)	1.34 (0.25)

[1] Values in parentheses are standard deviations.

Table 6: ASA Natural Mechanical Properties - F770 - T14 Standard Head

0.25 mm (0.010 in.) Layer Height		XZ Orientation[1]	ZX Orientation[1]
Tensile Properties: ASTM D638			
Yield Strength	MPa	35.2 (0.37)	26.9 (1.4)
	psi	5,100 (53.9)	3,910 (200)
Elongation @ Yield	%	3.0 (0.08)	2.3 (0.4)
Strength @ Break	MPa	33.7 (0.81)	27.0 (1.3)
	psi	4,900 (120)	3,910 (190)
Elongation @ Break	%	8.4 (1.5)	2.3 (0.4)
Modulus (Elastic)	GPa	1.85 (0.0195)	1.62 (0.0186)
	ksi	268 (2.83)	235 (2.70)
Flexural Properties: ASTM D790, Procedure A			
Strength @ Break	MPa	No Break	48.2 (4.8)
	psi	No Break	6,980 (700)
Strength @ 5% Strain	MPa	60.6 (2.3)	-
	psi	8,790 (340)	-
Strain @ Break	%	No Break	3.7 (0.7)
Modulus	GPa	1.90 (0.099)	1.72 (0.046)
	ksi	276 (14.3)	250 (6.67)
Impact Properties: ASTM D256, ASTM D4812			
Notched	J/m	60.9 (4.8)	28.5 (5.7)
	ft*lb/in	1.14 (0.091)	0.534 (0.11)
Unnotched	J/m	732 (140)	110 (22)
	ft*lb/in	13.7 (2.6)	2.07 (0.41)

[1] Values in parentheses are standard deviations.

T25 Tensile Part Processing: XZ tensile coupon printed dimensions were 165 x 22 x 5 mm (6.500 x 0.875 x 0.200 in.). ZX tensile coupons were water jetted from larger printed plaques to produce final coupon dimensions of 165 x 22 x 5 mm (6.500 x 0.875 x 0.200 in.). XZ and ZX tensile coupons were then tested using the standard D638 procedure, including coupon conditioning and pulling.

T25 Flexural Part Processing: XZ flexural coupon printed dimensions were 165 x 12.7 x 5 mm (6.500 x 0.500 x 0.200 in.). ZX flexural coupons were water jetted from larger printed plaques to produce final coupon dimensions of 165 x 12.7 x 5 mm (6.500 x 0.500 x 0.20 in.). XZ and ZX flexural coupons were then tested using the standard D790 procedure, including coupon conditioning.

Table 7: ASA Natural Mechanical Properties - F770 - T25 Head

0.33 mm (0.013 in.) Layer Height		XZ Orientation[1]	ZX Orientation[1]
Tensile Properties: Modified ASTM D638			
Yield Strength	MPa	32 (1.5)	27.7 (0.79)
	psi	4,640 (220)	4,020 (110)
Elongation @ Yield	%	2.7 (0.035)	2.6 (0.13)
Strength @ Break	MPa	30.6 (1.6)	27.8 (0.86)
	psi	4,440 (240)	4,030 (120)
Elongation @ Break	%	12 (1.1)	2.7 (0.23)
Modulus (Elastic)	GPa	1.71 (0.096)	1.55 (0.06)
	ksi	248 (14)	225 (8.7)
Flexural Properties: Modified ASTM D790, Procedure A			
Strength @ Break	MPa	58.1 (2.7)	47.2 (1.9)
	psi	8,420 (390)	6,850 (270)
Strain @ Break	%	No break	4.1 (0.31)
Modulus	GPa	1.79 (0.083)	1.58 (0.063)
	ksi	260 (12)	229 (9.1)

[1] Values in parentheses are standard deviations.

