

L-PBF Nickel 718

Parameters for Colibrium Additive's M2 Series 5



Nickel 718

Nickel chromium superalloys like 718 are often used in high-stress and high-temperature environments. The excellent high temperature strength and creep resistance derive from precipitation hardening of finely dispersed precipitates. Next to that Nickel 718 is a metal that is also highly resistant to the corrosive effects of hydrochloric acid and sulfuric acid. The favorable weldability of Nickel 718 makes this alloy suitable for additive manufacturing as well. Typical applications are high-quality components designed for thermally challenging environments such as rocket engines, gas-turbine hot sections, and heat exchangers.

M2 Series 5 Nickel 718

The Nickel 718 parameters for the Colibrium Additive M2 Series 5 are developed leveraging the performance of the previous M2 generations. The base parameters deliver good surface quality while maintaining a very good density and productivity. For highest all-around surface quality, the surface parameter has been developed. The hybrid parameter can significantly increase the productivity of parts having a high volume/surface ratio and still meeting highest surface quality requirements. Parameter 316 is optimized for steel recoater and highest productivity. All parameters succeed the minimum tensile properties specified in ASTM F3055 for additive manufactured parts in the heat treated state.



M2 Series 5 Nickel 718

Machine Configuration

M2 Series 5

Single- or dual-laser architecture

Nitrogen gas

Powder Chemistry

Nickel 718 powder chemical composition according to ASTM B637 UNS N07718

Particle size: 15 - 53 μm

Thermal States

As-Built

Solution Annealed + Age (SOLN+AGE)

SOLN: 980 °C for 1 hour in argon

AGE: 720 °C for 8 hours furnace cooling down to 620 °C for 8 hours, cooling in air

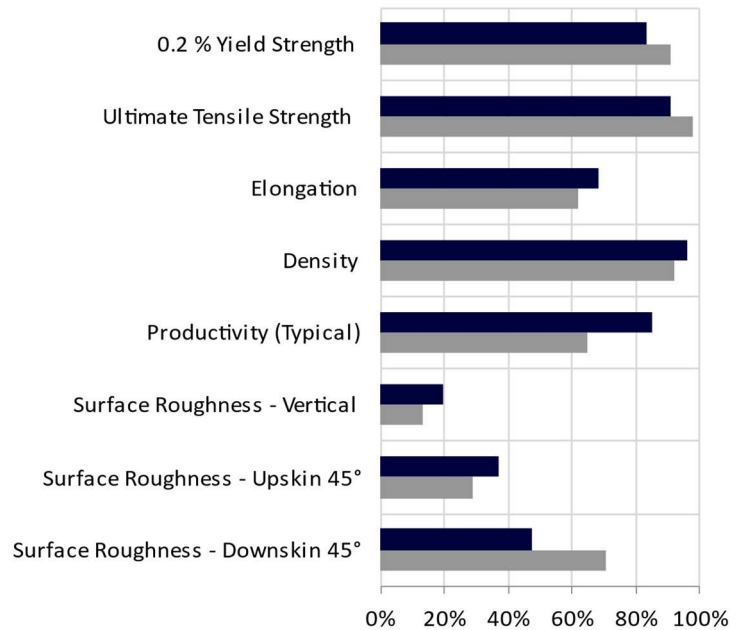
Parameter Availability and Thermal State Comparison

- Productivity Parameter 350 SOLN+AGE

1 kW, 50 μm layer thickness, rubber recoater

- Productivity Parameter 316 SOLN+AGE

400 W, 100 μm layer thickness, rubber recoater



Bar plot is generated by normalizing typical material data (containing both horizontal and vertical data) against a range defined for each material family. For Nickel 718-based alloys, the ranges are as follows: 0.2%YS: 0-1400 MPa UTS: 0-1500 MPa, Elongation: 0-30%, Density: 99-100% (as-built), Productivity: 5-60 cm^3/h , Surface Quality (all): 5-55 μm . 0% in the bar plot indicates the lower range value, 100% indicates the upper range value. For more details on parameter 316 see data sheet for 400 W parameters.

