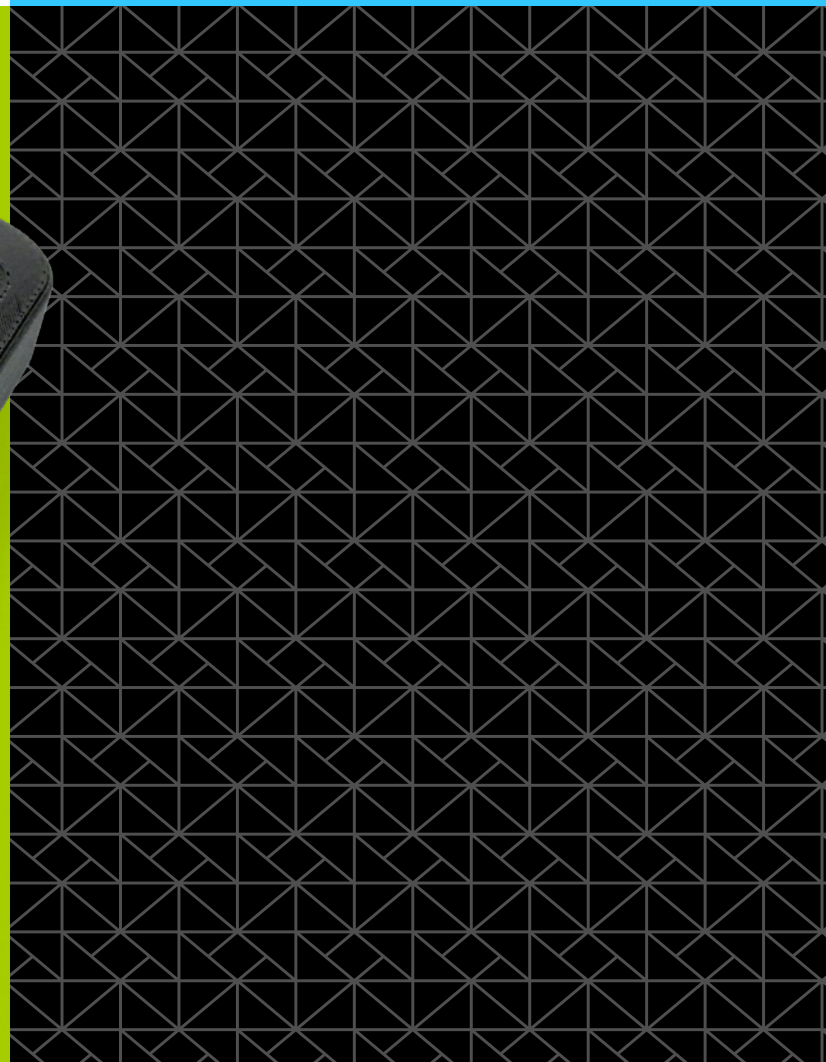


FDM

PA6/66-GF30-FR





Overview

FDM® PA6/66-GF30-FR is a 30% by weight glass fiber reinforced, flame-retardant nylon filament designed for rail and transportation OEMs and Tier suppliers using Fortus 450mc and F900 systems who need EN 45545-2 HL2 (R22/R23) compliance, strong mechanical performance, and high-quality, production-ready parts at a lower total cost.

Unlike PC-FR, which can fall short on strength, or ULTEM™ 9085 resin, which often exceeds performance needs and budget, FDM PA6/66-GF30-FR delivers excellent strength and stiffness, best-in-class Fortus printability, and a cost-effective balance of fire safety, performance, and value for certified end-use applications.

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Ordering Information

Table 1: Printer and Support Material Compatibility

Printer	Model Tip	Layer Height	Support Material	Support Tip
Fortus 450mc™	T20G	0.25 mm (0.010 in.)	SUP4050B™	T16
F900®	T20G	0.25 mm (0.010 in.)	SUP4050B	T16

Build Sheet

Fortus Nylon 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.)

