FFF and CFC Polymer System Overview

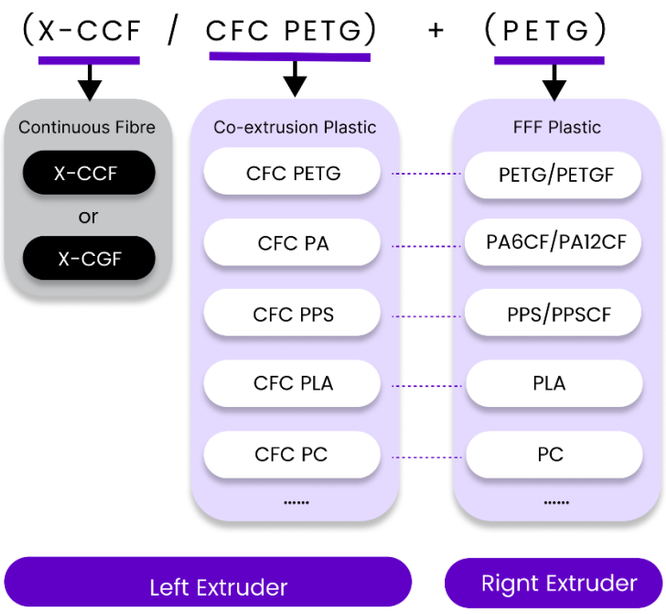
CFC continuous fiber 3D printing requires two types of filaments: FFF matrix filament and CFC composite material. Common FFF filaments include PLA, ABS, PETG, PA (Nylon), PC, etc. These materials deliver differentiated performance in strength, toughness, heat resistance and chemical resistance, and can be selected flexibly according to application scenarios.

CFC stands for **Composite Fiber Co-extrusion**. As a high-performance composite printing material system based on FibreSeeker's core patented technology, it retains the forming flexibility of thermoplastics. Developed specifically for continuous fiber reinforced printing, this co-extrusion binder system targets applications requiring high strength, high stiffness and lightweight design.

The continuous fiber is pre-impregnated with thermosetting resin. Acting as a high-strength bonding medium, CFC material improves adhesion between fibers and FFF filaments, and ensures stable transfer of interlayer load.

CFC and FFF System

X-CCF and X-CGF are thermosetting resin pre-impregnated continuous fiber filaments. Unable to print alone, they require matching matrix filaments such as CFC PLA, CFC PETG and CFC PA for co-printing. The full material system realizes composite manufacturing through the CFC process. The diagram on the right details the material naming rule and co-forming mechanism.



Why must FFF and CFC filaments be matched in pairs?

Not all polymer combinations produce reliable bonding. At the molecular level, adhesion between thermoplastics relies on the interdiffusion and entanglement of polymer chains at material interfaces. Material pairs with vastly different chemical structures exhibit minimal molecular interdiffusion. Bonding only depends on weak mechanical interlocking, which is prone to delamination and print failure.

PLA-Basic Technical Properties

FFF Polymer

PLA-Basic is an entry-level filament developed for 3D printing enthusiasts and beginners. This low-cost base material modified from PLA features easy printing performance, zero irritating odor, minimal stringing and no warpage with favourable forming results. It stands out as a cost-effective 3D printing filament and must be printed in combination with CFC PLA fiber.

Mechanical Properties

Property	Test Method	Typical Values
Tensile Strength (X-Y)	GB/T 1040	63.95 MPa
Tensile Strength (Z)	GB/T 1040	28.29 MPa
Elongation at Break (X-Y)	GB/T 1040	4.17 %
Elongation at Break (Z)	GB/T 1040	2.41 %
Bending Strength (X-Y)	GB/T9341	101.2 MPa
Bending Strength (Z)	GB/T9341	40.5 MPa
Bending Modulus (X-Y)	GB/T9341	3085.87 MPa
Bending Modulus (Z)	GB/T9341	2832.46 Mpa
Izod Impact Strength of Notched Specimen (X-Y)	GB/T 1843	3.09 KJ/m²
Izod Impact Strength of Notched Specimen (Z)	GB/T 1843	2.15 KJ/m²

Physical Properties

Property	Test Method	Typical Values
Density	GB/T 1033	1.24 g/cm^3
Melt Index	GB/T 3682	3.5-4.5 (190 °C /2.16kg)

Thermal Properties

Property	Test Method	Typical Values
Heat Deflection Temperature	GB/T 1634	50-60 °C (0.45Mpa)
Continuous Service Temperature	IEC 60216	N/A

PETG Technical Properties

FFF Polymer

PETG is an easy-to-print transparent 3D printing filament with high flowability, balanced performance and good chemical resistance. Printed components feature high toughness, low warpage, glossy transparent surfaces, weather resistance and anti-yellowing capability. Eco-friendly and BPA-free, it is ideal for aesthetic models, home appliance, electronic and cosmetic parts requiring toughness and impact resistance. It needs co-printing with CFC PETG fiber.

