Diran 410MF07
Material Guide

Stratasys® Diran™ 410MF07 is a nylon-based engineering thermoplastic with 7% mineral fill by weight. It demonstrates exceptional toughness and impact strength, and has a smooth lubricious surface that offers low sliding resistance.

Particularly effective for applications requiring a non-marring interface between the tool and the workpiece, Diran 410MF07 is well suited for jigs, fixtures and other general manufacturing aids.

System Overview and Compatibility

Diran 410MF07 is currently available on the F370™ 3D printer with 0.007 in. (0.178 mm), 0.010 in. (0.254 mm) and 0.013 in. (0.330 mm) layer heights. It uses SUP4000B™ as a breakaway support system, the only breakaway support offered on the F370. This support material is easier to remove than other Stratasys breakaway support systems. Diran 410MF07 requires the high-temperature build tray and uses a standard F370 print head for the model and support materials. Diran 410MF07 is available on the F370 in 90-cubic-inch spools, and SUP4000B is available in the F370 standard 60-cubic-inch spools.

stratasys®

Part Design

Designing parts for Diran 410MF07 follows much of the same process for designing other FDM® parts, and design for additive manufacturing (DFAM) guidelines should be followed (e.g., utilizing self-supporting angles where possible, observing minimum wall thicknesses, allowing proper clearance for assemblies, etc.). A general list of DFAM guidelines can be found within the Fused Deposition Modeling (FDM) Design Guidelines document.

A breakaway support system is used to support the model material in areas of overhang to prevent sagging. Model material is used to replace support material wherever possible due to large CTE differences between support and model. Although SUP4000B is one of the easiest supports to remove by hand, the designer should take this into account while designing the part. Self-supporting angles (angles greater than 55 degrees from the build platen) should be used whenever possible to eliminate support material. Areas that require support must be accessible for removal.

Part Processing

This material is available in Insight™ software and the Advanced FDM module for GrabCAD Print™ software.

Before processing parts, consider the design recommendations below:

Build Mode
Diran 410MF07 comes with two build modes, normal (default) and thin-wall. Changing the build mode to thin-wall reduces the oven temperature and is recommended for parts with sections thinner than 0.5 mm (0.2 in.) or for very small individual parts to avoid melting or sagging.

Layer Height
Building with a 0.013 in. (0.33 mm) layer height can reduce the tendency of corners to sag or droop. Consider building parts that do not have high resolution or fine feature details with a 0.013 in. (0.33 mm) layer height, which should reduce the build time measurably.

Support Parameters
Increasing the self-supporting angle can increase the quality of overhanging corners at the potential expense of increased support material usage, longer build times, and support structures that are more difficult to remove. The self-supporting angle parameter can be changed under the **Support > Setup** dialog box in Insight.

Support removal should also be taken into account during part processing, the two main considerations being the locations of the breakaway support and model material used as support. In areas where support cannot be eliminated by part design, the part must be oriented so that the support is accessible for removal, and that model material used as support is not trapped in enclosed spaces. Perforation layers can be added to the support structure to aid in removal of large areas of support.

Printing Parameters
Default part-processing parameters should be used unless the user is proficient in Insight and has determined that the changed values produce better results for a specific geometry. Default settings for a 0.010 in. layer height is two contours, with a +45/-45 solid raster fill for model material. The support default for this scenario is sparse support. The default setting for 0.007 and 0.013 in. layer heights is one contour, with a +45/-45 solid raster fill for model material, and support defaults to sparse support. Box support can be used for easier support removal where the geometry allows for box supports. To accommodate thin-walled features, thin-wall mode can be selected to lower the oven temperature and prevent melting or sagging.

Part Packing
Multiple Diran 410MF07 parts can be packed together in the same build. This often reduces build time (due to elimination of tip swaps between model and support for each part) and should be used to increase system utilization when operators are not present. For example, add another part to the pack so the build will finish in the morning rather than at night, or pack multiple parts together for a longer build over the weekend. Building multiple parts in a pack can also help with thin-walled features and reduce melting or sagging.

