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Our materials

Selective laser melting

Selective laser sintering

Stereolithography

Dear PROTIQ customers, all information reflects our knowledge and experience at publication. Material properties may be influenced by component geometry, environment and additives. Stated material or component properties and suitability for specific applications are not agreed or guaranteed. Customers are responsible for verifying properties and suitability for their application.

3D PRINTING WITH METALS

In SLM, metal powder is fused layer by layer into solid parts. We manufacture high-precision parts from copper, zinc, brass, steel and aluminium. They are leak-tight, robust and can be produced with wall thicknesses from 0,4 mm.

MATERIAL DATASHEET

LASER MELTING OF METALS

Material				Pure copper	RS Copper	CuCr1Zr	Zamak 5	RS Brass
								
	Properties	Condition	Unit					
General Properties	Density laser-melted	–	g/cm ³	8,9	8,7 – 8,9	8,8 – 8,9	6,2 – 6,4	8,2 – 8,6
Mechanical properties **	Tensile strength	as-built	MPa	220 ± 10	–	–	218 ± 40	310 ± 30
		heat-treated	MPa	–	220 ± 30	220 ± 30	–	–
	Yield strength (Rp 0,2%)	as-built	MPa	140 ± 20	–	–	185 ± 15	260 ± 10
		heat-treated	MPa	–	165 ± 20	170 ± 20	–	–
	Elongation at break	as-built	%	50 ± 10	–	–	1,5 ± 0,5	8 ± 3
		heat-treated	%	–	20 ± 5	25 ± 5	–	–
	Elastic modulus	as-built	GPa	–	–	–	28 ± 3	80 ± 5
		heat-treated	GPa	–	–	–	–	–
Thermal properties	Hardness	as-built	HRC	61 – 66 [HV10]	62 – 71 [HV10]	62 – 71 [HV10]	61 – 64 [HV10]	100 – 109 [HV10]
		heat-treated	HRC	–	–	–	–	–
	Thermal conductivity	as-built	W/(m*K)	415 ± 10	–	–	85	–
		heat-treated	W/(m*K)	–	265	260	–	–
	Specific heat capacity	as-built	J/kg*K	–	–	–	389	–
		heat-treated	J/kg*K	–	394	394	–	–
	Electrical conductivity (edge/core)	as-built	MS/m	57	51/32	49/32	–	8/8
		heat-treated	MS/m	–	–	–	–	–
Typical process-related values*	Roughness Ra/Rz after sandblasting (z-dir.)	–	µm	8 – 9/40 – 50	8 – 9/40 – 50	8 – 9/40 – 50	4 – 6 / 25 – 35	7 – 9 / 40 – 50
	Accuracy	–	mm	± 0,1 / ± 0,7 %	± 0,1 / ± 0,7 %	± 0,1 / ± 0,7 %	± 0,1 / ± 0,7 %	± 0,1 / ± 0,7 %
	Minimum wall thickness	–	mm	0,6	0,6	0,6	0,6	0,6

* Depending on component geometry and dimensions, these values may vary

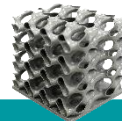
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MATERIAL DATASHEET

LASER MELTING OF METALS

Material				Steel 1.4540	Steel 1.4542	Steel 1.4404	Steel 1.2709	AlSi10Mg
								
	Properties	Condition	Unit					
General Properties	Density laser-melted	–	g/cm ³	7,7	7,7 – 7,8	7,9	8 – 8,1	2,67
Mechanical properties **	Tensile strength	as-built	MPa	1.200 ± 50	1.100 ± 50	670 ± 50	1.100 ± 100	410 ± 20
		heat-treated	MPa	min. 1.340	1.150 ± 150	–	2.030 ± 70	340 ± 20
	Yield strength (Rp 0,2%)	as-built	MPa	950 ± 150	750 ± 80	570 ± 50	1.000 ± 100	250 ± 20
		heat-treated	MPa	min. 1.200	1050 ± 150	–	1.950 ± 70	220 ± 10
	Elongation at break	as-built	%	17 ± 4	13 ± 2	min. 30	9 ± 4	6 ± 2
		heat-treated	%	min. 10	18 ± 3	–	4 ± 2	7 ± 2
	Elastic modulus	as-built	GPa	–	–	–	–	65 ± 5
		heat-treated	GPa	–	–	–	–	65 ± 5
Thermal properties	Thermal conductivity	as-built	W/(m*K)	13,7 ± 0,8	–	–	–	103 ± 5
		heat-treated	W/(m*K)	15,7 ± 0,8	–	–	–	–
	Specific heat capacity	as-built	J/kg*K	460 ± 20	–	–	450 ± 20	–
		heat-treated	J/kg*K	470 ± 20	–	–	–	–
Electrical properties	Electrical conductivity (edge/core)	as-built	MS/m	–	–	–	–	–
		heat-treated	MS/m	–	–	–	–	–
Typical process-related values*	Roughness Ra/Rz after sandblasting (z-dir.)	–	µm	5 /25	2,5 – 4,5/15 – 40	3 – 7/20 – 40	4 – 6,5/20 – 50	7 – 10/50 – 60
	Accuracy	–	mm	± 0,1 / ± 0,7 %	± 0,1 / ± 0,7 %	± 0,1 / ± 0,7 %	± 0,1 / ± 0,7 %	± 0,1 / ± 0,7 %
	Minimum wall thickness	–	mm	0,4	0,4	0,4	0,4	0,6

