

# FDM Nylon 12CF



## 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 12CF™ is a PA12 (polyamide 12) thermoplastic filament reinforced with chopped carbon fiber, 35% by weight. It has the highest flexural strength of any FDM thermoplastic, resulting in the highest stiffness-to-weight ratio. The combination of high strength, stiffness and light weight makes it an optimal replacement for heavier metal components in appropriate use cases.

Typical applications include strong, lightweight tooling, functional prototyping and select end-use parts.

## Contents:

|                             |   |
|-----------------------------|---|
| Ordering Information .....  | 3 |
| Physical Properties .....   | 4 |
| Mechanical Properties ..... | 5 |
| Appendix .....              | 7 |

## Ordering Information

**Table 1. Printer and Support Material Compatibility**

| Printer                        | Model Tip (Slice) | Support Material  | Support Tip |
|--------------------------------|-------------------|-------------------|-------------|
| Fortus 450mc™                  | T20C (10 slice)   | SR-110™ (soluble) | T12SR100    |
| Fortus 380mc™ CFE <sup>1</sup> | T20C (10 slice)   | SR-110 (soluble)  | T12SR100    |
| F900™                          | T20C (10 slice)   | SR-110 (soluble)  | T12SR100    |

<sup>1</sup> CFE – Carbon Fiber Edition.

### Build Sheet

Nylon

- 0.02 x 26 x 38 in.
- 0.02 x 16 x 18.5 in.
- 0.02 x 14 x 16.5 in.

### Hardware

Due to the high abrasion of this material, a system upgrade is required to support a hardened head and drive wheels. Ordering information can be found in Table 2.

**Table 2. FDM Nylon 12CF Ordering Information**

| Part Number                | Description                                                  |
|----------------------------|--------------------------------------------------------------|
| <b>Filament Canisters</b>  |                                                              |
| 355-02411                  | FDM Nylon 12CF, 92.3 cu in. - Plus                           |
| 355-03130                  | SR-110 Soluble Support, 92.3 cu in. - Plus                   |
| <b>Printer Consumables</b> |                                                              |
| 511-10720                  | T20C tip                                                     |
| 511-10100                  | T12SR100 tip                                                 |
| 325-00600                  | Nylon build sheet, 0.2 x 26 x 38 in. (0.76 x 660 x 965 mm)   |
| 325-00700                  | Nylon build sheet, 0.2 x 16 x 18.5 in. (0.76 x 406 x 470 mm) |
| 355-00700                  | Nylon build sheet, 0.2 x 16 x 16.5 in. (0.76 x 406 x 420 mm) |
| <b>System Upgrades</b>     |                                                              |
| 335-60000                  | Fortus 900mc Gen 3 Upgrade from Gen 1 & 2 Systems            |
| 325-63500                  | Hardened F900 Head Only                                      |

## Physical Properties

Values are measured as printed. XY, XZ, and ZX orientations were tested. For full details refer to the [Stratasys Materials Test Report](#) (immediate download upon clicking the link). DSC and TMA curves can be found in the Appendix.