For higher quality seams and a reduced potential for purge material in the part, a sacrificial tower is included in the pack, up to the full height of the parts (under the **Options > Sacrificial tower** menu in Control Center™ software) as a default setting.

There are multiple methods of part packing that result in different toolpath orders that can influence overall part quality. Packing multiple parts, or copying the same part, in Control Center orders the tool paths so each individual part is printed separately. This means the contour of the part is printed immediately, followed by the rasters for that part. Control Center can pack parts simply by inserting them into the platen window of the pack tab. Packing multiple parts as an assembly or in Insight makes the software treat all separate parts as one large part. This orders the toolpaths so that all the contours for each individual part are printed first, then all of the rasters are printed. If there are still issues with printing very small geometries and thin-walled parts with thin-wall mode selected, packing in CAD or Insight and changing the toolpath order helps reduce melting/sagging by giving the contour more time to cool and solidify before adding in the rasters.

System Preparation

The system should be prepared using the heads and build tray as mentioned in the system overview section of this document. A tip calibration must be performed when switching from a different material to Diran 410MF07, and when replacing the heads at the end of their recommended life. If the system was running lower-temperature materials, be sure to vacuum out any scrap pieces or material in the purge tower to avoid burning plastic.

The life of the standard F370 head is 1500 hours of printing. The user will receive a warning after 1200 hours of printing. It should be noted that high numbers of short toolpaths are harder on the heads than longer toolpaths. If building parts with many short toolpaths, it is recommended to change the head when the head warning is displayed to prevent a potential decrease in print quality.

Moisture Management

Both Diran 410MF07 and SUP4000B are more moisture sensitive than other F370 materials. Letting the material sit in ambient air for an hour could cause it to become wet and unprintable. If the material has been idle in the machine for more than 24 hours, the material in the tubing between the bay and the head should be discarded and the material reloaded. Even with continuous use the material will only remain dry enough for printing for three weeks in the material bay. Past three weeks the material should be removed from the printer and dried before resuming printing. Keep the material stored with fresh dry desiccant.

To dry the material, insert the spool into an oven at 70C for a minimum of 4 hours. Drying overnight is the longest recommended time for exceptionally wet material.

Support Removal

Parts are easily removed from the build sheet by first removing the build sheet from the machine and flexing the sheet. Support must either be removed immediately from the part, or the parts should completely cool to room temperature on the build tray prior to removal. The CTE difference between the model and support material is large enough to cause an inverse curl effect if the support cools with the model without the structure of the build tray. This is especially important with thinner flat parts. Because this oven build temperature is higher than any other F123™ Series material, use heat resistant gloves to remove the build tray and the parts. Once parts are removed from the build sheet, support material can be removed by breaking it off by hand, using a chisel, scraper, pliers, or various picks and other tools. Always use proper PPE when removing supports manually.

Post Processing

Diran 410MF07 can be sanded, painted, media blasted, bonded, machined, drilled, receive inserts and more, similarly to other thermoplastics.

Appendix:
Insight Packing

Remember, these procedures only apply to Insight. If packing multiple parts as one CMB file is needed using GrabCAD Print then the parts must be imported as an assembly in a CAD or STL file.

Multiple Different Geometries:

1. Process all parts separately. They must all be processed at the same layer height.

2. Select **Combine slice curve files** to combine two SJB files (Figure 1). This must be done with an SJB file already open.

3. Select the slice file to be added (slice curve size auto populates) and the desired part offset in the box from the menu on the right side of the screen (Figure 2). When you enter the numbers for the offset a yellow box the size of the new part appears, showing the exact location of the new part (Figure 3). Select OK when the part is in the right location and the slice files will combine (Figure 4).

