LaserForm® Ni718 (A)

A Nickel-based alloy fine-tuned for use with ProX® DMP 320 metal powder, producing parts for high temperature applications. LaserForm Ni718 (A) has outstanding corrosion resistance in various corrosive environments and excellent cryogenic properties.

LaserForm Ni718 (A) is formulated and fine-tuned specifically for 3D Systems DMP 320 metal 3D Printers to deliver highest part quality and best part properties. The print parameter database that 3D Systems provides together with the material has been extensively developed, tested and optimized in 3D Systems' part production facilities that hold the unique expertise of printing 500,000 challenging production parts year over year. Based on over 1000 test samples the below listed part quality data and mechanical properties give you high planning security. And for a 24/7 production 3D Systems' thorough Supplier Quality Management System guarantees consistent, monitored material quality for reliable process results.

Material Description

LaserForm Ni718 (A) is a nickel-based heat resistant alloy. This precipitation-hardening nickel-chromium alloy is characterized by good tensile, fatigue, creep and rupture strength at temperatures up to 700°C. Moreover it has outstanding corrosion resistance in various corrosive environments as well as excellent cryogenic properties.

These benefits make LaserForm Ni718 (A) ideal for many high temperature applications such as gas turbine parts, instrumentation parts, power and process industry parts etc. Parts can be post-hardened to 40 HRC by precipitation-hardening heat treatments. The parts can be machined, spark-eroded, welded, shot-peened, polished and coated if required.

Classification

The chemical composition of LaserFormTM Ni718 Type (A) is indicated in the table below in wt% and meets the requirements of ASTM F3055-14a.

Mechanical Properties [1,2,3,4,5]

MEASUREMENT	CONDITION	METRIC				U.S.			
		AS BUILT	AFTER STRESS RELIEF	AGED 1	AGED 2	AS BUILT	AFTER STRESS RELIEF	AGED 1	AGED 2
Ultimate Strength (MPa | ksi)	ASTM E8M								
Horizontal direction — XY Vertical direction — Z		NA 930 ± 20[5]	1120 ± 20[4] 1130 ± 10[5]	1300 ± 30[4] 1230 ± 20[5]	1400 ± 30[4] 1340 ± 20[4]	NA 135 ± 3	162 ± 3 164 ± 2	189 ± 5 178 ± 3	203 ± 5 194 ± 3
Yield strength Rp0.2% (MPa | ksi)	ASTM E8M								
Horizontal direction — XY Vertical direction — Z		NA 660 ± 20[5]	910 ± 20[4] 850 ± 20[5]	1010 ± 30[4] 1010 ± 20[5]	1230 ± 30[4] 1200 ± 20[4]	NA 96 ± 3	132 ± 3 123 ± 3	146 ± 5 146 ± 5	178 ± 5 174 ± 3
Elongation at break (%)	ASTM E8M								
Horizontal direction — XY Vertical direction — Z		NA 36 ± 2[5]	24 ±2[4] 31 ± 2[5]	21 ± 2[4] 24 ±4[5]	15 ± 2[4] 14 ± 2[4]	NA 36 ± 2	24 ±2 31 ± 2	21 ± 2 24 ±4	15 ± 2 14 ± 2
Hardness, Rockwell C (HRC)	ASTM E18	20 ± 2	32 ± 1	39 ± 1	40 ± 1	20 ± 2	32 ± 1	39 ± 1	40 ± 1
Impact toughness[2] (J/cm² | lb.ft)	ASTM E23	110 ± 6	56 ± 9	44 ± 5	NA	81 ± 5	41 ± 7	32 ± 4	NA

Thermal Properties [6]

MEASUREMENT	CONDITION	METRIC	U.S.
Thermal conductivity (W/(m.K) | Btu/(h.ft².°F))	At 21 °C/ 69.8 °F	11,4	6,6
	At 100°C / 212°F	18,3	10,6
Coefficient of Thermal Expansion (µm/m-°C | µm/in-°F)	At 200°C / 392°F	13,2	7,31
	At 600°C / 1112°F	13,9	7,74
Melting range (°C | °F)		1260-1335	2300-2435

[1] Parts manufactured with standard parameters on a ProX DMP 320, Config B
[2] Tested with charpy V-notch toughness test, DMV probe
[3] Values based on average and standard deviation
[4] Tested on ASTM E8M specimen with rectangular cross sections
[5] Tested on ASTM E8M specimen with circular cross sections type 4
[6] Values based on literature

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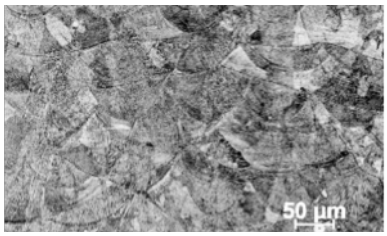
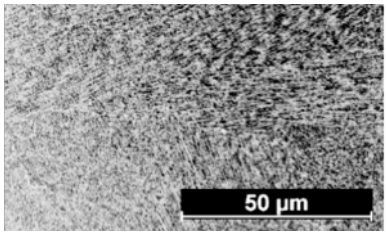
Physical Properties

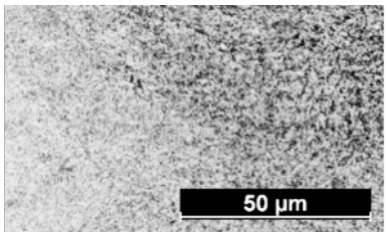
MEASUREMENT	CONDITION	METRIC		U.S.	
		AS BUILT AND AFTER STRESS RELIEF	AFTER HIP	AS BUILT AND AFTER STRESS RELIEF	AFTER HIP
Density — Relative, based on pixelcount (%)	Optical method	>99,9	≈100	>99,9	≈100
Density — Absolute theoretical[6] (g/cm³ | lb/in³)	Optical method	8,2		0,296	



Microstructure as built



Microstructure after stress relief



Microstructure after aging

Surface Quality[7]

MEASUREMENT	METRIC		U.S.	
	AS BUILT	SANDBLASTED	AS BUILT	SANDBLASTED
Surface Roughness — Horizontal direction (XY) (µm | µin)	3-5	3-5	120-195	120-195
Surface Roughness — Vertical direction (Z) (µm | µin)	5-7	3-5	195-275	120-195

Chemical Composition

Al	0.20-0.80
B	≤0.006
C	≤0.08
Co	≤1.00
Cr	17.00-21.00
Cu	≤0.30
Fe	Bal.
Mn,Si	≤0.35
Mo	2.80-3.30
Nb+Ta	4.75-5.50
Ni	50.00-55.00
P,S	≤0.015
Ti	0.65-1.15
Traces	≤0.001 Pb, Se each

[6] Values based on literature
[7] Values based on minimum and maximum ranges

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