System Requirements

Fortus 450mc

- Hardened machine upgrade
- Hardened Fortus 450mc head
- FDM PA6/66-GF30-FR material license (included if new system)

F900

- Hardened F900 head
- FDM PA6/66-GF30-FR material license

Table 2: FDM PA6/66-GF30-FR Ordering Information

Part Number	Description	System Compatibility
Filament Consumables		
Fortus Plus Canister (black snout)		
355-02280	FDM PA6/66-GF30-FR, 92.3 cu in - Plus	Fortus 450mc, F900
355-70160	SUP4050B Support, 92.3 cu in. - Plus	
Printer Consumables		
Fortus		
511-10745	T20G tip	Fortus 450mc, F900
511-10401	T16 tip	
325-00750-S	Nylon build sheet, 0.51 x 406 x 470 mm (0.02 x 16 x 18.5 in.), 20 pack	F900
325-00650-S	Nylon build sheet, 0.51 x 660 x 965 mm (0.02 x 26 x 38 in.), 10 pack	
Print Heads		
Fortus		
821726-XXXX	Hardened Fortus 450mc head (blue handle)	Fortus 450mc
325-63500	Hardened F900 head (folded sheet metal handle)	F900



Physical Properties

Values are measured as molded and printed on the Fortus 450mc with a 0.25 mm (0.010 in.) layer height. 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: FDM PA6/66-GF30-FR Physical Properties

Physical Properties - Printed			
Property	Test Method	Typical Values	
		XY	XZ
HDT @ 66 psi	ASTM D648 Method B	161 °C (321.8 °F)	185 °C (365 °F)
HDT @ 264 psi	ASTM D648 Method B	35 °C (95 °F)	153 °C (307.4 °F)
Mean CTE	ASTM E831 (-20 °C to 5 °C)	95.44 µm/[m·°C] (53.02 µin/[in·°F])	-
	ASTM E831 (25 °C to 80 °C)	214.2 µm/[m·°C] (119 µin/[in·°F])	-
	ASTM E831 (180 °C to 130 °C)	72.67 µm/[m·°C] (40.37 µin/[in·°F])	-
	ASTM E831 (140 °C to 150 °C)	156.3 µm/[m·°C] (86.83 µin/[in·°F])	-
Dielectric Constant	ASTM D150 1 kHz test condition	6.2	-
Dissipation Factor	ASTM D150 1 kHz test condition	0.14	-
Volume Resistivity	ASTM D257	1.3 x 10 ¹² Ω·cm	-
Thermal Conductivity	ASTM E1952 @20 °C	0.3221 W/[m·K] (0.1861 BTU/[hr·ft·°F])	-
	ASTM E1952 @90 °C	0.3252 W/[m·K] (0.1879 BTU/[hr·ft·°F])	-
Thermal Diffusivity	ASTM E1952 @20 °C	0.177 mm ² /s (2.74 x 10 ⁻⁴ in ² /s)	-
	ASTM E1952 @90 °C	0.151 mm ² /s (2.34 x 10 ⁻⁴ in ² /s)	-
Physical Properties - Non Printed			
Property	Test Method	Molded Plaques / Filament Samples	
Tg	ASTM D7426 Inflection Point	51.5 °C (124.7 °F)	
Specific Gravity	ASTM D792 @23 °C	1.400	

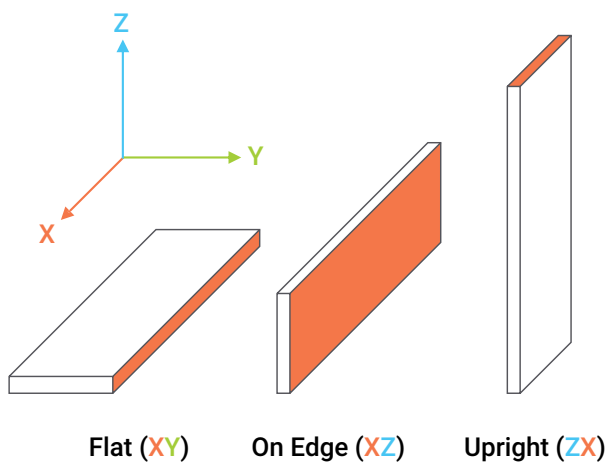


Mechanical Properties

FDM PA6/66-GF30-FR samples were printed with a 0.25 mm (0.010 in.) layer height on the F900 and the Fortus 450mc using a T20G tip. The breakaway support was manually removed before the samples were conditioned per the respective ASTM standard. For the full test procedure please see the [Stratasys Materials Test Procedure](#). For more information on compression testing and reporting please see the [Refining Compressive Yield Stress Measurement for FDM Materials](#) one pager.