Mechanical Properties

Property	Test Method	Test Condition	Typical Values
Tensile Strength (X-Y)	ISO527/2	50 mm/min	48 ± 10 MPa
Young's Modulus (X-Y)	ISO527/2	1 mm/min	-
Elongation at Break (X-Y)	ISO527/2	50 mm/min	11 ± 5 %
Flexural Strength (X-Y)	ISO 178	2 mm/min	70 ± 10 MPa
Flexural Modulus (X-Y)	ISO 178	2 mm/min	2100 ± 300 MPa
Izod Impact Strength of Notched Specimen (X-Y)	ISO 180	23 °C	3.0 ± 1 KJ/m^2
Izod Impact Strength of Notched Specimen (Z-X)	ISO 180	23 °C	5.0±2 KJ/m^2
Shore Hardness	ISO 868	23 °C	80D

Thermal Properties

Property	Test Method	Test Condition	Typical Values
Heat Distortion (X-Y)	ISO75	0.45 MPa	70 ± 5 °C
Glass Transition	ISO11357-2	10 °C /min	79.4 °C
Melting Temperature	ISO11357-3	10 °C /min	195 °C

PC Technical Properties

FFF Polymer

PC is produced using a polycarbonate resin specifically engineered for 3D printing. It delivers good stiffness and heat resistance with light diffusing properties. It needs co-printing with CFC PC fiber.

Mechanical Properties

Property	Test Method	Typical Values
Young's Modulus (X-Y)	ISO 527, GB/T 1040	2497 ± 154 MPa
Tensile Strength (X-Y)	ISO 527, GB/T 1040	69.1 ± 3.0 MPa
Elongation at Break (X-Y)	ISO 527, GB/T 1040	4.8 ± 0.9 %
Young's Modulus (Z)	ISO 527, GB/T 1040	2371 ± 55 MPa
Tensile Strength (Z)	ISO 527, GB/T 1040	52.8 ± 1.7 MPa
Elongation at Break (Z)	ISO 527, GB/T 1040	2.7 ± 0.1 %
Bending Modulus (X-Y)	ISO 178, GB/T 9341	2640 ± 47 MPa
Bending Strength (X-Y)	ISO 178, GB/T 9341	106.1 ± 1.6 MPa
Notched Charpy Impact Strength (X-Y)	ISO 179, GB/T 1043	4.1 ± 0.9 kJ/m^2

Physical Properties

Property	Test Method	Typical Values
Density	ISO1183, GB/T1033	11.19 g/cm^3 at 21.5 °C
Melt Index	260 °C, 2.16kg	8-11 g/10 min
Light Transmission	GB/T 2410	89 %

Thermal Properties

Property	Test Method	Typical Values
Glass Transition Temperature	DSC, 10 °C/min	113 °C
Heat Deflection Temperature	ISO 75 1.8 MPa	107 °C
Heat Deflection Temperature	ISO 75 0.45 MPa	113 °C

PET-GF15 Technical Properties

FFF Polymer

PET-GF15 is the bridge of the gap between every day usability and industrial performance, offering a strong, heat-resistant, and user-friendly filament for both professional and hobbyist applications. It needs co-printing with CFC PETGF fiber.

Mechanical Properties

Property	Test Method	Typical Values
Young's Modulus (X - Y)	ISO 527, GB/T 1040	4144.2 ± 133.3 MPa
Tensile Strength (X - Y)	ISO 527, GB/T 1040	59.9 ± 0.8 MPa
Elongation at Break (X – Y)	ISO 527, GB/T 1040	4.0 ± 0.5 %
Bending Modulus (X - Y)	ISO 178, GB/T 9341	3705.4 ± 84.5 MPa
Bending Strength (X - Y)	ISO 306, GB/T 1633	104.2 ± 2.4 MPa
Charpy Impact Strength (X-Y) Notched	ISO 179，GB/T 1043	8.7 ± 0.6 kJ/m²
Charpy Impact Strength (X-Y) Nn-notched	ISO 179，GB/T 1043	27.2 ± 2.0 kJ/m²

Physical Properties

Property	Test Method	Typical Values
Density	ISO1183, GB/T1033	1.43 g/cm^3 at 23 °C
Melt Index	270°C, 2.16 kg	36.9 g/10 min
Surface Resistivity (Ω)	ANSI ESD S11.11	OL, >1012 Ω