**Table 3. FDM Nylon 12CF Physical Properties**

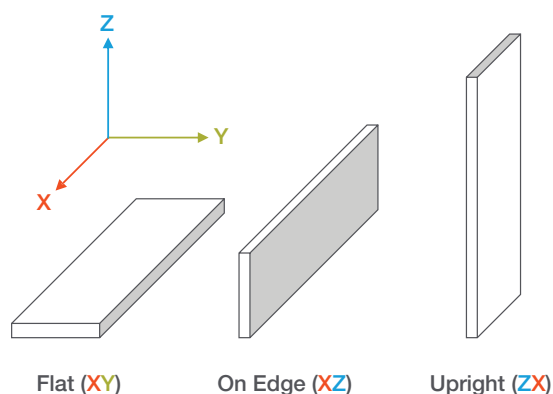
| Property            | Test Method                       | Typical Values                       |                                    |
|---------------------|-----------------------------------|--------------------------------------|------------------------------------|
|                     |                                   | XY                                   | XZ/ZX                              |
| HDT @ 66 psi        | ASTM D648<br>Method B             | 160 °C (320 °F)                      | 168 °C (335 °F)                    |
| HDT @ 264 psi       | ASTM D648<br>Method B             | 130 °C (266 °F)                      | 154 °C (309 °F)                    |
| Tg                  | ASTM D7426<br>Inflection Point    | 38 °C (100 °F)                       |                                    |
| Mean CTE            | ASTM E831<br>(-50 °C to 20 °C)    | 155 µm/[m*°C]<br>(86 µin./[in.*°F])  | 37 µm/[m*°C]<br>(21 µin./[in.*°F]) |
| Mean CTE            | ASTM E831<br>(20 °C to 60 °C)     | 180 µm/[m*°C]<br>(100 µin./[in.*°F]) |                                    |
| Mean CTE            | ASTM E831<br>(60 °C to 115 °C)    | 195 µm/[m*°C]<br>(108 µin./[in.*°F]) |                                    |
| Mean CTE            | ASTM E831<br>(115 °C to 150 °C)   | 295 µm/[m*°C]<br>(164 µin./[in.*°F]) |                                    |
| Mean CTE            | ASTM E831<br>(20 °C to 105 °C)    |                                      | 46 µm/[m*°C]<br>(26 µin./[in.*°F]) |
| Mean CTE            | ASTM E831<br>(105 °C to 150 °C)   |                                      | 58 µm/[m*°C]<br>(32 µin./[in.*°F]) |
| Volume Resistivity  | ASTM D257                         | 3*10 <sup>^7</sup> Ω*cm              |                                    |
| Dielectric Constant | ASTM D150<br>1 kHz test condition | Too conductive                       |                                    |
| Dielectric Constant | ASTM D150<br>2 MHz test condition | 11.4                                 | 10.0                               |
| Dissipation Factor  | ASTM D150<br>1 kHz test condition | Too conductive                       |                                    |
| Dissipation Factor  | ASTM D150<br>2 MHz test condition | 0.100                                | 0.000                              |
| Specific Gravity    | ASTM D257<br>@23 °C               | 1.19                                 |                                    |

# Mechanical Properties

FDM Nylon 12CF samples were printed with a 0.010 in. (0.254 mm) layer height on the F900. For the full test procedure please see the [Stratasys Materials Test Procedure](#) (immediate download upon clicking the link).

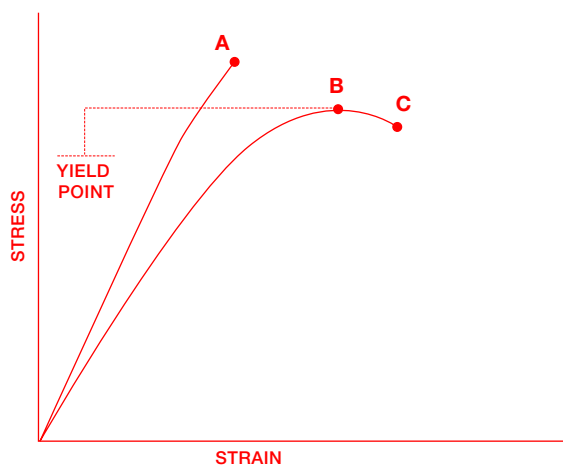
## Print Orientation

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 Nylon 12CF Mechanical Properties (Fortus 450mc - T20C tip)**