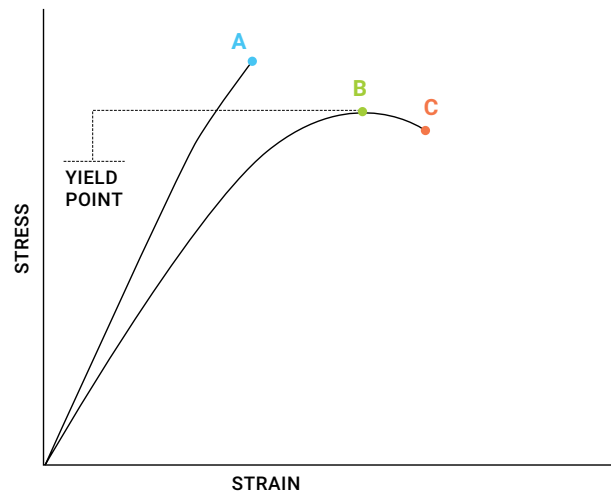
Print Orientation

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: FDM PA6/66-GF30-FR Mechanical Properties - Fortus 450mc - T20G tip**

0.25 mm (0.010 in.) Layer Height		XZ Orientation ¹	ZX Orientation ¹
Tensile Properties: ASTM D638			
Yield Strength	MPa	61.7 (2.2)	No yield
	psi	8,950 (320)	No yield
Elongation at Yield	%	4.4 (0.73)	No yield
Strength at Break	MPa	61.1 (2.3)	23.7 (1.4)
	psi	8,860 (330)	3,440 (210)
Elongation at Break	%	4.6 (0.86)	1.1 (0.14)
Modulus (Elastic)	GPa	5.6 (0.31)	3.05 (0.18)
	ksi	813 (44)	443 (27)
Flexural Properties: ASTM D790, Procedure A			
Strength at Break	MPa	121 (5)	47.4 (10)
	psi	17,500 (720)	6,880 (1,500)
Strain at Break	%	3.7 (0.35)	3.1 (0.72)
Modulus	GPa	6.07 (0.39)	2.1 (0.23)
	ksi	880 (57)	305 (34)
Compression Properties: ASTM D695			
0.2% Offset Yield	MPa	22.3 (0.98)	31 (1.4)
	psi	3,230 (140)	4,490 (200)
1.0% Offset Yield	MPa	30.8 (1.1)	45.6 (1.7)
	psi	4,470 (150)	6,620 (250)
Modulus	GPa	1.6 (0.16)	1.67 (0.063)
	ksi	232 (23)	243 (9.2)
Impact Properties: ASTM D256, ASTM D4812			
Notched	J/m	74.6 (3.4)	17.2 (2.7)
	ft*lb/in	1.4 (0.064)	0.322 (0.05)
Unnotched	J/m	730 (79)	83.5 (22)
	ft*lb/in	13.7 (1.5)	1.56 (0.4)

¹ Values in parenthesis are standard deviations.

**Table 5: FDM PA6/66-GF30-FR Mechanical Properties - F900 - T20G tip**

0.25 mm (0.010 in.) Layer Height		XZ Orientation ¹	ZX Orientation ¹
Tensile Properties: ASTM D638			
Yield Strength	MPa	62.3 (6.2)	No yield
	psi	9,040 (890)	No yield
Elongation at Yield	%	3.2 (0.7)	No yield
Strength at Break	MPa	60.2 (7.6)	24.4 (4.2)
	psi	8,730 (1,100)	3,540 (620)
Elongation at Break	%	3.3 (0.76)	1.1 (0.22)
Modulus (Elastic)	GPa	5.83 (0.8)	3.14 (0.16)
	ksi	845 (120)	456 (23)
Flexural Properties: ASTM D790, Procedure A			
Strength at Break	MPa	114 (10)	46.2 (10)
	psi	16,500 (1,400)	6,700 (1,500)
Strain at Break	%	4.1 (0.32)	3.4 (0.85)
Modulus	GPa	5.66 (0.52)	1.96 (0.22)
	ksi	820 (75)	284 (31)
Compression Properties: ASTM D695			
0.2% Offset Yield	MPa	33 (11)	53.7 (8.1)
	psi	4,790 (1,500)	7,780 (1,200)
1.0% Offset Yield	MPa	43.1 (12)	72.4 (7.4)
	psi	6,250 (1,800)	10,500 (1,100)
Modulus	GPa	2.34 (0.65)	2.62 (0.28)
	ksi	339 (94)	381 (41)
Impact Properties: ASTM D256, ASTM D4812			
Notched	J/m	77.1 (7)	22.1 (4.5)
	ft*lb/in	1.44 (0.13)	0.413 (0.085)
Unnotched	J/m	391 (53)	95.4 (19)
	ft*lb/in	7.32 (1)	1.79 (0.35)

¹ Values in parentheses are standard deviations.