Thermal Properties

Property	Test Method	Typical Values
Glass Transition Temperature	DSC, 10°C/min	59.5 °C
Melting Temperature	DSC, 10°C/min	231.6 °C
Crystallization Temperature	DSC, 10 °C /min	201.4 °C
Heat Deflection Temperature	ISO 75 1.8 MPa	71.8 °C

PA6-CF Technical Properties

FFF Polymer

PA6-CF is a carbon fiber reinforced PA6 (Nylon 6) filament. The carbon fiber reinforcement provides significantly improved stiffness, strength and heat resistance with outstanding layer adhesion. It needs co-printing with CFC PACF fiber.

Mechanical Properties

Property	Test Method	Typical Values
Young's Modulus (X-Y)	ISO 527, GB/T 1040	7453 ± 656 MPa
Tensile Strength (X-Y)	ISO 527, GB/T 1040	105. ± 5.0 MPa
Elongation at Break (X-Y)	ISO 527, GB/T 1040	3.0 ± 0.3 %
Bending Modulus (X-Y)	ISO 178, GB/T 9341	8339 ± 369 MPa
Bending Strength (X-Y)	ISO 306, GB/T 1633	169.0 ± 4.7 MPa
Charpy Impact Strength (X-Y)	ISO 179， GB/T 1043	13.34 ± 0.5 kJ/m^2

Physical Properties

Property	Test Method	Typical Values
Density	ISO1183, GB/T1033	1.17 g/cm^3 at 23°C
Melt Index	300°C, 2.16 kg	20.5 g/10min
Sheet Resistance in Moisture State	ASTM D991	1 – 10 (108 Ω/sq)

Thermal Properties

Property	Test Method	Typical Values
Glass Transition Temperature	DSC, 10 °C/min	74.2 °C
Melting Temperature	DSC, 10 °C/min	218.5 °C
Crystallization Temperature	DSC, 10 °C /min	184.6 °C
Heat Deflection Temperature	ISO 75 1.8 MPa	173 °C

PPS-CF10 Technical Properties

FFF Polymer

PPS-CF10 is a carbon fiber reinforced PPS (Polyphenylene sulfide) filament, with minimal warping during printing and no need for a heated chamber. With exceptional mechanical strength, high heat resistance, chemical resistance, V0 flame retardancy, and moisture insensitivity, it's specifically designed for professionals operating in extreme conditions. It needs co-printing with CFC PPSCF fiber.

Mechanical Properties

Property	Test Method	Typical Values
Young's Modulus (X-Y)	ISO 527, GB/T 1040	5446.7 ± 149.0 MPa
Tensile Strength (X-Y)	ISO 527, GB/T 1040	59.4 ± 1.3 MPa
Elongation at Break (X-Y)	ISO 527, GB/T 1040	1.4 ± 0.1 %
Young's Modulus (Z)	ISO 527, GB/T 1040	2790.0 ± 152.6 MPa
Tensile Strength (Z)	ISO 527, GB/T 1040	32.0 ± 5.1 MPa
Elongation at Break (Z)	ISO 527, GB/T 1040	1.6 ± 0.2 %
Bending Modulus (X-Y)	ISO 178, GB/T 9341	4646.9 ± 136.9 MPa
Bending Strength (X-Y)	ISO 178, GB/T 9341	94.3 ± 1.9 MPa
Charpy Impact Strength (X-Y) Un-notched	ISO 179, GB/T 1043	11.4 ± 0.7 kJ/m^2

Physical Properties

Property	Test Method	Typical Values
Density	ISO1183, GB/T1033	1.29 g/cm^3 at 23 °C
Melt Index	300°C, 2.16 kg	26.2 g/10 min
Surface Resistivity (Ω)	ANSI ESD S11.11	OL, >1012 Ω

Thermal Properties

Property	Test Method	Typical Values
Glass Transition Temperature	DSC, 10 °C/min	97.7 °C
Melting Temperature	DSC, 10 °C/min	279.7 °C
Crystallization Temperature	DSC, 10 °C /min	218.8 °C
Heat Deflection Temperature	ISO 75 1.8 MPa	71.8 °C

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CFC PETG Technical Properties

CFC Polymer

CFC PETG is a highly transparent PETG filament with excellent compatibility with PETG and continuous fibers. It is primarily used for 3D printing via composite nozzles alongside continuous fibers.

