HP 3D High Reusability PA 12

Materials Technical Fact Sheet

General Properties

Common information for all print modes

Category	Measurement	Value	Method
General Properties	Powder melting point (DSC)	187°C/369°F	ASTM D3418
	Particle size	60 µm	ASTM D3451
	Bulk density of powder	0.425 g/cm³ 0.015 lb/in³	ASTM D1895
	Density of parts	1.01 g/cm³ 0.036 lb/in³	ASTM D792
	Crystallization temperature[1]	149.6°C / 301.28°F	ASTM D3417
Reusability	Refresh ratio for stable performance	20%	
Environmental conditions	Recommended relative humidity	50-70% RH	

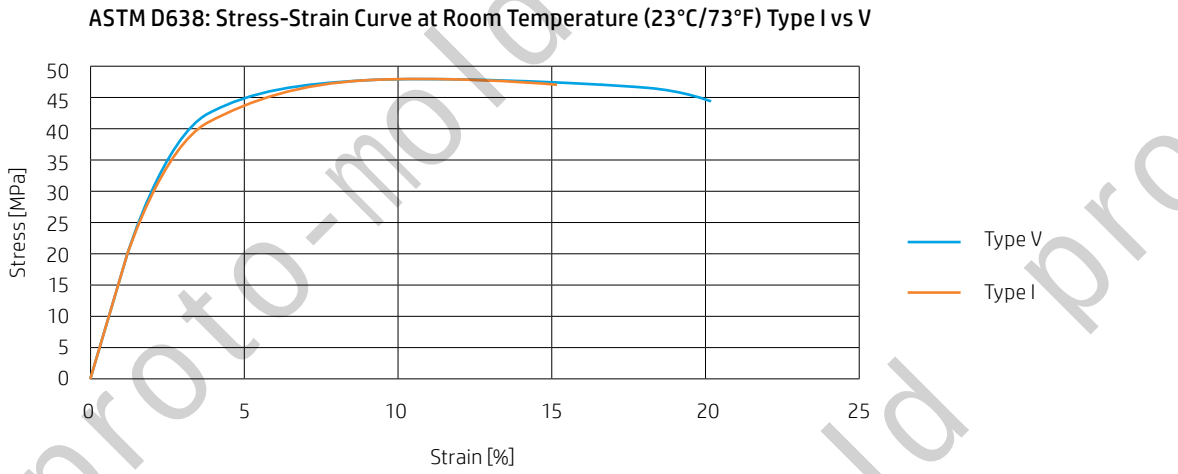
Balanced print mode

Technical specifications[2]