UV Aging

Natural color ASA coupons were built on the F900 using the T16 tip with 0.254 mm (0.010 in.) layer height. The coupons were then tested before and after UV exposure. Ten ASTM D638 upright (ZX) coupons were tested in tensile after UV exposure and an additional 10 ASTM D638 ZX coupons were the control (no UV Exposure). The UV exposed samples were cycled in the QUV chamber per ASTM G154 (Standard Practice for Operating Fluorescent Ultraviolet (UV) Lamp Apparatus for Exposure of Non-Metallic Materials) for 1000 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 8: ASA (Natural) UV Exposure Test Results - F900 - T16 Tip

Material	Conditioning	Yield Strength		Stress at Break		Elongation at Break	Increase in Stress at Break	Modulus	
		(psi)	(MPa)	(psi)	(MPa)	%	%	(ksi)	(GPa)
ASA (Natural)	No UV Exposure	4,430	30.5	4,420	30.5	2.8	-	264	1.82
	UV Exposure	4,390	30.3	4,290	29.5	2.3	-3.00	283	1.95

Appendix

Figure 1: 2nd Heating Scan DSC Data for the ASA Black Flat (XY) Sample

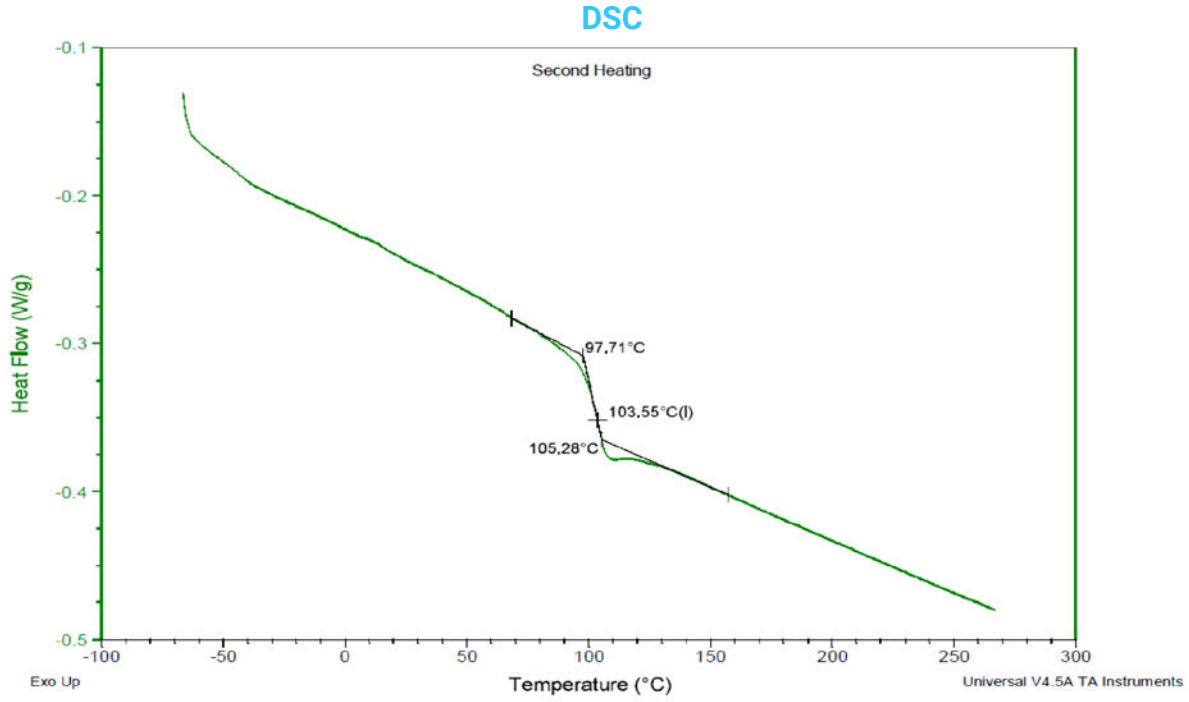


Figure 2: Dimension Change Data as a Function of Temperature for the ASA Black Flat (XY) Sample