* Depending on component geometry and dimensions, these values may vary

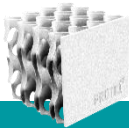
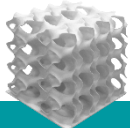
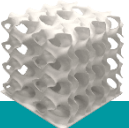
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3D PRINTING WITH TECHNICAL PLASTICS

Polyamides are durable, chemically resistant plastics. They can be dyed in almost any color and manufactured leak-tight on request. PROTIQ also offers filled, flexible and high-temperature-resistant variants.

MATERIAL DATASHEET

LASER SINTERING OF PLASTICS

Material				PA 12	PA 12 GF	PA 2210 FR	PA 6X
							
	Properties	Test method	Unit				
General properties	Color	—	—	white	white/grayish	white/beige	white/beige
	Base material	—	—	PA 12	PA 12 + glass beads	PA 12	PA 6X
	Density laser-sintered	—	g/cm ³	0,9-1,0	1,2-1,3	1,06	1,00 – 1,04
	Roughness (Ra/Rz)	—	µm	8–11 / 50–70	6–7 / 40–50	6–10 / 30–55	5–10 / 30–50
Mechanical properties	Hardness (Shore A/D)	ISO 868 /*ISO 7619-1	—	75±2 D	80 D	79 D	78 D
	Flexural modulus	DIN EN ISO 178	MPa	1.500	2.600 – 2.900*	2300	—
	Flexural strength	DIN EN ISO 178	MPa	58	73 – 78,3	65	—
	Tensile modulus	DIN EN ISO 527	MPa	1.700 ± 150*	2.800 – 3.200*	2.200 – 2.500*	2.200 – 2.500*
	Tensile strength	DIN EN ISO 527	MPa	45 – 50*	45 – 53*	38 – 46*	54 – 60*
	Ball indentation	DIN EN ISO 2039	N/mm ²	78	—	—	—
	Elongation at break	DIN EN ISO 527	%	15 ± 10	5 – 9*	3–7*	15–25*
	Izod impact	DIN EN ISO 180	kJ/m ²	32,8 ± 3,4	15 – 21*	—	—
	Izod notched impact	DIN EN ISO 180	kJ/m ²	4,4 ± 0,4	4 – 4,2*	—	—
	Charpy notched impact	DIN EN ISO 179/1eA	kJ/m ²	4,8 ± 0,3	4,1 – 5,4*	—	—
	Charpy impact	DIN EN ISO 179/1eU	kJ/m ²	53 ± 3,8	21,8 – 35*	—	—
Thermal properties	Melting point	EN ISO 11357-1	°C	176	176	185	215
	HDT (1,80 MPa)	ISO 75-1/-2	°C	70	96 – 101	—	80
	HDT (0,45 MPa)	ISO 75-1/-2	°C	(0,65 MPa) 154	157 – 163	—	195
	Vicat softening temp. B/50	DIN EN ISO 306	°C	163	163 – 166	—	—
	Vicat softening temp. A/50	DIN EN ISO 306	°C	181	175 – 179	—	—
Electrical properties	Volume resistivity	DIN 53482 ICE-Publ. 92	Ω*cm	10 ¹³ – 10 ¹⁵	—	—	—
	Surface resistance	DIN 53482 ICE-Publ. 92	Ω	10 ¹³	—	—	—
	Dielectric strength	DIN 53481	kV/mm	92	—	—	—

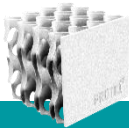
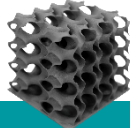
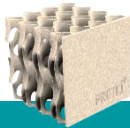
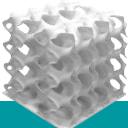
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LASER SINTERING OF PLASTICS

