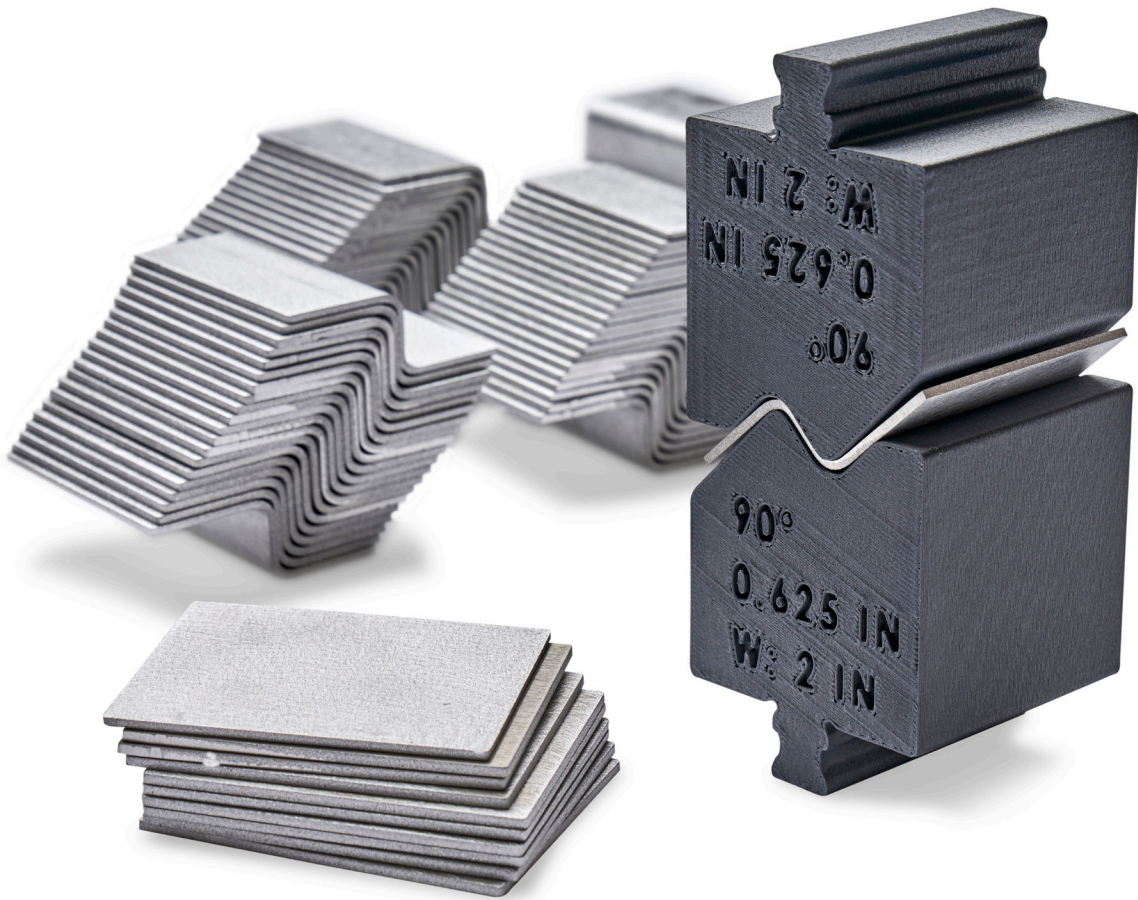


FDM Nylon-CF10



Carbon Fiber Filled 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-CF10 is a composite material combining a blended nylon polymer with 10% chopped carbon fiber (by weight), enhancing the material's strength and rigidity. The nylon base polymer also gives FDM Nylon-CF10 good chemical resistance.

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Product Information

Table 1. Printer and Support Material Compatibility

| Printer | Model Tip (Slice) | Support Material | Support Tip |
|---------|---|--|--------------------------------------|
| F190™CR | F123CR Hardened Extrusion Head (all slice heights) | QSR Support (SR-35 soluble) SUP4000B™ (breakaway support) | F123 Std Head (all slice heights) |
| F370®CR | F123CR Hardened Extrusion Head (all slice heights) | QSR Support (SR-35 soluble) SUP4000B (breakaway support) | F123 Std Head (all slice heights) |