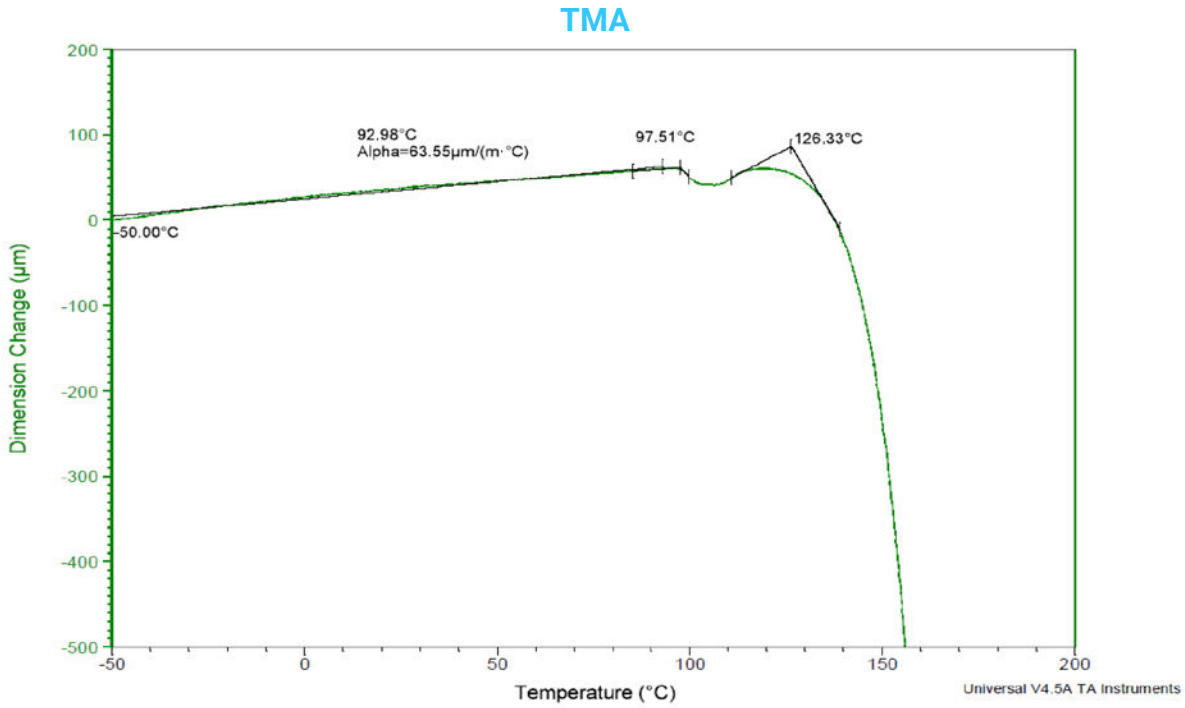


Figure 3: Dimension Change Data as a Function of Temperature for the ASA Black On Edge (XZ) Sample