Category	Measurement	Specimen	Value	Method
Mechanical properties	Tensile strength, max load,[3] XY, XZ, YX, YZ	Type V	48 MPa/6960 psi	ASTM D638
		Type I	48 MPa/6960 psi	ASTM D638
	Tensile strength, max load,[3] ZX, ZY	Type V	48 MPa/6960 psi	ASTM D638
		Type I	48 MPa/6960 psi	ASTM D638
	Tensile modulus,[3] XY, XZ, YX, YZ	Type V	1800 MPa/261 ksi	ASTM D638
		Type I	1800 MPa/261 ksi	ASTM D638
	Tensile modulus,[3] ZX, ZY	Type V	1800 MPa/261 ksi	ASTM D638
		Type I	1800 MPa/261 ksi	ASTM D638
	Elongation at break,[3] XY, XZ, YX, YZ	Type V	20%	ASTM D638
		Type I	15%	ASTM D638
	Elongation at break,[3] ZX, ZY	Type V	15%	ASTM D638
		Type I	12%	ASTM D638
	Elongation at yied,[3] XY, XZ, YX, YZ	Type V	11%	ASTM D638
		Type I	11%	ASTM D638
	Elongation at yied,[3] ZX, ZY	Type V	10%	ASTM D638
		Type I	10%	ASTM D638
	Poisson ratio,[3] XY, XZ, YX, YZ	Type I	0.47	ASTM D638
	Poisson ratio,[3] ZX, ZY	Type I	0.43	ASTM D638
	Flexural modulus,[4] XY, XZ, YX, YZ		1800 MPa/261 ksi	ASTM D790
	Flexural modulus,[4] ZX, ZY		1800 MPa/261 ksi	ASTM D790
	Flexural strength (@ 5%),[4] XY, XZ, YX, YZ		70 MPa/10150 psi	ASTM D790
	Flexural strength (@ 5%),[4] ZX, ZY		70 MPa/10150 psi	ASTM D790
	Charpy impact notched (@23°C/73.4°F), XY, XZ, YX, YZ		2.8 kJ/m²	ISO 179-1/1eA
	Charpy impact notched (@-20°C/-4°F), XY, XZ, YX, YZ		2.3 kJ/m²	ISO 179-1/1eA
	Charpy impact notched (@-40°C/-40°F), XY, XZ, YX, YZ		2.2 kJ/m²	ISO 179-1/1eA
	Charpy impact notched (@23°C/73.4°F), ZX, ZY		2.8 kJ/m²	ISO 179-1/1eA
	Charpy impact notched (@-20°C/-4°F), ZX, ZY		2.3 kJ/m²	ISO 179-1/1eA
	Charpy impact notched (@-40°C/-40°F), ZX, ZY		2.2 kJ/m²	ISO 179-1/1eA
	Charpy Impact unnotched (@23°C/73.4°F), XY, XZ, YX, YZ		35 kJ/m²	ISO 179-1/1eU
	Charpy Impact unnotched (@23°C/73.4°F), ZX, ZY		20 kJ/m²	ISO 179-1/1eU
	Izod impact notched (@3.2 mm, 23°C/73.4°F), XY, XZ, YX, YZ		3.6 kJ/m²	ASTM D256 Test Method A
	Izod impact notched (@3.2 mm, -20°C/-4°F), XY, XZ, YX, YZ		2.9 kJ/m²	ASTM D256 Test Method A
	Izod impact notched (@3.2 mm, -40°C/-40°F), XY, XZ, YX, YZ		2.7 kJ/m²	ASTM D256 Test Method A
	Izod impact notched (@3.2 mm, 23°C/73.4°F), ZX, ZY		3.5 kJ/m²	ASTM D256 Test Method A
	Izod impact notched (@3.2 mm, -20°C/-4°F), ZX, ZY		2.9 kJ/m²	ASTM D256 Test Method A
	Izod impact notched (@3.2 mm, -40°C/-40°F), ZX, ZY		2.7 kJ/m²	ASTM D256 Test Method A
	Izod Impact unnotched (@3.2mm, 23°C/73.4°F), XY, XZ, YX, YZ		35 kJ/m²	ASTM D256 Test Method A
	Izod Impact unnotched (@3.2mm, 23°C/73.4°F), ZX, ZY		20 kJ/m²	ASTM D256 Test Method A
	Izod impact notched (@10 mm, 23°C/73.4°F), XY, XZ, YX, YZ		2.4 kJ/m²	ASTM D256 Test Method A
	Izod impact notched (@10 mm, 23°C/73.4°F), ZX, ZY		2.4 kJ/m²	ASTM D256 Test Method A
	Izod Impact unnotched (@10mm, 23°C/73.4°F), XY, XZ, YX, YZ		35 kJ/m²	ASTM D256 Test Method A
	Izod Impact unnotched (@10mm, 23°C/73.4°F), ZX, ZY		20 kJ/m²	ASTM D256 Test Method A
	Compression modulus[5], XY, XZ, YX, YZ, ZX, ZY		1500 MPa / 218 ksi	ASTM D695
	Compression strength[5] (@ 10%)[4], XY, XZ, YX, YZ, ZX, ZY		65 Mpa / 9427 psi	ASTM D695
	Rockwell – Ball Indentation Hardness (@100kg, Scale E), XY, XZ, YX, YZ, ZX, ZY		70	ASTM D785
	Shore Hardness D, XY, XZ, YX, YZ, ZX, ZY		80	ASTM D2240
	Roughness, XY, XZ, YX, YZ, ZX, ZY		7 µm	ASTM D7127