Performance Test Data

Property	Test Condition	Test Standard	Value
Basic Physical Properties			
Density	23 °C	GB/T 1033	1.29 g/cm³
Heat Deflection Temperature (HDT)	0.45 MPa	GB/T 1634	76 °C
Mechanical Properties of Printed Specimens			
Tensile Strength (X-Y)	50mm/min	GB/T 1040.2	57 MPa
Tensile Strength (X-Z)	50mm/min	GB/T 1040.2	32 MPa
Flexural Strength	2mm/min	GB/T 9341	82 MPa
Flexural Modulus	2mm/min	GB/T 9341	2200 MPa
Notched Charpy Impact Strength	2.75 J	GB/T 1843	4 kJ/m²

CFC PA Technical Properties

CFC Polymer

CFC PA is high-purity PA12, featuring excellent compatibility with PA6-CF and continuous fibers. It is mainly applied to continuous fiber 3D printing with composite nozzles.

Mechanical Properties

Property	Test Standard (ASTM)	Value
Young's Modulus (X - Y)	D638 (ISO 527, GB/T 1040)	1580± 195 MPa
Tensile Strength (X - Y)	D638 (ISO 527, GB/T 1040)	56.8 ± 0.53 MPa
Elongation at Break (X – Y)	D638 (ISO 527, GB/T 1040)	15.86±2.41 %
Flexural Modulus (X - Y)	D790 (ISO 178, GB/T 9341)	1580 ± 195 MPa
Flexural Strength (X - Y)	D790 (ISO 178, GB/T 9341)	68.7 ± 1.8 MPa
Charpy Impact Strength (X - Y)	D256 (ISO 179, GB/T 1043)	11.42 ± 0.9 kJ/m²

Physical Properties

Property	Test Standard	Value
Density	ASTM D792(ISO 1183, GB/T 1033)	1.43 23 °C, g/cm³
Melt Flow Rate	270 °C, 2.16 kg	36.9 g/10 min
Glass Transition Temperature	DSC, 10 °C/min	59.5 °C
Melting Temperature	DSC, 10 °C/min	231.6 °C
Crystallization Temperature	DSC, 10 °C /min	201.4 °C

Recommended Printing Settings

FFF matrix filaments and CFC composites require different printing parameters and settings cannot be shared. Recommended printing conditions are shown in the three tables below.

FFF Polymer

Parameter	PLA-Basic	PETG	PC
Nozzle Temperature	210-230 °C	240-260 °C	250–270 °C
Bed Temperature	45-60 °C	60-70 °C	90–105 °C
Build Plate Material	PEI	Normal	Texture PEI (Glue when needed)
Printing Speed	< 300 mm/s	≤ 300 mm/s	50–200 mm/s
Retraction Distance	-	0.8–1.2 mm	1–3 mm
Retraction Speed	-	30–40 mm/s	20–40 mm/s
Closure Chamber		—	70–100 °C
Drying Condition	50℃ >8H	60-65℃	75˚C, 6h
Cooling Fan	ON	ON	OFF

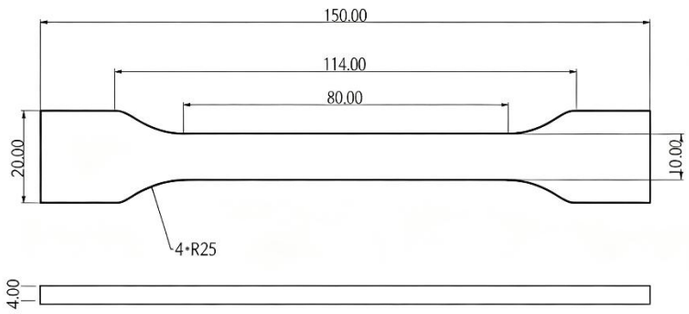
Parameter	PET-GF15	PA6-CF	PPS-CF10
Nozzle Temperature	280–310 °C	200–300 °C	310-350 °C
Bed Temperature	70–80 °C	25–50 °C	80-90 °C
Printing Speed	≤250 mm/s	30–60 mm/s	≤ 300 mm/s
Environmental Temperature	Room Temp.	Room Temp.–50 °C	Room Temp.
Cooling Fan	OFF	OFF	OFF

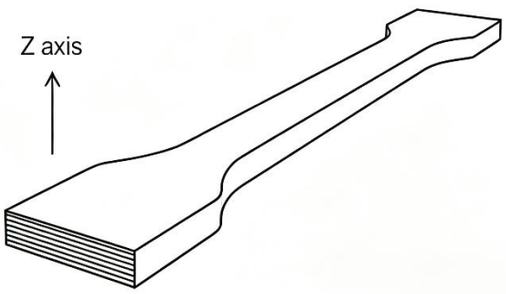
CFC Polymer

Parameter	CFC PETG	CFC PA
Nozzle Temperature	250 °C	250–260 °C
Bed Temperature	75 °C	75 °C
Build Plate Material	Glass, PEI, Spring Steel Sheet	lass, PEI; apply PVP adhesive if needed
First Layer Temperature	250 °C	250–260 °C
Cooling Fan	—	OFF
Recommended Ambient Temperature	Room Temperature – 50℃	Room Temperature – 50 °C
Drying Condition	60 °C，4–8 h	70–80℃，8-12 h