4. Repeat this process until all desired parts have been combined, regenerate support and toolpaths.

5. Save the job and import the resulting CMB file in Control Center.
   Note
   Combining slice files will not save over the existing files.

Figure 1. Menu location for **Combine slice curve** files.
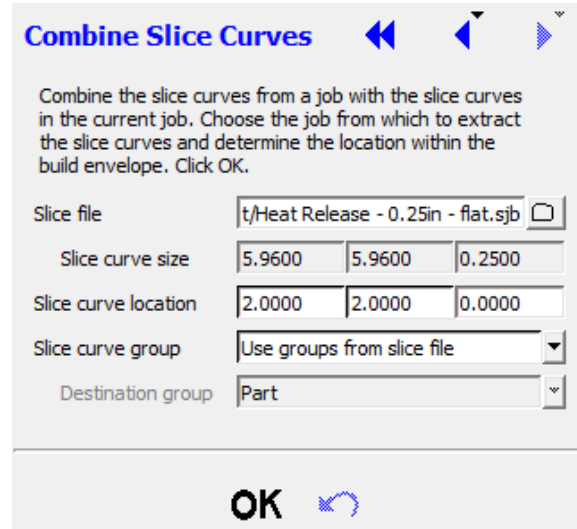

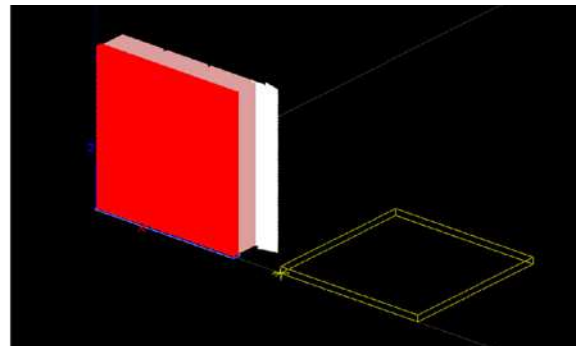Figure 2. Menu on the right side of the screen.

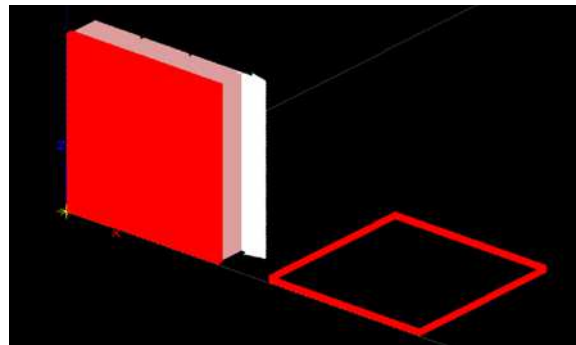Figure 3. Yellow box showing the location of the new part relative to the pre-loaded file.

Figure 4. Combined slice file.

Multiple Copies of a Single Part:

1. Using Insight, select **Move/Rotate/Copy** to make multiple copies of a single file.

2. Drag the cursor across the screen to select the entire part (all layer lines will show up as white if selected) (Figure 6).

3. In the menu on the right side of the screen (Figure 7), select the option **Yes** next to **Keep original**, then enter the offset from the origin where the part should be copied. Click **OK** and the part will copy into the new location (Figure 8). Repeat this process until the correct number of copies is in the file, regenerate toolpaths and save the job.
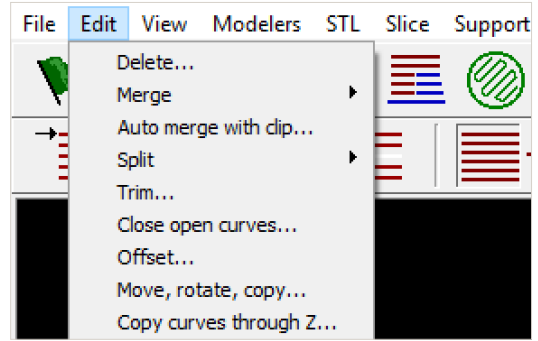