Fire Protection of Railway Vehicles

EN 45545-2

These tests were done to show that FDM PA6/66-GF30-FR complies to the tested standard, not to show certification to any specific standard. It is suggested that additional testing be conducted if there are any questions about how FDM PA6/66-GF30-FR will perform for a specific part.

FDM PA6/66-GF30-FR was printed in the XY orientation with a T20G tip on the Stratasys Fortus 450mc and F900 systems using default settings and tested per EN 45545-2 testing standards. Results were given for requirement sets R22 and R23.

* It should be noted that products printed with different settings or on different machines may perform differently

* Further testing should be done by the end user to make sure the material fits their final application

Table 6: FDM PA6/66-GF30-FR EN 45545-2 Fire Safety Classification Matrix - Fortus 450mc

Requirement Set	1 mm	7 mm
R22	HL2	HL2
R23	HL3	HL3

Table 7: FDM PA6/66-GF30-FR EN 45545-2 Fire Safety Classification Matrix - F900

Requirement Set	1.1 mm	7.3 mm
R22	HL2	HL2
R23	HL3	HL3

Table 8: FDM PA6/66-GF30-FR Fire Protection of Railway Vehicles Test Results For R22 and R23 Requirement Sets - Fortus 450mc

Test Standard	Results	1 mm XY	7 mm XY
ISO 5659-2 (smoke opacity) 25 kW/m ²	Ds(4)	19.8	2.6
	VOF4	23.6	3.6
	Dm	168.1	172.1
EN 17084 Method 1 (smoke toxicity)	ITC 4 mins	0.01	0.01
	ITC 8 mins	0.02	0.02
ISO 4589-2 (limit oxygen index)	ILO (%O ₂)	34.3	38.3

Table 9: FDM PA6/66-GF30-FR Fire Protection of Railway Vehicles Test Results For R22 and R23 Requirement Sets - F900

Test Standard	Results	1.1 mm XY	7.3 mm XY
ISO 5659-2 (smoke opacity) 25 kW/m ²	Ds(4)	70.6	46.3
	VOF4	110.3	47.3
	Dm	171.7	209.2
EN 17084 Method 1 (smoke toxicity)	ITC 4 mins	0.35	0.4
	ITC 8 mins	0.35	0.4
ISO 4589-2 (limit oxygen index)	ILO (%O ₂)	34.1	36.5



Fire Protection of Automotive Interiors

FMVSS 302

These tests were done to show that FDM PA6/66-GF30-FR complies to the tested standard, not to show certification to any specific standard. It is suggested that additional testing be conducted if there are any questions about how FDM PA6/66-GF30-FR will perform for a specific part.

FDM PA6/66-GF30-FR was printed in the XY orientation with a T20G tip on the Stratasys F900 system using default settings and tested per FMVSS 302 testing standards. Results show that FDM PA6/66-GF30-FR does not support combustion and meets the flammability requirements of FMVSS 302.

Table 10: FDM PA6/66-GF30-FR Fire Protection of Automotive Interior Test Results

Specimen	Thickness (mm)	Burn Distance (mm)	Burn Time (sec)	Burn Rate (mm/min)	Remarks
1	1.1	0	0	0	DSC ¹
2	1.1	0	0	0	DSC
3	1.1	0	0	0	DSC
4	1.1	0	0	0	DSC
5	1.1	0	0	0	DSC
Average Burn Rate				0	DSC
Maximum Burn Rate				0	