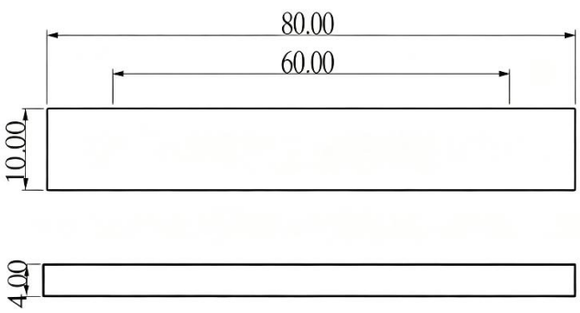
Test Specimens

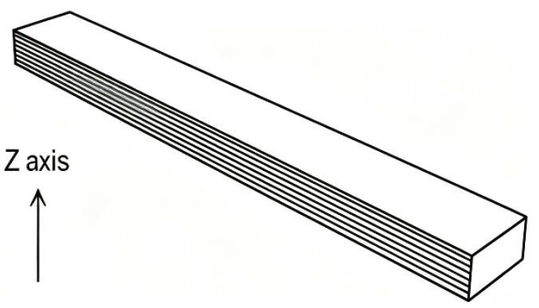
Tensile Testing Specimen



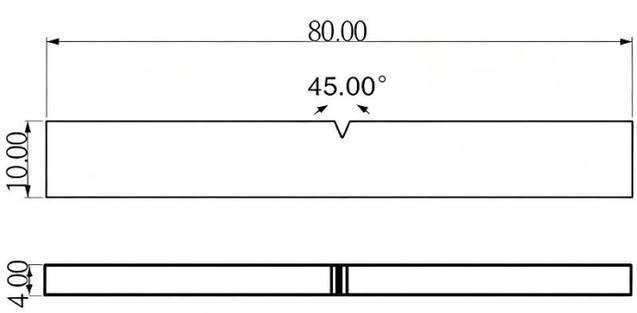


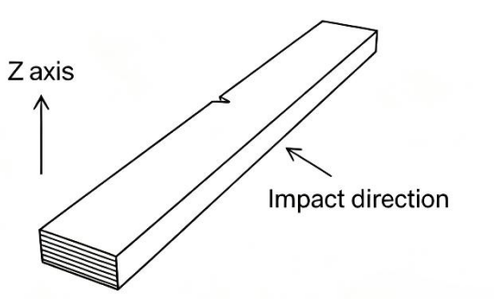
Flexural Testing Specimen





Impact Testing Specimen





Moisture Content & Drying Conditions for FFF Polymer

Different FFF filaments feature varying hygroscopicity. Drying treatment is recommended prior to printing. The two tables below list the maximum allowable moisture content and recommended drying conditions for various FFF filaments.

Moisture Content

Material	Maximum Moisture Content	Moisture Susceptibility
PLA-Basic	250 ppm	Low
PETG/CFC PETG	500 ppm	Medium
PC	200 ppm	Medium-High
PET- GF15	500 ppm	Medium-High
CFC PA	500 ppm	Very High
PA6-CF	500 ppm	Very High
PPS-CF10	100 ppm	Low

Recommended Drying Conditions

Material	Temperature	Time	Instructions
PLA-Basic	50-55 °C	4–6 h	Low-temp hot air drying to avoid spool deformation
PETG/CFC PETG	60-70 °C	6 h	Prone to stringing and bubbling; seal after opening
PC	75-85 °C	6-8 h	Fully dry before printing
PET- GF15	65-70 °C	8 h	store and use in dry environment
CFC PA	70-80 °C	8-12 h	Covers PA6, PA66 and copolyamides; significant grade-to-grade differences.
PA6-CF	70-80 °C	8-12 h	Continuous feeding from heated dryer
PPS-CF10	120 °C	6-8 h	Requires heat-resistant spools and specialized oven

Note: Maximum moisture content refers to the recommended upper limit before feeding into the printer / melt processing.1% = 10,000 ppm. Drying parameters are specified for hot-air circulating or dehumidifying ovens. Consumer household ovens have large temperature fluctuations. Confirm the temperature resistance of filament spools when drying high-temperature materials.