LaserForm Ni718 (A)

Ni718 (A) is fine-tuned for use with DMP Flex/Factory 350, DMP Flex/Factory 350 Dual, DMP Flex 350 Triple and DMP Factory 500 metal printers, 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 to deliver high part quality and consistent 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 more than 1,000,000 challenging metal production parts in various materials year over year. Based on a multitude of test samples, the properties listed below provide high confidence to the user in terms of job-to-job and machine-to-machine repeatability. Using the LaserForm material enables the user to experience consistent and reliable part quality.

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 over 1400 MPa Ultimate Tensile Strength (UTS) by precipitation-hardening heat treatments. The parts can be machined, spark-eroded, welded, shot-peened, polished and coated if required.

Mechanical Properties

DMP FLEX/FACTORY 350 – LT 30, 60[1, 2, 3, 4]	TEST METHOD	METRIC		U.S.	
		NHT	HSAA	NHT	HSAA
Ultimate Tensile Strength (MPa | ksi)	ASTM E8/E8M				
Horizontal direction — XY		NA	1400 ± 60	NA	203 ± 10
Vertical direction — Z		930 ± 20	1340 ± 40	135 ± 6	194 ± 6
Yield strength Rp0.2% (MPa | ksi)	ASTM E8/E8M				
Horizontal direction — XY		NA	1230 ± 60	NA	178 ± 10
Vertical direction — Z		660 ± 20	1200 ± 40	96 ± 6	174 ± 10
Elongation at break (%)	ASTM E8/E8M				
Horizontal direction — XY		NA	15 ± 4	NA	15 ± 4
Vertical direction — Z		30 ± 4	14 ± 8	30 ± 4	14 ± 8

DMP FACTORY 500 – LT 60[5, 6, 7, 8]	TEST METHOD	METRIC		U.S.	
		NHT	HAA	NHT	HAA
Ultimate Tensile Strength (MPa | ksi)	ASTM E8				
Horizontal direction — XY		1080 ± 20	1520 -40/+20	157 ± 3	220 -6/+3
Vertical direction — Z		1010 ± 25	1440 -40/+20	146 ± 4	209 -6/+3
Yield strength Rp0.2% (MPa | ksi)	ASTM E8				
Horizontal direction — XY		790 ± 25	1350 -40/+30	115 ± 4	196 -6/+4
Vertical direction — Z		660 ± 30	1280 ± 50	96 ± 4	186 ± 7
Plastic elongation (%)	ASTM E8				
Horizontal direction — XY		29 ± 6	16 ± 4	29 ± 6	16 ± 4
Vertical direction — Z		32 ± 4	18 ± 5	32 ± 4	18 ± 5

HIGH TEMPERATURE TENSILE PROPERTIES DMP FACTORY 500 – LT605[5,9]	TEST METHOD	METRIC		U.S.	
		NHT	HAA	NHT	HAA
Ultimate Tensile Strength (MPA | ksi)					
Vertical direction – Z		NA	1185 ± 25	NA	172 ± 4
Yield strength Rp0.2% (MPa| ksi)	ASTM E21,				
Vertical direction – Z	at 650°C	NA	1055 ± 20	NA	153 ± 3
Plastic elongation (%)					
Vertical direction – Z		NA	20 ± 3	NA	20 ± 3

[1] Parts manufactured with standard parameters on a DMP Flex/Factory 350, Config B using layer thickness 30 µm (LT30) and 60 µm (LT60) ; values are also indicative for DMP Flex/Factory Dual and DMP Flex 350 Triple
[2] Values based on average and double standard deviation
[3] NHT refers to non-heat-treated sample condition; HSAA refers to a modified homogenization followed with solutioning and double aging as prescribed in ASTM F3055
[4] NHT samples tested according to ASTM E8M using round tensile test specimen type 4 ; HSAA samples tested according to ASTM E8 using rectangular tensile test specimen type 8
[5] Parts manufactured with standard parameters on a DMP Factory 500, using layer thickness 60 µm (LT60)
[6] Values based on average and 95% tolerance interval with 95% confidence
[7] Tested according to ASTM E8 using round tensile test specimen type 4
[8] HAA refers to the homogenization with double aging (HAA) heat treatment as prescribed in ASTM F3055
[9] High temperature tensile properties based on limited sample size. For information only. Values based on average and double standard deviation