¹ Doesn't Support Combustion (DSC): material never ignites



Appendix

Figure 1: DSC at 20 °C 0.4 mm

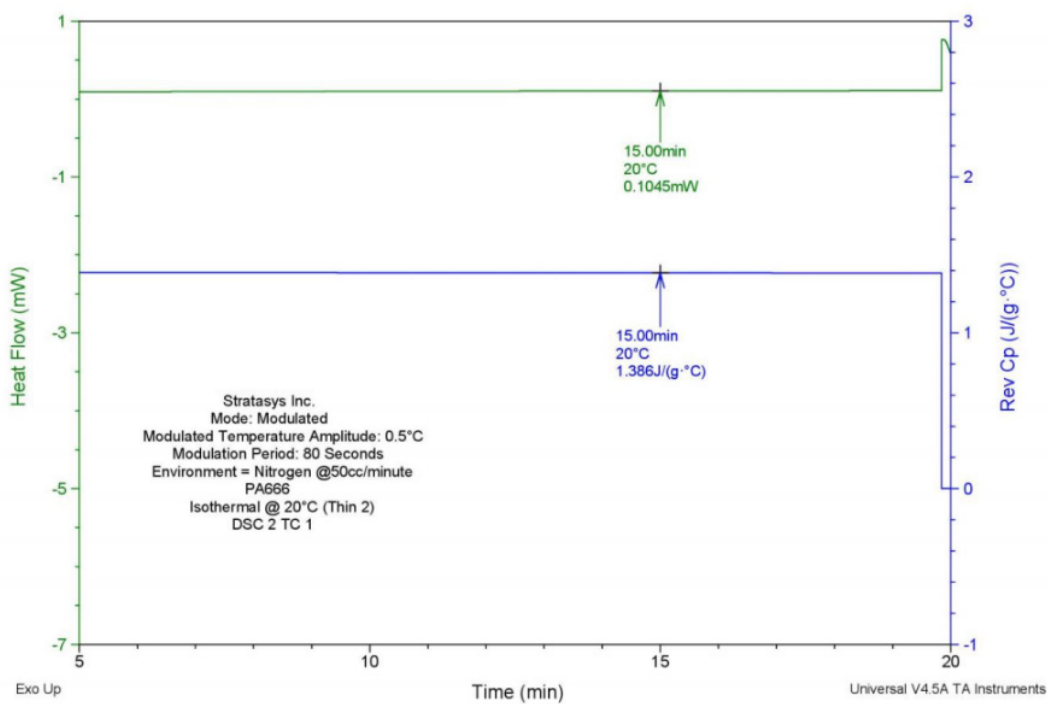
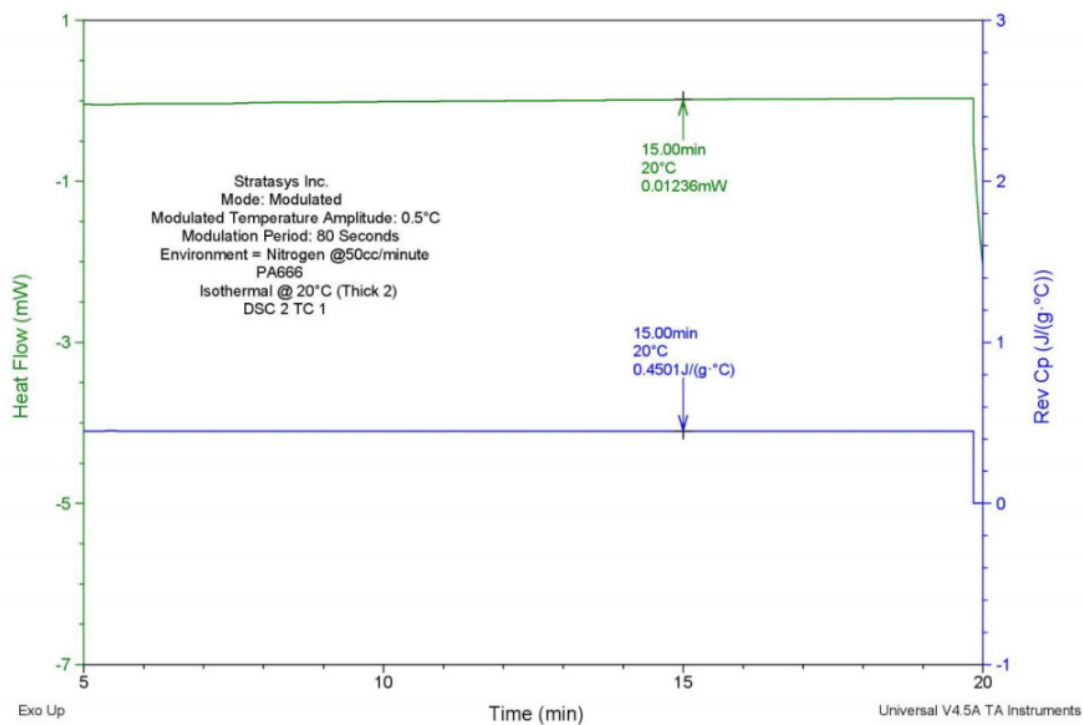