Material				PA 11	PA11 ESD	PEKK	TPU 80A
							
	Properties	Test method	Unit				
General properties	Color	—	—	white	dark gray	beige/brownish	white
	Base material	—	—	PA 11	PA 11	PEKK	TPU
	Density laser-sintered	—	g/cm ³	1,02	1,07	1,29	1,1 – 1,2
	Roughness (Ra/Rz)	—	µm	6–10 / 35–45	6–10 / 35–45	—	13–17 / 72–84
Mechanical properties	Hardness (Shore A/D)	ISO 868 /*ISO 7619-1	—	—	—	—	80 A
	Flexural modulus	DIN EN ISO 178	MPa	1.250 – 1.300*	1.650 – 2.550*	—	—
	Flexural strength	DIN EN ISO 178	MPa	—	—	—	—
	Tensile modulus	DIN EN ISO 527	MPa	1.100 – 1.250*	1.550 – 2.300*	3.900 – 4.000*	55*
	Tensile strength	DIN EN ISO 527	MPa	45 – 46*	47 – 55*	60 – 81*	5,5 – 8*
	Ball indentation	DIN EN ISO 2039	N/mm ²	—	—	—	—
	Elongation at break	DIN EN ISO 527	%	31 – 45*	22 – 31*	1,6 – 2,3*	300 – 550*
	Izod impact	DIN EN ISO 180	kJ/m ²	No break – 86*	81 – 83*	—	—
	Izod notched impact	DIN EN ISO 180	kJ/m ²	5,2 – 7,7*	3,0 – 3,5*	—	—
	Charpy notched impact	DIN EN ISO 179/1eA	kJ/m ²	4,5 – 8,3*	5,3 – 7,3*	1,7 – 2,7*	—
	Charpy impact	DIN EN ISO 179/1eU	kJ/m ²	85 – 198*	101 – 107*	6,5 – 10,4*	—
Thermal properties	Melting point	EN ISO 11357-1	°C	203	204	298	95
	HDT (1,80 MPa)	ISO 75-1/-2	°C	76	111	—	—
	HDT (0,45 MPa)	ISO 75-1/-2	°C	176	186	—	—
	Vicat softening temp. B/50	DIN EN ISO 306	°C	177	183	—	60
	Vicat softening temp. A/50	DIN EN ISO 306	°C	191	192	—	—
Electrical properties	Volume resistivity	DIN 53482 ICE-Publ. 92	Ω*cm	—	2,3 * 10 ⁶ (x), 2,1 * 10 (z)	—	—
	Surface resistance	DIN 53482 ICE-Publ. 92	Ω	—	1,3 * 10 ⁴ (x), 3,4 * 10 ⁴ (z)	—	—
	Dielectric strength	DIN 53481	kV/mm	—	0	—	—

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MATERIAL DATASHEET

LASER SINTERING OF PLASTICS

Supplement PA2210 FR – Flammability					
	Result	Test standard	Method	Ignition time	
Flammability	Test passed	CS 25/JAR25/ FAR 25 § 25-853	–	12s	1,7 mm
	Test passed		–		2,0 mm
Flammability	Test passed	UL 94	HB	–	0,75 mm
	Test passed	UL 94	V-0	–	3,0 mm
Smoke density	Test passed	ABD 0031 (Issue:F)	AITM 2.0007	–	1,7 mm
	Test passed			–	2,0 mm
Toxicity	Test passed	ABD 0031 (Issue:F)	AITM 3.0005	–	1,7 mm
	Test passed			–	2,0 mm
Approval requirements: JAR 25, UL 94					

3D PRINTING WITH HIGH-DETAIL PLASTICS

Epoxy resins enable components with very high detail accuracy and smooth surfaces. They are ideal for delicate structures, design models and demanding prototypes. Components are manufactured using stereolithography (SLA).

MATERIAL DATASHEET

STEREOLITHOGRAPHY

Material		RS Tough	RS High Temp	RS Clear
				
Properties*	Unit			
Color		gray	amber	transparent
Tensile strength	MPa	41	58,3	65
Tensile modulus	MPa	1.890	2750	2800
Flexural modulus	MPa	1.850	2620	2200
Elongation at break	%	18	3,3	6,2
Shore D hardness	-	86	–	–
Izod notched impact	J/m	44	18,2	25
Thermal expansion (0-150°C)	µm/m/°C	–	79,6	–
HDT at 0,45 MPa	°C	62	238*	73,1
HDT at 1,82 MPa	°C	54	101*	58,4

* after thermal treatment