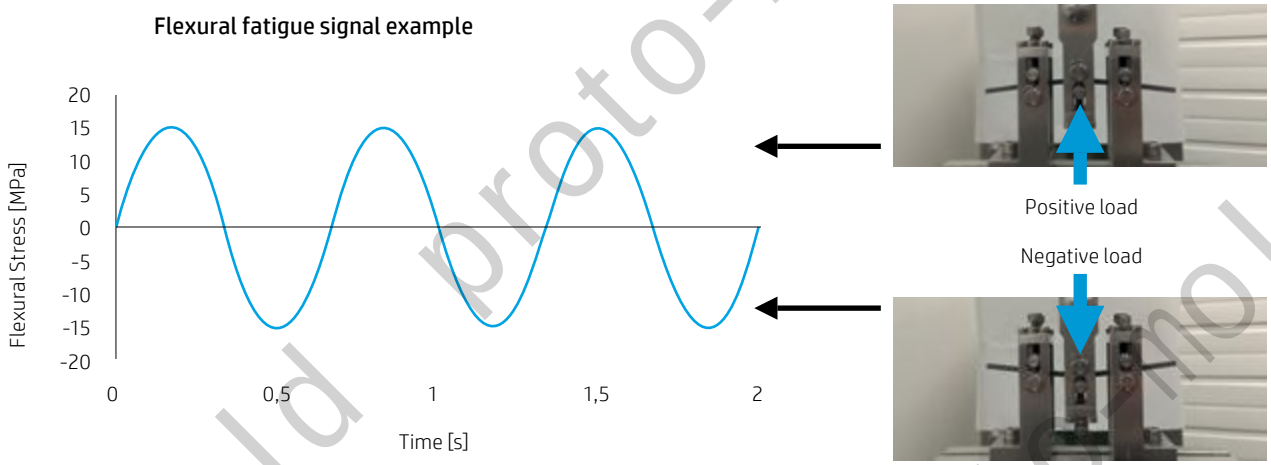
Category	Measurement	Specimen	Value	Method
Thermal properties	Heat deflection temperature (@0.45 MPa, 66 psi), XY, XZ, YX, YZ		175°C/347°F	ASTM D648 Test Method A
	Heat deflection temperature (@0.45 MPa, 66 psi), ZX, ZY		175°C/347°F	ASTM D648 Test Method A
	Heat deflection temperature (@1.82 MPa, 264 psi), XY, XZ, YX, YZ		95°C/203°F	ASTM D648 Test Method A
	Heat deflection temperature (@1.82 MPa, 264 psi), ZX, ZY		95°C/203°F	ASTM D648 Test Method A
	Vicat softening temperature (@A-10N), XY, XZ, YX, YZ, ZX, ZY		175°C/347°F	ASTM D1525 Test rate A
	Vicat softening temperature (@A-50N), XY, XZ, YX, YZ, ZX, ZY		165°C/329°F	ASTM D1525 Test rate A
Electrical properties	Surface resistivity, XY, XZ, YX, YZ, ZX, ZY		1.5 * 10^{11} ohm	ASTM D257

Stress - strain curve (XY)[2]