Figure 2: DSC at 20 °C 3.4 mm



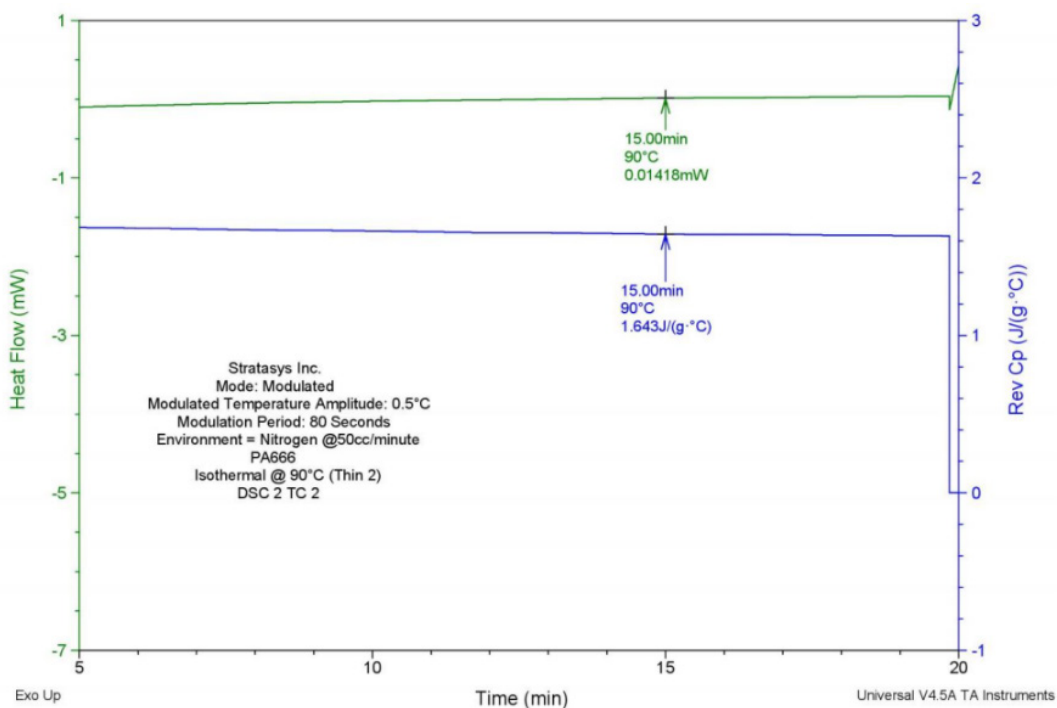
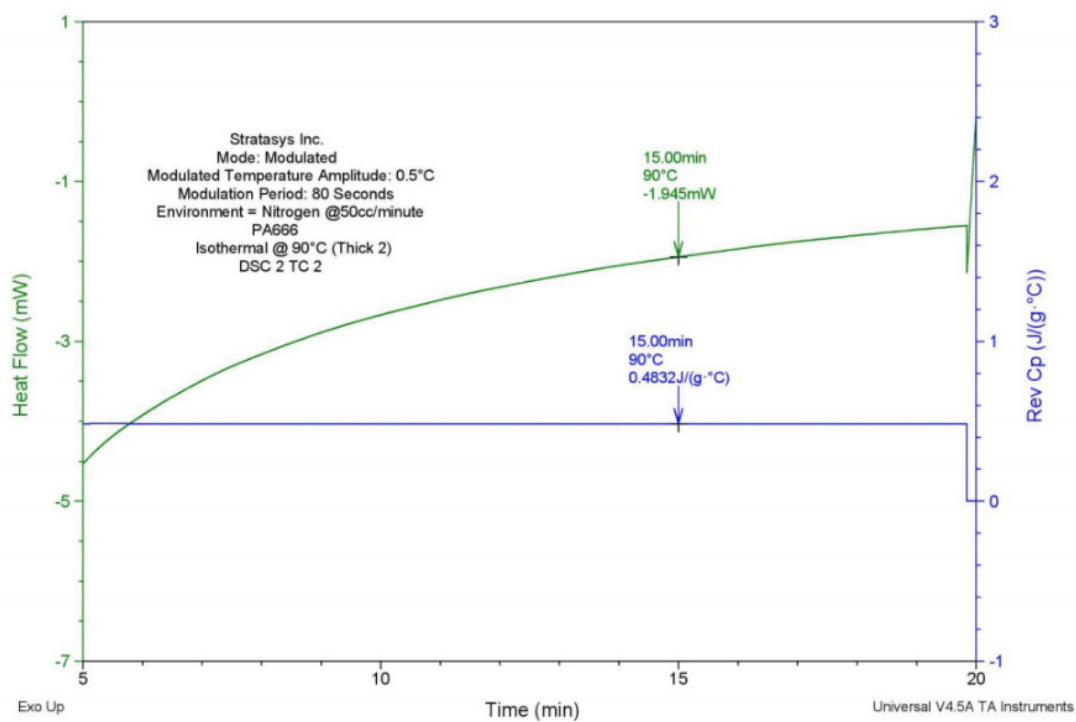
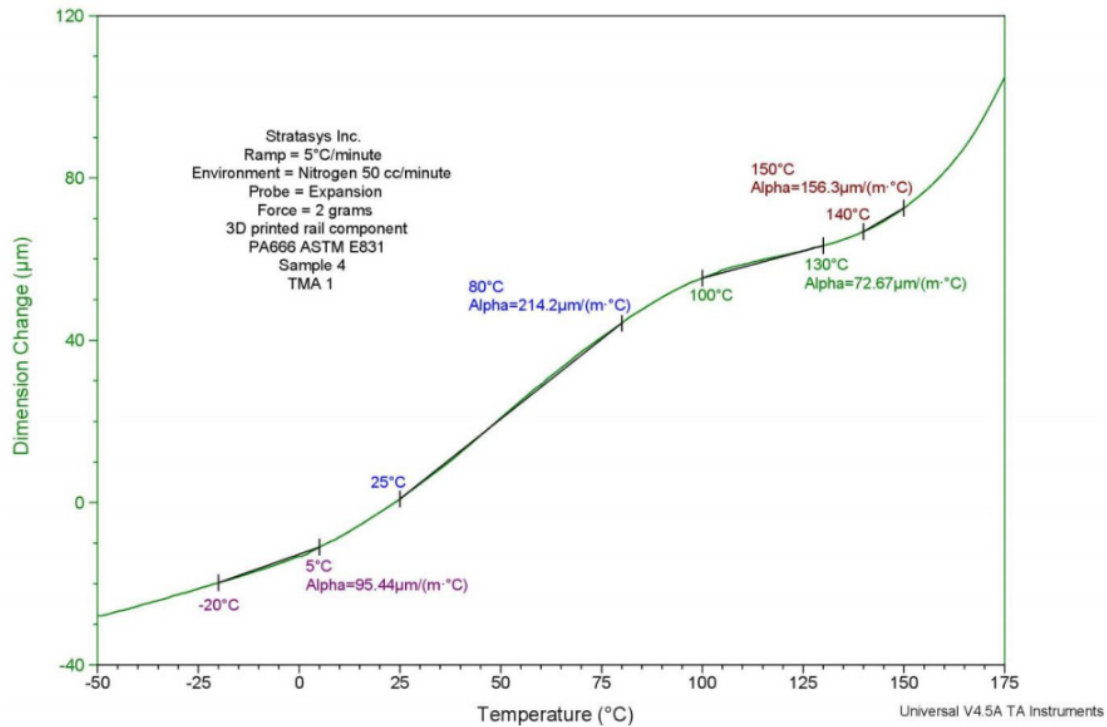
**Figure 3: DSC at 90 °C 0.4 mm****Figure 4: DSC at 90 °C 3.4 mm**



Figure 5: TMA



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MATERIAL DATA SHEET FDM

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