Figure 5. Menu location for **Move, rotate, copy**.
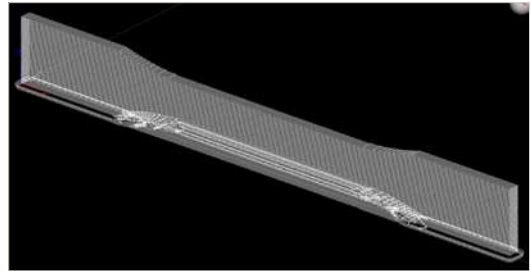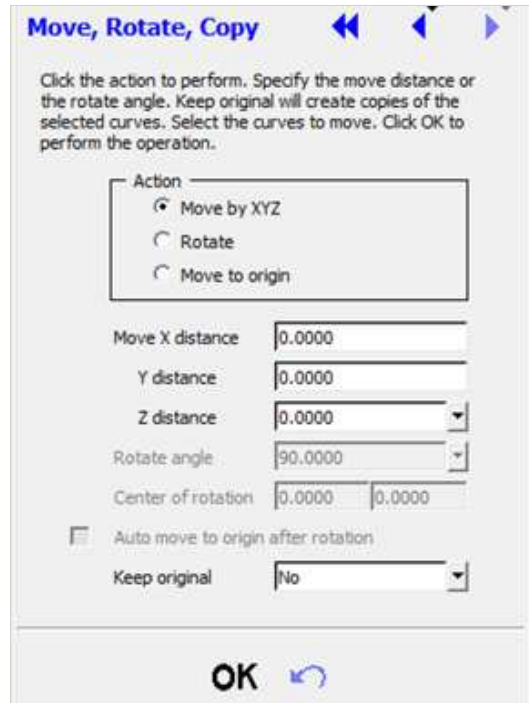

Figure 6. Selected Part.

Figure 7. Move, rotate, copy menu on the right side of the screen.
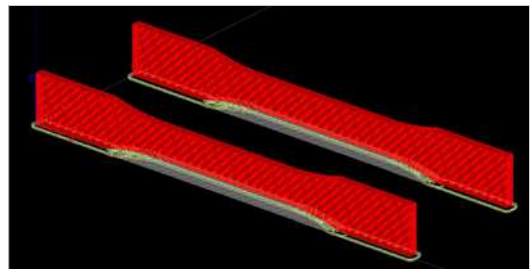

Figure 8. Part copied in Insight.

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)

laserlines
01295 672500
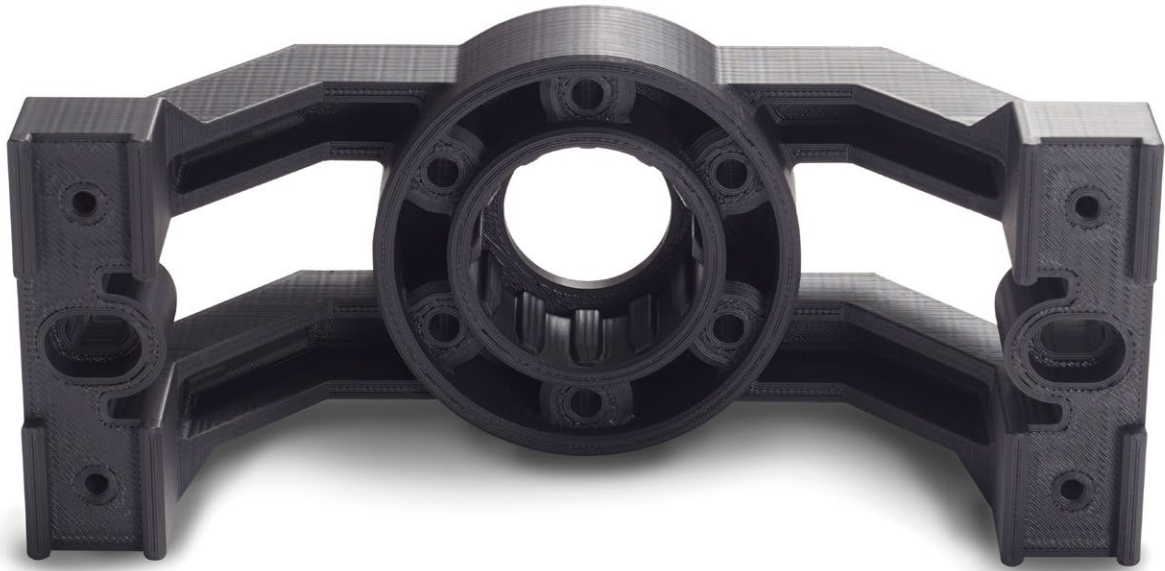3dworld@laserlines.co.uk
www.3dprinting.co.uk