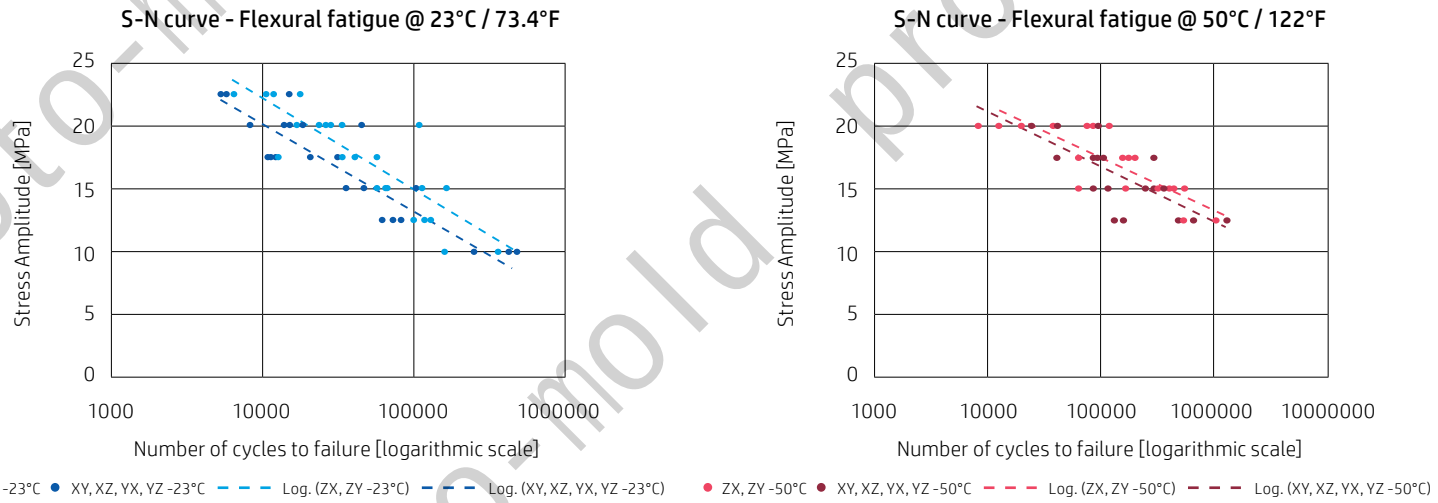


Flexural fatigue

Flexural fatigue tested according to ASTM D7774 using a 3-point bending support with 60 mm span. Specimens of 127 x 12.7 x 3.2 mm were cycled applying a sinusoidal signal with a determined positive and negative load as peaks. This signal was applied at a frequency of 1.5 Hz until the specimen fails:



For each orientation, the number of cycles to failure, in logarithmic axis, has been plotted in function of the signal's stress amplitude:



Using the trendline for each orientation, an average amplitude value is obtained to failure at some specific number of cycles:

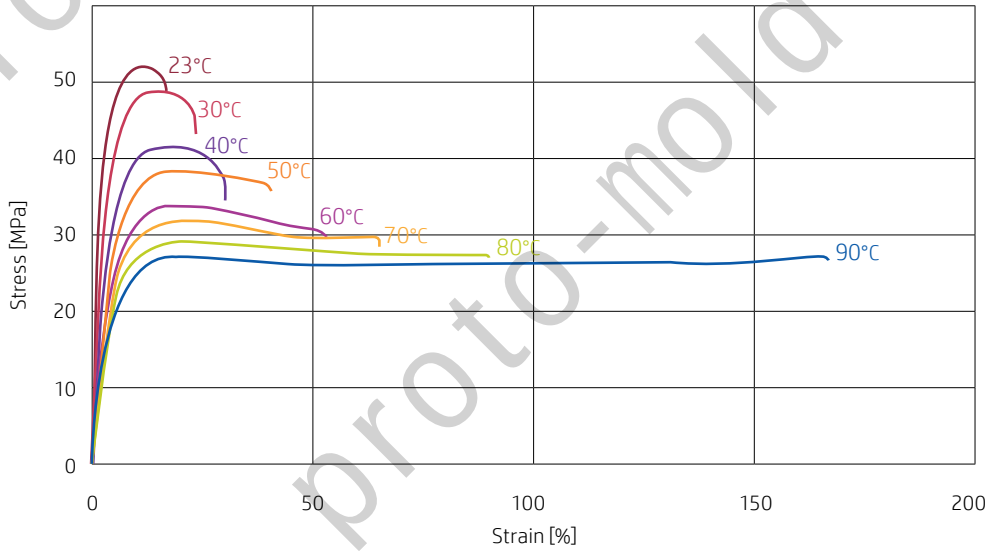
	Stress Amplitude [MPa]			
	23°C / 73.4°F		50°C / 122°F	
Cycles	XY. XZ. YX. YZ	ZX. ZY	XY. XZ. YX. YZ	ZX. ZY
5000	± 22.5	± 24.7	± 22.5	± 22.9
10000	± 20.6	± 22.7	± 21.2	± 21.6
50000	± 16.1	± 18.0	± 18.1	± 18.8
100000	± 14.1	± 15.9	± 16.8	± 17.5
500000	± 9.6	± 11.2	± 13.8	± 14.6
1000000	± 7.7	± 9.2	± 12.5	± 13.4

Influence of temperature on Mechanical Properties[2]

This test has been done by exposing type I specimens at different temperatures for 3 hours in an environmental chamber. A group of type I tensile bars has been exposed to each of the temperatures. The results displayed are the average values of the specimens tested.

Stress-strain curves at different temperatures

XY, XZ, YX, YZ orientations:



ZX, ZY orientations: