

UniFuse™ IN718 60µm 400W Performance

· Laser Powder Bed Fusion 3D printing,

Chemical Composition:

Element	C [wt.-%]	Mn [wt.-%]	Si [wt.-%]	P [wt.-%]	S [wt.-%]	Cr [wt.-%]	Co [wt.-%]	Mo [wt.-%]	Nb+Ti [wt.-%]
Min	0.0	0.0	0.0	0.0	0.0	17.0	0.0	2.80	4.75
Max	0.08	0.35	0.035	0.015	0.015	21.0	1.0	3.30	5.50

Element	Ti [wt.-%]	Al [wt.-%]	Fe [wt.-%]	Cu [wt.-%]	Ni [wt.-%]	B [wt.-%]
Min	0.65	0.20	remainder	0.0	50.00	0.0
Max	1.15	0.8		0.3	55.00	0.006

Power Properties:

Density (g/cm³)

Tap Density (Typical)	6.2 g/cm ³ ± 0.06
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Typical properties at nominal density and nominal composition:

Coupon Type: ASTM E8 – 21

As-built mechanical properties

Material properties	Symbol	As-built ⁽¹⁾
Density [g/cm ³] ⁽²⁾⁽⁹⁾	ρ	8.19
Density [%] ⁽²⁾	%	≥ 99.95
Porosity [%] ⁽²⁾	P	≤ 0.05
Ultimate Tensile Strength [MPa] ⁽³⁾⁽⁴⁾	R _{m xy-bar}	1064 ± 4
	R _{m z-bar}	990 ± 15
Yield Strength [MPa] ⁽³⁾⁽⁴⁾	R _{p0.2xy-bar}	744 ± 6
	R _{p0.2z-bar}	614 ± 12
Fracture Elongation [%] ⁽³⁾⁽⁴⁾	A xy-bar	30 ± 1.1
	A z-bar	36 ± 1.3
Surface roughness in z-direction, no treatment [µm] ⁽⁷⁾⁽⁸⁾	R _a	7 ± 1.0
	S _a	6.4 ± 0.6

Heat-treated mechanical properties

Material properties	Symbol	Heat-treat ⁽¹⁾⁽⁵⁾
Density [g/cm ³] ⁽²⁾⁽⁹⁾	ρ	8.22
Density [%] ⁽²⁾	%	≥ 99.95
Porosity [%] ⁽²⁾	p	≤ 0.05
Ultimate Tensile Strength [MPa] ⁽³⁾⁽⁴⁾	R _{m xy-bar}	1512 ± 11
	R _{m z-bar}	1436 ± 5
Yield Strength [MPa] ⁽³⁾⁽⁴⁾	R _{p0.2 xy-bar}	1364 ± 10
	R _{p0.2 z-bar}	1301 ± 7
Fracture Elongation [%] ⁽³⁾⁽⁴⁾	A xy-bar	15.3 ± 0.7
	A z-bar	13.1 ± 1.8 ⁽⁶⁾
Surface roughness in z-direction [μm] ⁽⁷⁾⁽⁸⁾	R _a	7 ± 1.0
	S _a	6.4 ± 0.6

Remarks:

1) Properties are given for the laser melted product printed at 60μm layer thickness. Auxiliary operations, e.g., heat treatments, surface modifications, coating processes, bead blasting, etc. may influence the displayed properties. Error values provided with a +/- are given to one standard deviation for printing within machine and environmental specifications.

2) The indicated density limits are valid for the mean density of a component. For complex and geometrically unfavorable shapes the local segment density can deviate from these limits and therefore materials properties may be affected.

3) Materials properties stated in the tables above have been determined on the basis of ASTM E8-21.

4) Mechanical characteristics are typical mean values valid for the indicated nominal density level, and will vary from printer to printer.

5) Specimens were heat treated as follows:

Stress relief per ASTM F3055-14a: 1065C ± 15C for 90min -5/+15min.

Age per AMS 5664.

6) Fracture Elongation is 14.1±/ - 0.7% for z-bars when the 4 z-bars located in the corners of the plates, where low airflow is measured, are removed from the data set. The average Fracture Elongation of said 4 coupons located in the corners is 10.5%, with a minimum of 9.0%.

7) Roughness measurement in accordance with DIN EN ISO 4287.

8) Surface roughness values are dependent on the gas flow characteristics of the machine.

9) Material density varies within the range of possible chemical composition variations.