|                                                    |           | XZ Orientation <sup>1</sup> | ZX Orientation <sup>1</sup> |
|----------------------------------------------------|-----------|-----------------------------|-----------------------------|
| <b>Tensile Properties: ASTM D638</b>               |           |                             |                             |
| Yield Strength                                     | MPa       | No yield                    | No yield                    |
|                                                    | psi       | No yield                    | No yield                    |
| Elongation @ Yield                                 | %         | No yield                    | No yield                    |
| Strength @ Break                                   | MPa       | 83 (2)                      | 33 (4)                      |
|                                                    | psi       | 12,110 (250)                | 4,745 (510)                 |
| Elongation @ Break                                 | %         | 2.4 (0.3)                   | 1.2 (0.2)                   |
| Modulus (Elastic)                                  | GPa       | 9.5 (0.6)                   | 3.0 (0.4)                   |
|                                                    | ksi       | 1,380 (95)                  | 434 (62)                    |
| <b>Flexural Properties: ASTM D790, Procedure A</b> |           |                             |                             |
| Strength @ Break                                   | MPa       | 150 (2)                     | 62 (3)                      |
|                                                    | psi       | 22,245 (310)                | 9,070 (490)                 |
| Strain @ Break                                     | %         | 2.7 (0.1)                   | 3.1 (0.2)                   |
| Modulus                                            | GPa       | 11.1 (0.3)                  | 2.3 (0.1)                   |
|                                                    | ksi       | 1,610 (40)                  | 340 (12)                    |
| <b>Compression Properties: ASTM D695</b>           |           |                             |                             |
| Yield Strength                                     | MPa       | 110 (3)                     | 140 (3)                     |
|                                                    | psi       | 15,975 (440)                | 20,425 (380)                |
| Modulus                                            | GPa       | 6.8 (0.5)                   | 3.7 (0.1)                   |
|                                                    | ksi       | 980 (80)                    | 530 (15)                    |
| <b>Impact Properties: ASTM D256, ASTM D4812</b>    |           |                             |                             |
| Notched                                            | J/m       | 105 (7)                     | 25 (3)                      |
|                                                    | ft*lb/in. | 2.0 (0.1)                   | 0.45 (0.06)                 |
| Unnotched                                          | J/m       | 345 (40)                    | 120 (20)                    |
|                                                    | ft*lb/in. | 6.5 (0.7)                   | 2.3 (0.3)                   |

<sup>1</sup> Values in parenthesis are standard deviations.

## Appendix

Figure 1. 2nd heating scan DSC data for the Nylon 12CF Flat (XY) sample.