stratasys.com
ISO 9001:2015 Certified

Diran 410MF07

stratasys

FDM Thermoplastic Filament
Perfect for manufacturing
tooling applications.

Overview

Diran™ 410MF07 is a nylon-based thermoplastic FDM® material, mineral-filled 7% by weight. It demonstrates very good toughness and impact strength combined with resistance to hydrocarbon-based chemicals. Its smooth, lubricious surface quality offers low sliding resistance.

Typical applications include jigs, fixtures and other forms of general manufacturing tooling, and is particularly effective for applications needing a non-marring interface between the tool and the workpiece.

Contents:

Ordering Information

3D Printer Compatibility: F370™

Support Material: SUP4000B™

Build Tray: F370, High Temperature

Table 1. Diran 410MF07 Thermoplastic Filament Ordering Information

Part Number	Description
Filament Canisters	
333-90410	Diran 410MF07, 90 cu in, F123
333-60400	SUP4000B™, 60 cu in, F123
Printer Consumables	
123-00300	F370 Extrusion Head
123-00314-S	F370 Build Tray, High Temperature

Physical Properties

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

For full details refer to the Stratasys Materials Test Procedure on www.stratasys.com.

DSC and TMA curves can be found in the Appendix.

Table 2. Diran 410MF07 Thermoplastic Filament Physical Properties

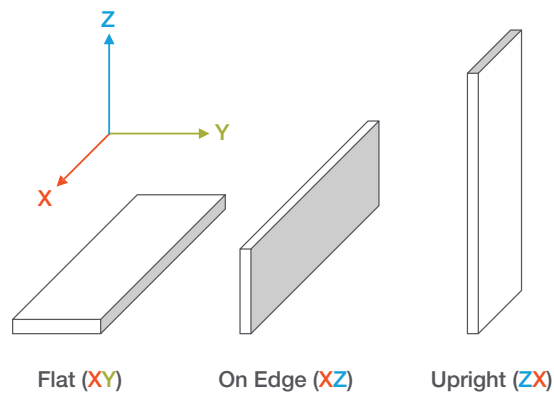| Property	Test Method	Typical Values XY	Typical Values XZ/ZX
HDT @ 66psi	ASTM D648 Method B	90 °C (194 °F)	90 °C (194 °F)
HDT @ 264psi	ASTM D648 Method B	70 °C (158 °F)	70 °C (158 °F)
Tg	ASTM D7426 Inflection Point	117 °C (243 °F)	117 °C (243 °F)
Mean CTE	ASTM E831 (40 °C to 140 °C)	55 µm/[m·°C] (31 µin/[in·°F])	113 µm/[m·°C] (63 µin/[in·°F])
Volume Resistivity	ASTM D257	> $1.5*10^{15}$ Ω·cm	> $1.5*10^{15}$ Ω·cm
Dielectric Constant	ASTM D150 1 kHz test condition	3.58	3.73
Dielectric Constant	ASTM D150 2 MHz test condition	2.85	2.95
Dissipation Factor	ASTM D150 1 kHz test condition	0.013	0.014
Dissipation Factor	ASTM D150 2 MHz test condition	0.000	0.012
Specific Gravity	ASTM D792 @ 23 °C	1.16	1.16

Mechanical Properties

Samples were printed with 0.010 in. (0.254 mm) layer height.