Build Tray

- F190CR build tray
- F370CR build tray

Table 2. FDM Nylon-CF10 Ordering Information

| Part Number | Description |
|----------------------------|---|
| Filament Spools | |
| 333-90450 | FDM Nylon-CF10 90 cu. in. |
| 333-63500 | QSR Support 60 cu. in. |
| 333-60400 | SUP4000B 60 cu. in. |
| Printer Consumables | |
| 123-00303-S | F190CR Build Tray, Standard |
| 123-00304 | F370CR Build Tray, Standard |
| 123-00602-S | F123CR Hardened Head for FDM Nylon-CF10 |

Physical Properties

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

Table 3. FDM Nylon-CF10 Physical Properties

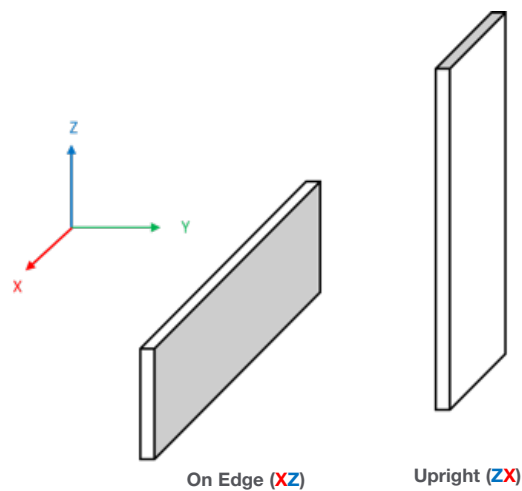
| Property | Test Method | Typical Values | |
|--------------------|--------------------------------|-------------------|------------------|
| | | XY | XZ/ZX |
| HDT @ 66 psi | ASTM D648 Method B | 58 °C (136 °F) | 77 °C (171 °F) |
| HDT @ 264 psi | ASTM D648 Method B | 52 °C (126 °F) | 62 °C (144 °F) |
| Tg | ASTM D7426 Inflection Point | 109 °C (228.2 °F) | |
| CTE (XY) | ASTM E831 (RT to 60 °C) | 94 µm/[m*°C] | 79 µm/[m*°C] |
| CTE (Z) | ASTM E831 (RT to 60 °C) | 180 µm/[m*°C] | 148 µm/[m*°C] |
| Volume Resistivity | ASTM D257 | 1.88E+15 Ohms-cm | 4.25E+13 Ohms-cm |
| Specific Gravity | ASTM D792@23 °C | 1.1411 | |

Mechanical Properties

FDM Nylon-CF10 samples were printed with a 0.010 in. (0.254 mm) layer height.

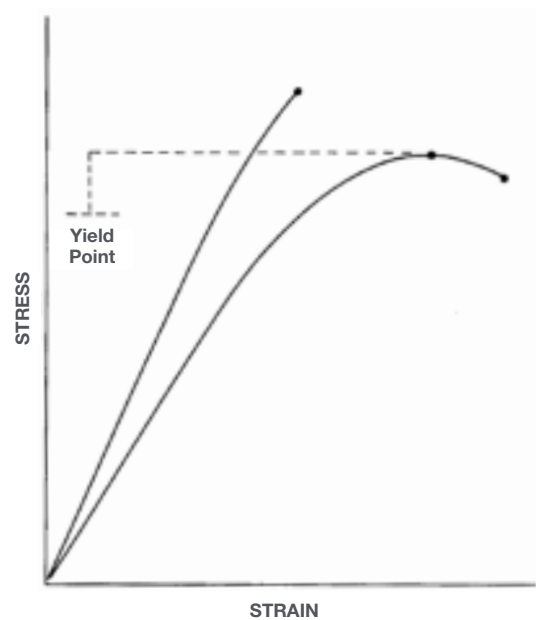
Print Orientation

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. To the left 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-CF10 Mechanical Properties