Printed Part Properties[1,5]

DENSITY	TEST METHOD	METRIC	U.S.
Theoretical density (g/cm³ | lb/in³)	Value from literature	8.2	0.296
Relative density (%)[10,11] DMP Flex/Factory 350	Optical method (pixel count)	≥ 99.6 Typical 99.9	≥ 99.6 Typical 99.9
Relative density (%)[10,11] DMP Factory 500	Optical method (pixel count)	≥ 99.7 Typical 99.9	≥ 99.7 Typical 99.9

SURFACE ROUGHNESS R_a[11,12,13]	TEST METHOD	METRIC	U.S.
Vertical side surface (µm | µin)	ISO 25178	Typically, around 5	Typically, around 197

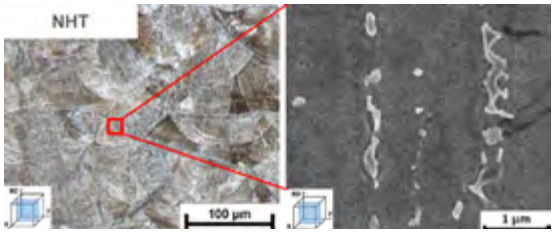
Thermal Properties[14]

MEASUREMENT	CONDITION	METRIC	U.S.
Thermal conductivity (W/(m.K) | BTU.in/h.ft².°F)	At 21 °C/ 69.8 °F	11.4	79
	At 100°C / 212°F	18.3	127
Coefficient of Thermal Expansion (µm/m-°C | µin/(in.°F)	At 200°C / 392°F	13.2	7.33
	At 600°C / 1112°F	13.9	7.72
Melting range (°C | °F)		1260-1335	2300-2435

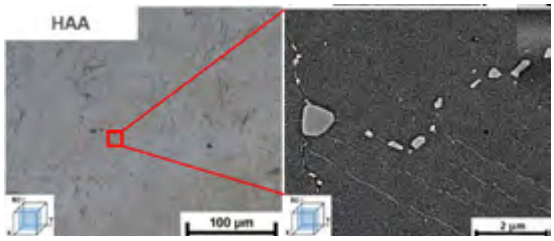
Chemical Composition

Parts built with LaserForm Ni718 Type (A) have a chemical composition that complies with ASTM F3055.

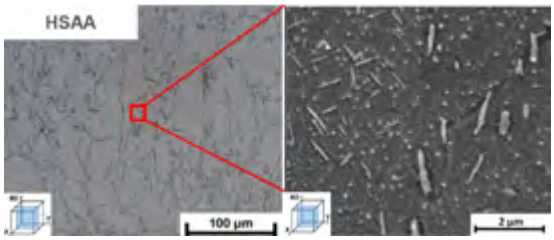
ELEMENT	% OF WEIGHT
Al	0.20-0.8
B	≤0.006
C	≤0.08
Co	≤1.0
Cr	17.00-21.00
Cu	≤0.3
Fe	Bal.
Mn	≤0.35
Mo	2.80-3.30
Nb+Ta	4.75-5.50
Ni	50.00-55.00
P	≤0.015
S	≤0.015
Si	≤0.35
Ti	0.65-1.15



Microstructure NHT



Microstructure after HAA



Microstructure after HSAA

[10] May deviate depending on specific part geometry
[11] Minimum values based on 95% tolerance interval with a 95% confidence. Tested on specific 3DS test coupons
[12] Surface treatment performed with Finox zirconia blasting medium at 5 bar
[13] Vertical side surface measurement along the building direction
[14] Values based on literature

To confirm the suitability of this material for your specific application, please contact the 3D Systems Application Innovation Group (AIG): https://www.3dsystems.com/consulting/application-innovation-group