For the full test procedure please see the Stratasys Materials Test Procedure on www.stratasys.com.
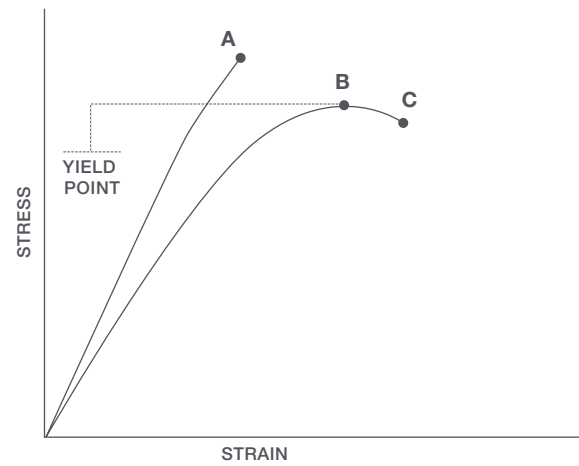
Print Orientation

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 3. Diran 410MF07 Thermoplastic Filament Mechanical Properties

		XZ Orientation[1]	ZX Orientation[1]
Tensile Properties: ASTM D638			
Yield Strength	MPa	45 (2)	No yield
	psi	6,490 (220)	No yield
Elongation @ Yield	%	4.26 (0.04)	No yield
Strength @ Break	MPa	40 (3)	30 (2)
	psi	5,860 (440)	4,460 (295)
Elongation @ Break	%	12 (3)	3.1 (1.0)
Modulus (Elastic)	GPa	1.69 (0.02)	1.46 (0.02)
	ksi	245 (3)	210 (3)
Flexural Properties: ASTM D790, Procedure A			
Strength @ Break	MPa	No break	45 (2)
	psi	No break	6,770 (325)
Strength @ 5% Strain	MPa	60 (2)	-
	psi	8,800 (230)	-
Strain @ Break	%	No break	3.1 (0.6)
Modulus	GPa	1.85 (0.04)	1.47 (0.07)
	ksi	270 (6)	210 (10)
Compression Properties: ASTM D695			
Yield Strength	MPa	75 (5)	160 (30)
	psi	10,980 (630)	23,560 (4330)
Modulus	GPa	1.54 (0.03)	1.45 (0.02)
	ksi	220 (4)	210 (3)
Impact Properties: ASTM D256, ASTM D4812			
Izod, Notched	J/m	380 (135)	27 (5)
	ft*lb/in	7 (3)	0.5 (0.1)
Izod, Unnotched	J/m	1,415 (200)	140 (25)
	ft*lb/in	25 (4)	2.6 (0.5)