### DSC

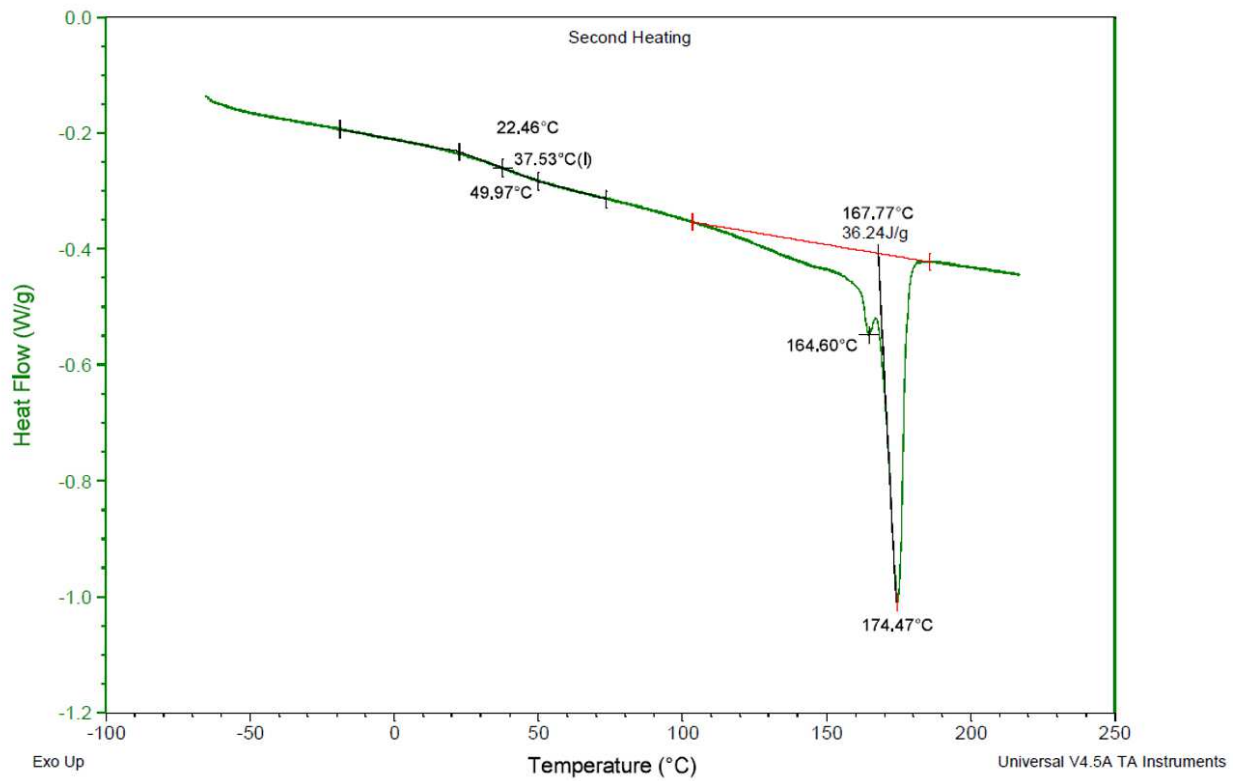


Figure 2. Dimension change data as a function of temperature for the Nylon 12CF Flat (XY) sample.

### TMA

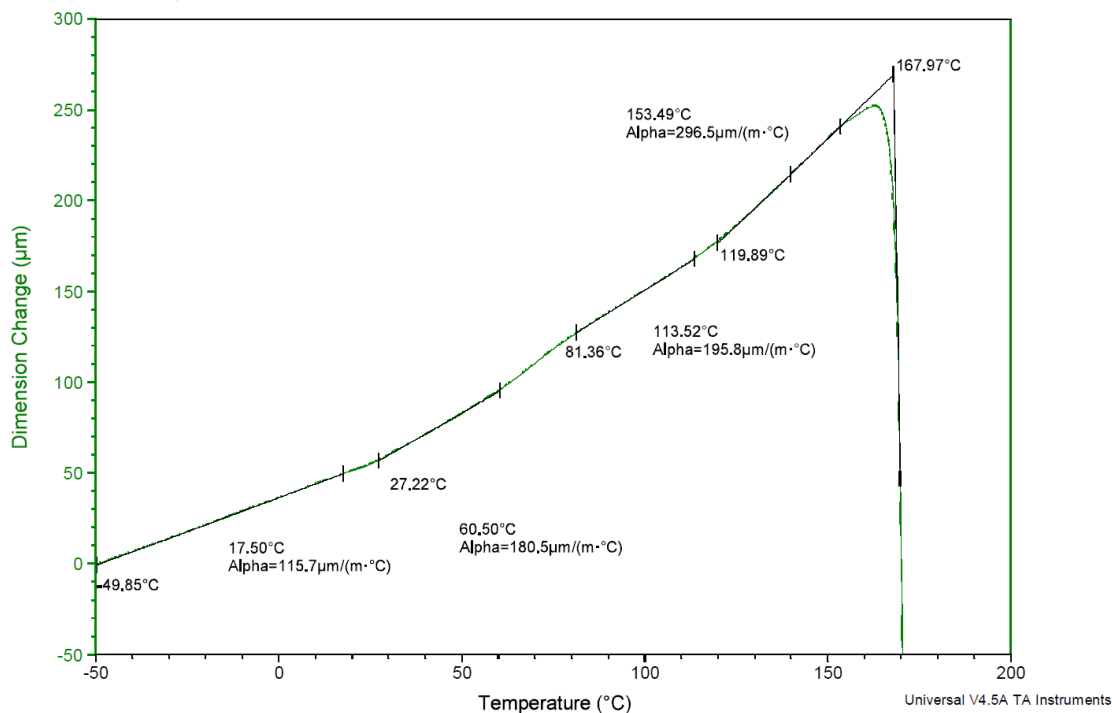


Figure 3. Dimension change data as a function of temperature for the Nylon 12CF On Edge (XZ) sample.

