

MARKFORGED MATERIAL PROPERTIES



THERMOPLASTICS	Test Standard	Onyx	Nylon
Tensile Modulus (GPa) Acetone	ASTM D638	1.4	0.94
Tensile Stress at Yield (MPa)	ASTM D638	36	31
Tensile Strain at Yield (%)	ASTM D638	25	27
Tensile Stress at Break (MPa)	ASTM D638	30	54
Tensile Strain at Break (%)	ASTM D638	58	260
Flexural Strength (MPa)	ASTM D790 ¹	81	32
Flexural Modulus (GPa)	ASTM D790 ¹	2.9	0.84
Heat Deflection Temp (°C)	ASTM D648 B	145	49 (140 ²)
Density (g/cm ³)	N/A	1.18	1.1
Izod Impact - notched (J/m)	ASTM D256-10 A	334	1015

TESTING CONDITIONS

Fiber Reinforcement	Unidirectional (0° Plies) reinforcement on all sample plaques tested. Fibers are laid lengthwise along the longest dimension of the sample. ⁴
Fiber Tensile Specimens	9.8" x 0.5" x 0.048" (Carbon Fiber), 9.8" x 0.5" x 0.08" (All other fibers)
Plastic Tensile Specimens	ASTM D638 type IV beams
Flexural Specimens	3 pt. bending, 4.5" x 0.4" x 0.12" specimen size
Compressive Specimens	5.5" x 0.5" x 0.085" (Carbon Fiber), 5.5" x 0.5" x 0.12" (Carbon Fiber)
Heat Deflection Conditions	0.45 MPa (Standard ASTM D648 Method B)

ADDITIONAL NOTES

1. Measured by a method similar to ASTM D790
2. HDT of a Nylon beam with <10% HSHT content (fiber added)
3. Two samples measured instead of five
4. Photos to right show Carbon Fiber and Kevlar test samples. Note unidirectional (left to right) reinforcement
5. Fiber tests are plastic-independent (samples with Nylon and Onyx behave the same)

CARBON CFF



KEVLAR CFF



CONTINUOUS FIBERS⁵

	Test Standard	Carbon CFF	Kevlar CFF	HSHT Glass CFF
Tensile Strength (MPa)	ASTM D3039	700	610	600
Tensile Modulus (GPa)	ASTM D3039	54	27	21
Tensile Strain at Break (%)	ASTM D3039	1.5	2.7	3.9
Flexural Strength (MPa)	ASTM D790 ¹	470	190	420
Flexural Modulus (GPa)	ASTM D790 ¹	51	26	21
Flexural Strain at Break (%)	ASTM D790 ¹	1.2	2.1	2.2
Compressive Strength (MPa)	ASTM D6641	320	97	192
Compressive Modulus (MPa)	ASTM D6641	54	28	21
Compressive Strain at Break (%)	ASTM D6641	0.7	1.5	n/a
Heat Deflection Temp (°C)	ASTM D648 B	105	105	150
Density (g/cm ³)	N/A	1.4	1.25	1.6
Izod Impact - notched (J/m)	ASTM D256-10 A	958	1873 ²	2603
				3117

STRESS VS STRAIN GRAPH