(1) Values in parentheses are standard deviations

Appendix

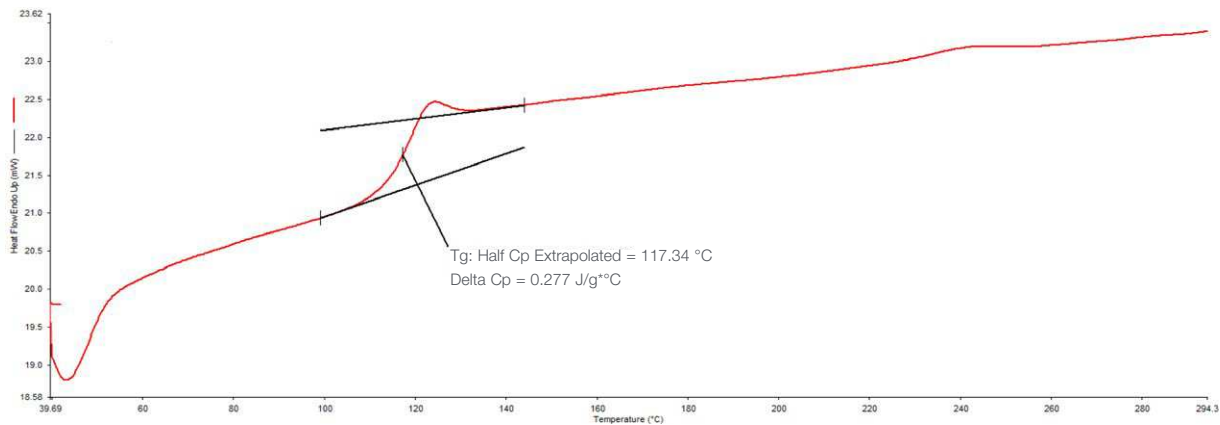**Figure 1. 2nd heating scan, DSC, for Diran 410MF07**

