Markforged Onyx 3D Printed Polymer

Categories: Polymer; Rapid Prototyping Polymer; Thermoplastic

Material Notes: Onyx yields stiff, strong, and accurate parts. Stronger and stiffer than ABS, Onyx can be reinforced with any continuous fiber. Onyx has excellent surface finish, chemical resistivity, and heat tolerance.

Physical Properties	Metric	English	Comments
Density	1.20 g/cc	0.0434 lb/in³	

Mechanical Properties	Metric	English	Comments
Tensile Strength at Break	30.0 MPa	4350 psi	ASTM D638
Tensile Strength, Yield	36.0 MPa	5220 psi	ASTM D638
Elongation at Break	58 %	58 %	ASTM D638
Elongation at Yield	25 %	25 %	ASTM D638
Tensile Modulus	1.40 GPa	203 ksi	ASTM D638
Flexural Strength	81.0 MPa	11700 psi	ASTM D790
Flexural Modulus	2.90 GPa	421 ksi	ASTM D790
Izod Impact, Notched	3.30 J/cm	6.18 ft-lb/in	ASTM D256-10A

Thermal Properties	Metric	English	Comments
Maximum Service Temperature, Air	145 °C	293 °F	Deflection Temperature; load unknown; ASTM D648B

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Markforged Nylon 3D Printed Polymer

Categories: Polymer; Rapid Prototyping Polymer; Thermoplastic; Nylon (Polyamide PA)

Physical Properties	Metric	English	Comments
Density	1.10 g/cc	0.0397 lb/in³	

Mechanical Properties	Metric	English	Comments
Tensile Strength at Break	54.0 MPa	7830 psi	ASTM D638
Tensile Strength, Yield	31.0 MPa	4500 psi	ASTM D638
Elongation at Break	260 %	260 %	ASTM D638
Elongation at Yield	27 %	27 %	ASTM D638
Tensile Modulus	0.940 GPa	136 ksi	ASTM D638
Flexural Strength	32.0 MPa	4640 psi	ASTM D790
Flexural Modulus	0.840 GPa	122 ksi	ASTM D790
Izod Impact, Notched	10.0 J/cm	18.7 ft-lb/in	ASTM D256-10A

Thermal Properties	Metric	English	Comments
Maximum Service Temperature, Air	49.0 °C	120 °F	Deflection Temperature; load unknown; ASTM D648B

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Markforged Carbon 3D Printed Composite

Categories: Polymer; Rapid Prototyping Polymer; Thermoplastic

Material Notes: Carbon Fiber reinforcement is commonly used for parts that replace machined aluminum. Continuous Filament Fabrication (CFF) adds fiber reinforcement to printed parts. Within a thermoplastic matrix, Markforged uses proprietary technology to lay down continuous long-strand fiber. Users can control the layers reinforced, amount, orientation, and type of reinforcing fiber.

Physical Properties	Metric	English	Comments
Density	1.40 g/cc	0.0506 lb/in³	

Mechanical Properties	Metric	English	Comments
Tensile Strength at Break	700 MPa	102000 psi	ASTM D638
Elongation at Break	1.5 %	1.5 %	ASTM D638
Tensile Modulus	54.0 GPa	7830 ksi	ASTM D638
Flexural Strength	470 MPa	68200 psi	ASTM D790
Flexural Modulus	51.0 GPa	7400 ksi	ASTM D790
Flexural Strain at Break	1.2 %	1.2 %	ASTM D790
Compressive Strength	320 MPa	46400 psi	ASTM D6641
Compressive Modulus	54.0 GPa	7830 ksi	ASTM D6641
Izod Impact, Notched	9.60 J/cm	18.0 ft-lb/in	ASTM D256-10A

Thermal Properties	Metric	English	Comments
Maximum Service Temperature, Air	105 °C	221 °F	Deflection Temperature; load unknown; ASTM D648B

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Markforged Fiberglass 3D Printed Composite

Categories: Polymer; Rapid Prototyping Polymer; Thermoplastic

Material Notes: Fiberglass reinforcement results in strong, robust tools. Continuous Filament Fabrication (CFF) adds fiber reinforcement to printed parts. Within a thermoplastic matrix, Markforged uses proprietary technology to lay down continuous long-strand fiber. Users can control the layers reinforced, amount, orientation, and type of reinforcing fiber.