| 0.010 in. Layer Height | | XZ Orientation | ZX Orientation |
|--|----------|----------------|----------------|
| Tensile Properties: ASTM D638 | | | |
| Yield Strength | MPa | 69.1 (3.74) | 25.4 (3.61) |
| | psi | 10034 (543) | 3684 (524) |
| Elongation @ Yield | % | 4.44 (0.61) | 2.52 (0.60) |
| Strength @ Break | MPa | 67.6 (4.12) | 24.7 (3.81) |
| | psi | 9809 (598) | 3576 (552) |
| Elongation @ Break | % | 4.74 (0.73) | 2.41 (0.62) |
| Modulus (Elastic) | GPa | 4.15 (0.12) | 1.57 (0.071) |
| | ksi | 602 (16.7) | 228 (10.3) |
| Flexural Properties: ASTM D790, Procedure A | | | |
| Strength @ Break | MPa | 123.7 (2.74) | 39.7 (3.49) |
| | psi | 17940 (398) | 5751 (506) |
| Strain @ Break | % | 4.61 (0.24) | 3.16 (0.44) |
| Modulus | GPa | 5.37 (0.17) | 1.54 (0.101) |
| | ksi | 779 (24.7) | 223 (14.7) |
| Compression Properties: ASTM D695 | | | |
| Yield Strength | MPa | No Yield | No Yield |
| | psi | No Yield | No Yield |
| Peak Strength | MPa | 76.1 (40.0) | 124.2 (12.15) |
| | psi | 11034 (5801) | 18016 (1762) |
| Modulus | GPa | 2.13 (0.041) | 1.57 (0.045) |
| | ksi | 309 (5.9) | 228 (6.5) |
| Impact Properties: ASTM D256, ASTM D4812 | | | |
| Notched | J/m | 202.7 (8.6) | 36.4 (13.4) |
| | ft*lb/in | 3.79 (0.16) | 0.68 (0.25) |
| Unnotched | J/m | 1030.5 (74.3) | 117.11 (17.1) |
| | ft*lb/in | 19.27 (1.39) | 2.19 (0.32) |

(1) Values in parenthesis are standard deviations.

Table 5. FDM Nylon-CF10 Mechanical Properties with SUP4000B Support

| 0.010 in. Layer Height | | XZ Orientation | ZX Orientation |
|--|----------|----------------|----------------|
| Tensile Properties: ASTM D638 | | | |
| Yield Strength | MPa | 75.2 (2.0) | 35.8 (1.1) |
| | psi | 10900 (280) | 5190 (160) |
| Elongation @ Yield | % | 5.0 (0.29) | 3.7 (0.33) |
| Strength @ Break | MPa | 74.3 (2.1) | 35.7 (1.1) |
| | psi | 10800 (300) | 5170 (160) |
| Elongation @ Break | % | 5.4 (0.59) | 3.7 (0.33) |
| Modulus (Elastic) | GPa | 4.20 (0.086) | 1.73 (0.031) |
| | ksi | 609 (12) | 251 (4.4) |
| Flexural Properties: ASTM D790, Procedure A | | | |
| Strength @ Break | MPa | 132 (2.1) | 57.7 (1.7) |
| | psi | 19100 (310) | 8370 (250) |
| Strain @ Break | % | 4.7 (0.16) | 4.6 (0.20) |
| Modulus | GPa | 5.24 (0.084) | 1.67 (0.039) |
| | ksi | 760. (120) | 243 (5.6) |
| Compression Properties: ASTM D695 | | | |
| Peak Strength | MPa | 80.6 (2.7) | 139 (1.7) |
| | psi | 11700 (390) | 20100 (250) |
| Modulus | GPa | 1.85 (0.036) | 1.43 (0.034) |
| | ksi | 268 (5.2) | 208 (4.9) |
| Impact Properties: ASTM D256, ASTM D4812 | | | |
| Notched | J/m | 187 (7.2) | 41.2 (6.3) |
| | ft*lb/in | 3.50 (0.13) | 0.772 (0.12) |
| Unnotched | J/m | 1030 (73) | 145 (15) |
| | ft*lb/in | 19.4 (1.4) | 2.71 (0.28) |

(1) Values in parenthesis are standard deviations.

Chemical Resistance

Nylon-CF10 was tested for resistance to chemical exposure by soaking coupons in reagents for 72 hours. Afterwards the coupons were tensile tested following ASTM D638. Chemicals tested and percent change from control is listed below. Data generated from samples printed with QSR support material.

Table 6. Change in Mechanical Properties- 72 hour Chemical Exposure

| | Reagent | XZ | ZX |
|----------------------|----------------------|------|------|
| Tensile Strength | 30% Nitric Acid | -32% | -43% |
| | 30% Sulfuric Acid | -24% | -23% |
| | 40% Sodium Hydroxide | s-1% | -5% |
| | Concentrated Ammonia | -33% | -34% |
| % Elongation @ break | 30% Nitric Acid | 132% | -33% |
| | 30% Sulfuric Acid | 59% | -9% |
| | 40% Sodium Hydroxide | -9% | -20% |
| | Concentrated Ammonia | 90% | -1% |
| Tensile Modulus | 30% Nitric Acid | -21% | 6% |
| | 30% Sulfuric Acid | 3% | 13% |
| | 40% Sodium Hydroxide | 17% | 38% |
| | Concentrated Ammonia | 2% | -12% |

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