COMPOSITE MATERIAL DATASHEET

Markforged

Onyx GF™

HIGH-STRENGTH COLOR COMPOSITE

Onyx GF is a chopped-glass-fiber-filled nylon filament built for industrial tooling and end-use parts. It delivers the surface finish, dimensional accuracy, and print reliability of Onyx with added functional color and non-conductive properties. Compatible with Continuous Fiber Reinforcement, Onyx GF can be reinforced for higher-load applications where structural performance is critical.

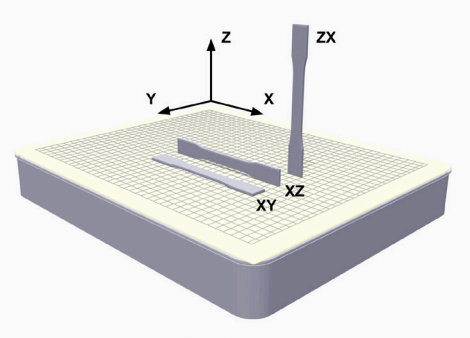
Available in six colors, Onyx GF brings visual differentiation to the factory floor without added process steps. Select colors support safety compliance and error-proofing workflows where color-coded, identifiable tooling is an operational requirement. Designed for automotive, aerospace, defense, and other demanding manufacturing environments, Onyx GF is built for teams that require both material performance and visual organization at scale.

Material Properties	Unit	Test (ASTM)	Onyx GF™ XY Orientation	Test (ASTM)	Carbon Fiber
Tensile Strength at Yield	MPa (ksi)	D638[1]	57.9 ± 0.7 (8.4 ± 0.1)	-	
Tensile Strength at Break	MPa (ksi)	D638[1]	56.5 ± 0.9 (8.2 ± 0.1)	D3039	800 (116)
Tensile Modulus	GPa (ksi)	D638[1]	3.1 ± 0.1 (446 ± 10)	D3039	60 (8,702)
Elongation at Break	%	D638[1]	6.2 ± 0.6	D3039	1.5
Flexural Strength	MPa (ksi)	D790	88.2 ± 2.4 (12.8 ± 0.3)	D790	540 (78.3)
Flexural Modulus	GPa (ksi)	D790	2.4 ± 0.1 (343 ± 8)	D790	51 (7,397)
Compressive Strength	MPa (ksi)	D695[2]	71.8 ± 4.0 (10.4 ± 0.6)	D6641	420 (60.9)
Compressive Modulus	GPa (ksi)	D695[2]	1.8 ± 0.1 (261 ± 17)	D6641	62 (8,992)
Notched Izod Impact Resistance	J/m (ft*lb/in)	D256 A[3]	161 ± 9 (3.0 ± 0.2)	D256	960 (18)
Density	g/cm³	-	1.21 ± 0.01	-	1.4
Heat Deflection Temperature (1.8 MPa)	°C (°F)	D648 A[4]	138 (280)	-	-
Mean CTE (30 to 50°C)	µm/(m*°C)	E831[2]	35.8	-	-
Mean CTE (60 to 160°C)	µm/(m*°C)	E831[2]	45.7	-	-
Thermal Conductivity	W/(m*K)	E1530[2]	0.280 ± 0.002	-	-

Onyx GF specimens were printed with a layer height of 125 µm using default solid fill settings on an FX10 and conditioned at 52% RH and 23 ± 2°C for 44 ± 2 h in accordance with Procedure A of ASTM D618 unless otherwise noted. Carbon Fiber data were derived from pure fiber test specimens. Actual part strength will depend on the amount and pathing of fiber in the part.
[1]Tensile specimens are ASTM D638 type I beams.
[2]Compressive, CTE, and thermal conductivity data were provided by an accredited third party test facility.
[3]Impact specimens were 12.7 mm wide and printed with a notch according to the geometry specified in ASTM D256.
[4]HDT was measured via DMA using an internal method based on ASTM D648.

DIRECTIONAL MECHANICAL AND THERMAL PROPERTIES

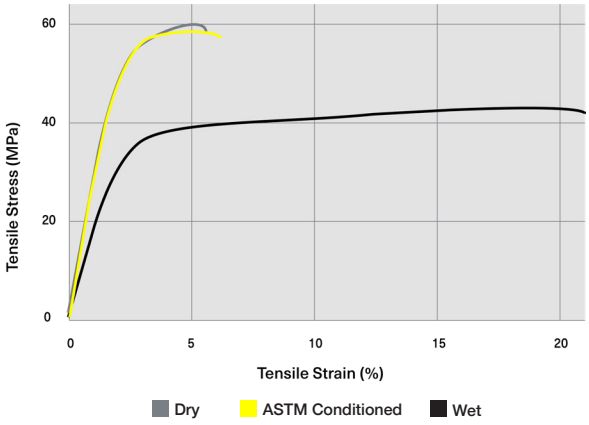
The mechanical and thermal properties of Onyx GF may vary with print orientation. In tension, most parts are strongest when the print orientation and loading direction are parallel, and weakest when the print orientation and loading direction are perpendicular. When heated, Onyx GF parts will have the lowest thermal expansion in the X and Y orientations, and the highest in the Z orientation when print layers are stacked.



Property	Unit	XZ Orientation	XY Orientation	ZX Orientation[5]
Tensile Strength at Yield	MPa	73.7 ± 2.1	57.9 ± 0.7	-
Tensile Strength at Break	MPa	70.7 ± 1.8	56.5 ± 0.9	25.9 ± 3.5
Tensile Modulus	GPa	4.2 ± 0.2	3.1 ± 0.1	1.5 ± 0.2
Elongation at Break	%	5.9 ± 0.4	6.2 ± 0.6	3.2 ± 0.3
Mean CTE (30 to 50°C)[6]	µm/(m*°C)	35.8	35.8	121
Mean CTE (60 to 160°C)[6]	µm/(m*°C)	45.7	45.7	284

MECHANICAL PROPERTIES IN DIFFERENT ENVIRONMENTS

The mechanical properties of Onyx GF may change based on the moisture absorbed from its ambient environment. Increased moisture content will result in a more durable part, behavior that is typical of nylon-based materials.



Property (XY Orientation)	Unit	Dry[7]	Conditioned[8]	Wet[9]
Tensile Strength at Yield	MPa	60.4 ± 1.9	57.9 ± 0.7	41.7 ± 0.7
Tensile Strength at Break	MPa	59.4 ± 1.7	56.5 ± 0.9	40.4 ± 0.9
Tensile Modulus	GPa	3.1 ± 0.1	3.1 ± 0.1	1.9 ± 0.1
Elongation at Break	%	5.5 ± 0.3	6.2 ± 0.6	21.9 ± 3.0

Onyx GF specimens were printed with a layer height of 125 µm using default solid fill settings on an FX10 and conditioned at 52% RH and 23 ± 2°C for 44 ± 2 h in accordance with Procedure A of ASTM D618 unless otherwise noted. Carbon Fiber data were derived from pure fiber test specimens. Actual part strength will depend on the amount and pathing of fiber in the part.
[5]ZX tensile specimens were machined from a cuboidal tube printed on an FX-10 with solid fill settings, 4 walls, and 4 floors.
[6]CTE specimens have cuboid geometry, so XY and XZ specimens are identical.
[7]Dry specimens were dried under vacuum at 75°C for 24 h prior to testing.
[8]Conditioned specimens were conditioned at 52% RH and 23 ± 2°C for 44 ± 2 h in accordance with Procedure A of ASTM D618.
[9]Wet specimens were soaked in water for 72 h prior to testing.