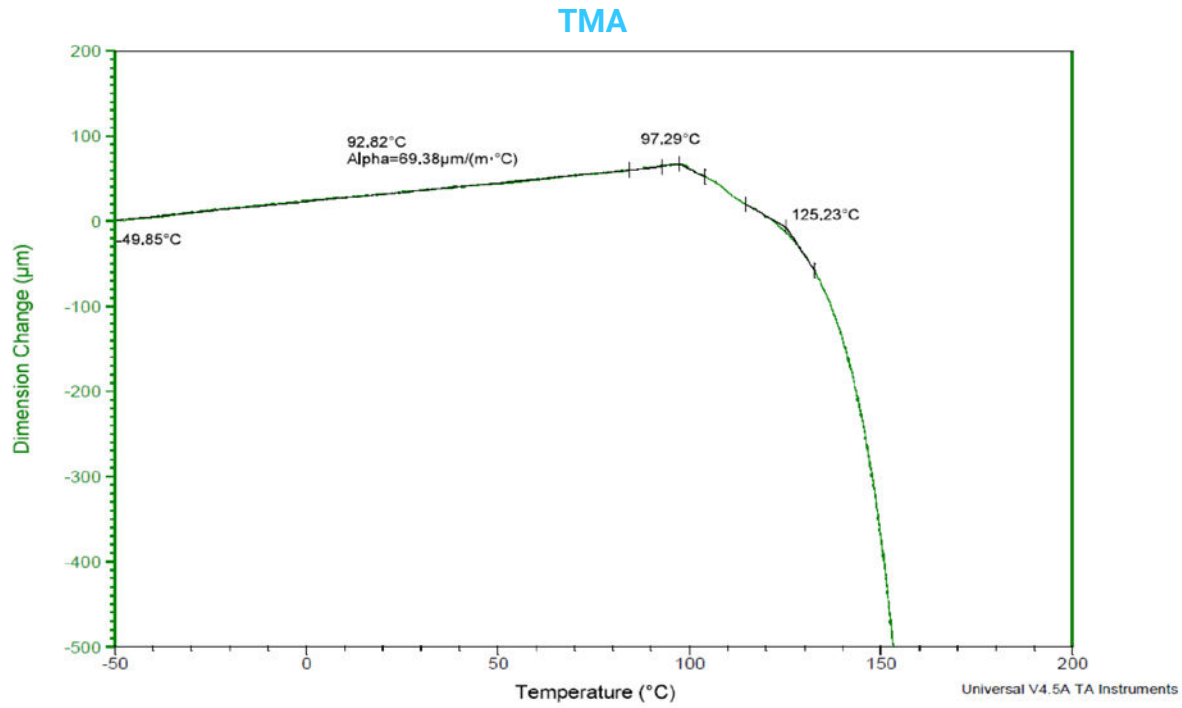
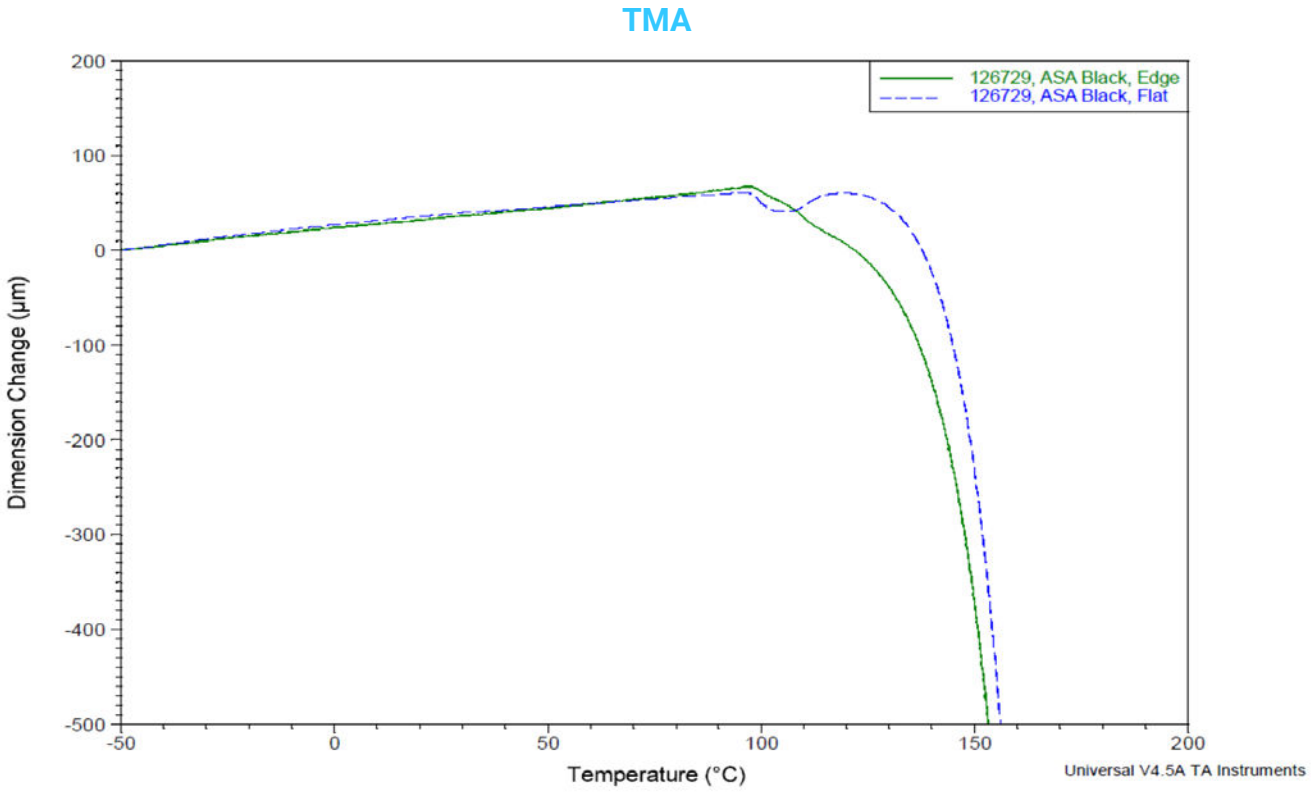


Figure 4: Overlay of the Dimension Change Data for the Flat (XY) and On Edge (XZ) ASA Black Samples



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