### TMA

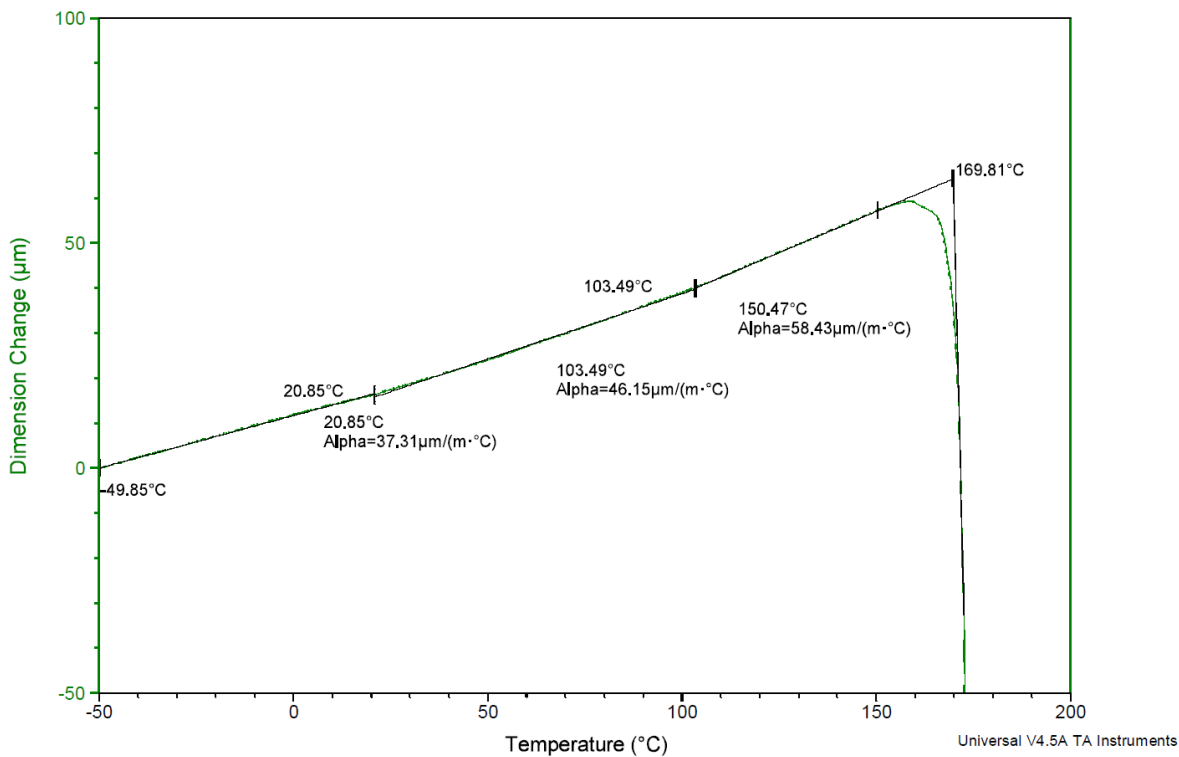
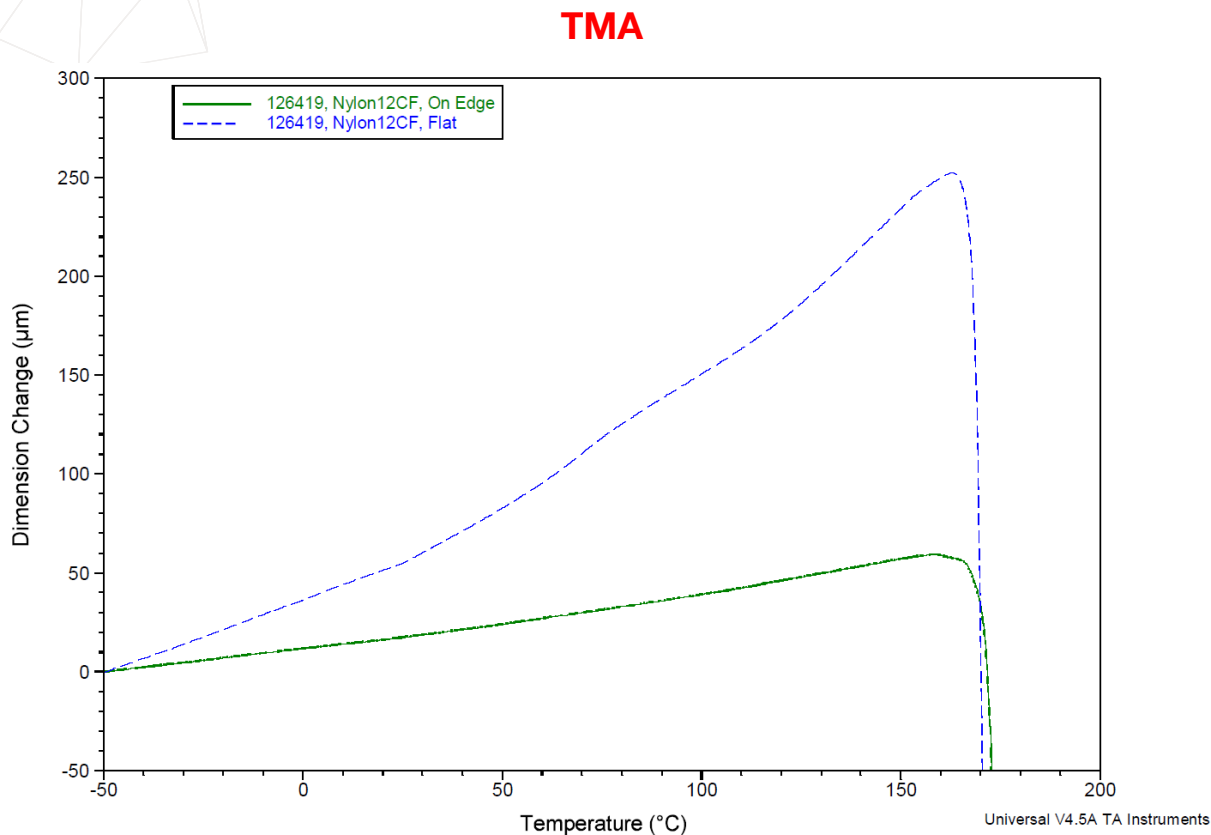


Figure 4. Overlay of the dimension change data for the Flat (XY) and On Edge (XZ) Nylon 12CF samples.



PADT Inc.



**Headquarters**

7755 South Research Drive  
Tempe, AZ 85284, USA

(480) 813-4884  
Info@padtinc.com

© 2020 Stratasys. All rights reserved. Stratasys, the Stratasys Signet logo, FDM, and Fortus are registered trademarks of Stratasys Inc. FDM Nylon 12CF, SR-110, Fortus 380mc CFE, Fortus 450mc and F900 are trademarks of Stratasys, Inc. All other trademarks are the property of their respective owners, and Stratasys assumes no responsibility with regard to the selection, performance, or use of these non-Stratasys products. Product specifications subject to change without notice.  
Printed in the USA. MDS\_FDM\_Nylon 12CF\_0420a