Productivity Parameter 350 - 1 kW / 100 μm

Typical Build Rate

	(cm ³ /h)
Typical build rate with coating ¹	51.6
Theoretical melting rate bulk per laser ²	68.4

¹ Using standard Factory Acceptance Test layout and 2 lasers

² Calculated (layer thickness × scan velocity × hatch distance)

Tensile Performance at Room Temperature

Thermal State	Modulus of Elasticity (GPa)		0.2% Yield Strength (MPa)		Ultimate Tensile Strength (MPa)	
	H	V	H	V	H	V
As-Built	150	112	555	540	910	905
SOLN+AGE	151	128	1145	1180	1330	1395

Thermal State	Elongation (%)		Area Reduction (%)	
	H	V	H	V
As-Built	37	34.5	51	58
SOLN+AGE	22	18.5	29	24

Physical Properties at Room Temperature

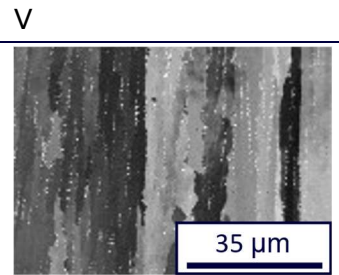
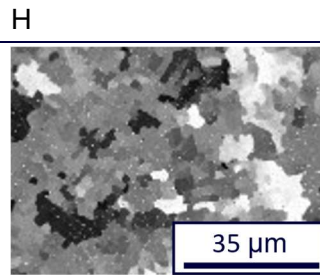
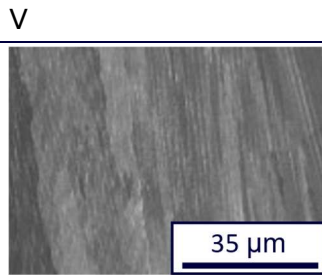
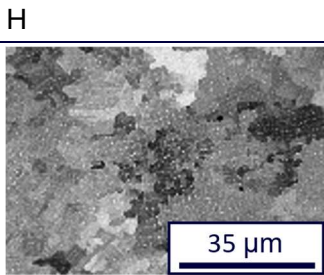
	Overhang Surface Roughness, Ra (μm)			Surface Roughness, Ra (μm)	
	45°	60°	75°	H	V
Upskin	23	16	10	29	14
Downskin	28	20	13		

Thermal State	Relative Density (%)		Hardness (HV10)
	H	V	H
As-Built	99.9	99.9	262
SOLN+AGE	99.9	99.9	465

Microstructure

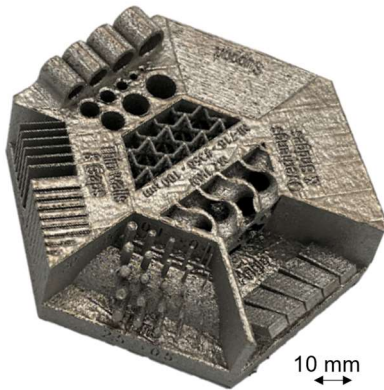
As-Built

SOLN+AGE



Minimum Feature Resolution

The minimum feature resolution part was designed to demonstrate parameter capability to produce specific features such as minimum wall thickness, minimum gap width, minimum pin diameter, minimum drill hole diameter (horizontal and vertical), minimum unsupported downskin angle, and maximum unsupported bridge length.



Feature	Result
Minimum Wall Thickness (mm)	0.33
Minimum Gap Width (mm)	0.47
Minimum Pin Diameter (mm)	0.33
Minimum Drill Hole Diameter, V (mm)	0.43
Minimum Drill Hole Diameter, H (mm)	0.78
Minimum Printable Angle (°)	25
Maximum Bridge Length (mm)	5

Data Sheet Nomenclature and Notation

H: Horizontal, perpendicular to build direction.

V: Vertical, parallel to build direction.

Other angles are measured from horizontal.

Roughness measurements have been performed according to DIN EN ISO 4287 and DIN EN ISO 4288. In general analysis of the surface quality is strongly dependent on the methodology used and therefore deviations might be observed depending on methodology used. Vertical and horizontal sidewalls have been characterized using a tactile system, overhangs using an optical system.

Tensile evaluations were performed according to ASTM E8 or E21, depending on test temperature.

Minimum features have been characterized using a coordinate measuring machine (CMM) and an optical microscope.

All figures and data contained herein are approximate and/or typical only and are dependent on several factors including but not limited to process and machine parameters. The information provided on this material data sheet is illustrative only and cannot be considered binding.