Tg: Half Cp Extrapolated = 117.34 °C
Delta Cp = 0.277 J/g*°C

Figure 2. TMA CTE curve inplane with the layer

Sample: Flat-1
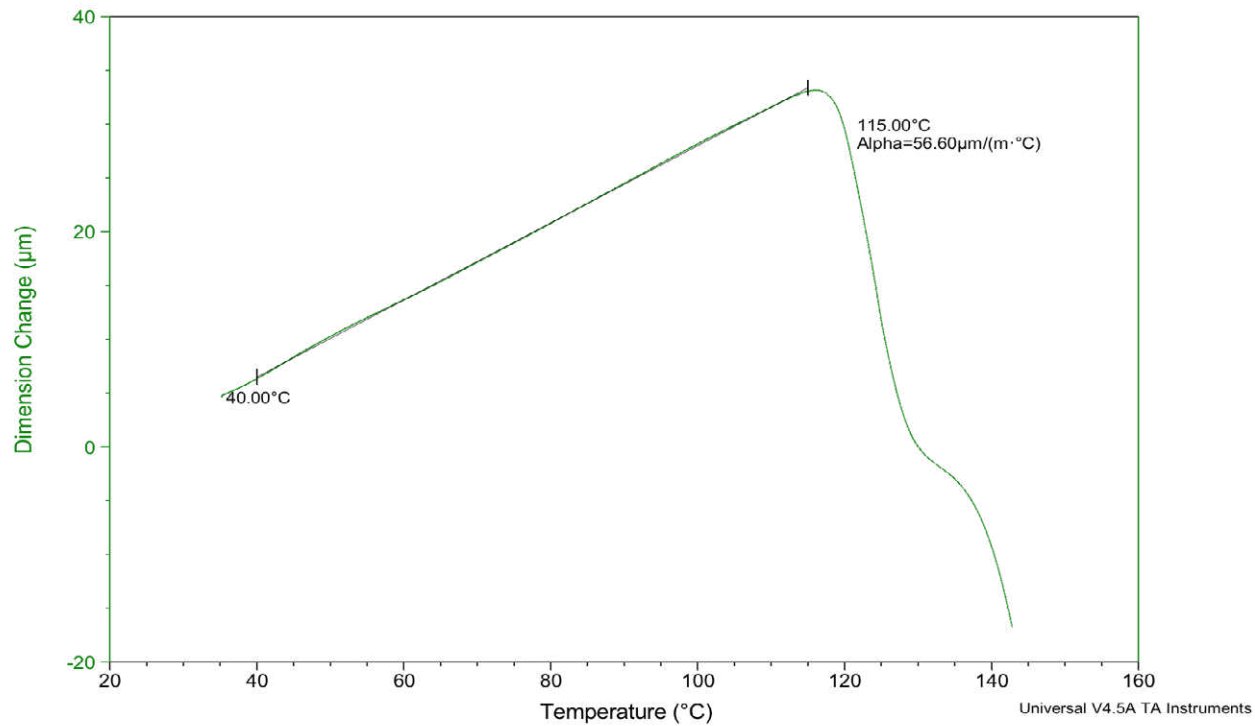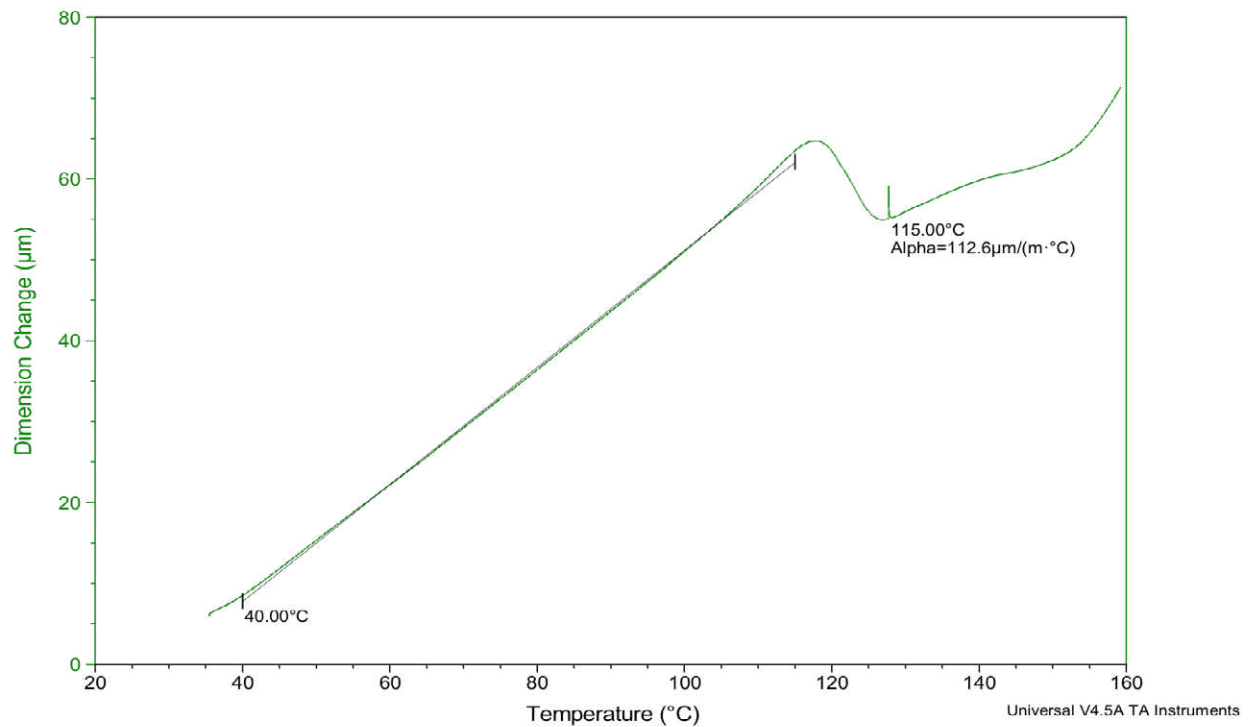Size: 6.3338 mm
Method: Ramp
Comment: RT-160C @ 3C/min

TMA

115.00°C
Alpha=56.60μm/(m·°C)

40.00°C

Universal V4.5A TA Instruments

Figure 3. TMA CTE curve normal to the layer

Sample: Side-1
Size: 6.4269 mm
Method: Ramp
Comment: RT-160C @ 3C/min

TMA

115.00°C
Alpha=112.6µm/(m·°C)

40.00°C

Universal V4.5A TA Instruments

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)

stratasys.com
ISO 9001:2015 Certified

laserlines
01295 672500
3dworld@laserlines.co.uk
www.3dprinting.co.uk