Physical Properties	Metric	English	Comments
Density	1.50 g/cc	0.0542 lb/in³	

Mechanical Properties	Metric	English	Comments
Tensile Strength at Break	590 MPa	85600 psi	ASTM D638
Elongation at Break	3.8 %	3.8 %	ASTM D638
Tensile Modulus	21.0 GPa	3050 ksi	ASTM D638
Flexural Strength	210 MPa	30500 psi	ASTM D790
Flexural Modulus	22.0 GPa	3190 ksi	ASTM D790
Flexural Strain at Break	1.1 %	1.1 %	ASTM D790
Compressive Strength	140 MPa	20300 psi	ASTM D6641
Compressive Modulus	21.0 GPa	3050 ksi	ASTM D6641
Izod Impact, Notched	26.0 J/cm	48.7 ft-lb/in	ASTM D256-10A

Thermal Properties	Metric	English	Comments
Maximum Service Temperature, Air	105 °C	221 °F	Deflection Temperature; load unknown; ASTM D648B

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Markforged HSHT FG 3D Printed Composite

Categories: Polymer; Rapid Prototyping Polymer; Thermoplastic

Material Notes: High Strength High Temperature (HSHT) Fiberglass is best used for parts loaded in high operating temperatures. Continuous Filament Fabrication (CFF) adds fiber reinforcement to printed parts. Within a thermoplastic matrix, Markforged uses proprietary technology to lay down continuous long-strand fiber. Users can control the layers reinforced, amount, orientation, and type of reinforcing fiber.

Physical Properties	Metric	English	Comments
Density	1.50 g/cc	0.0542 lb/in³	

Mechanical Properties	Metric	English	Comments
Tensile Strength at Break	600 MPa	87000 psi	ASTM D638
Elongation at Break	3.9 %	3.9 %	ASTM D638
Tensile Modulus	21.0 GPa	3050 ksi	ASTM D638
Flexural Strength	420 MPa	60900 psi	ASTM D790
Flexural Modulus	21.0 GPa	3050 ksi	ASTM D790
Flexural Strain at Break	2.2 %	2.2 %	ASTM D790
Compressive Strength	192 MPa	27800 psi	ASTM D6641
Compressive Modulus	21.0 GPa	3050 ksi	ASTM D6641
Izod Impact, Notched	31.0 J/cm	58.1 ft-lb/in	ASTM D256-10A

Thermal Properties	Metric	English	Comments
Maximum Service Temperature, Air	150 °C	302 °F	Deflection Temperature; load unknown; ASTM D648B

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Markforged Kevlar® 3D Printed Composite

Categories: Polymer; Rapid Prototyping Polymer; Thermoplastic

Material Notes: Kevlar® possesses excellent durability, making it optimal for parts that experience repeated and sudden loading. As stiff as fiberglass and much more ductile, it's best used for end of arm tooling. Continuous Filament Fabrication (CFF) adds fiber reinforcement to printed parts. Within a thermoplastic matrix, Markforged uses proprietary technology to lay down continuous long-strand fiber. Users can control the layers reinforced, amount, orientation, and type of reinforcing fiber.

Physical Properties	Metric	English	Comments
Density	1.50 g/cc	0.0542 lb/in³	

Mechanical Properties	Metric	English	Comments
Tensile Strength at Break	610 MPa	88500 psi	ASTM D638
Elongation at Break	2.7 %	2.7 %	ASTM D638
Tensile Modulus	27.0 GPa	3920 ksi	ASTM D638
Flexural Strength	190 MPa	27600 psi	ASTM D790
Flexural Modulus	26.0 GPa	3770 ksi	ASTM D790
Flexural Strain at Break	2.1 %	2.1 %	ASTM D790
Compressive Strength	97.0 MPa	14100 psi	ASTM D6641
Compressive Modulus	28.0 GPa	4060 ksi	ASTM D6641
Izod Impact, Notched	20.0 J/cm	37.5 ft-lb/in	ASTM D256-10A

Thermal Properties	Metric	English	Comments
Maximum Service Temperature, Air	105 °C	221 °F	Deflection Temperature; load unknown; ASTM D648B

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