Meltio Nickel 718

ERNiFeCr-2 / S Ni 7718 / 2.4667

Nickel 718 is a highly versatile and corrosion-resistant alloy with exceptional mechanical properties at both high and low temperatures. Its ability to withstand harsh environments and high-stress applications has made it a popular choice across a range of industries, including aerospace, energy, and marine. Being Nickel 718 a difficult alloy to work using conventional methods, 3D Printing facilitates its usage for a broader range of applications.

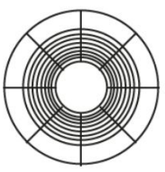
Properties	High Strength, Age-hardenable, High temperature and Corrosion Resistance
Applications	Aerospace, Energy / Oil and Gas and Chemical and Automotive

Wire Chemical Composition	Ni	C	Si	Mn	Cr	Fe	Ti	Mo	Nb+Ta	Al
Weight Percent [%]	Bal.	0.05	0.2	0.2	19.0	20.0	0.9	3.0	5.2	0.5

Wire Density
8.2 g/cm³

Melting Point		
1644 - 1700 K	1371 - 1427 ºC	2500 - 2600 °F

Spool Specs



Meltio Materials are tightly spooled and packaged to ensure the best compatibility with Meltio systems.

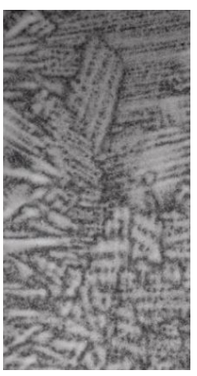
Wire Diameter	1.0 mm
Weight on Spool	15 kg
Volume on Spool	1829 cm³
Spool Type	BS300
Wire Coating	Uncoated

Relative density as 3D printed	> 99.8%

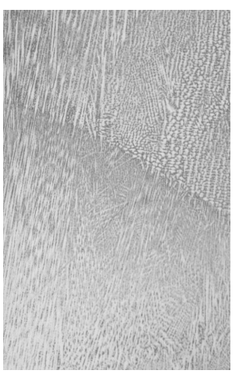
Micrography

The images show delta-phase dendrites along the direction of manufacturing within the gamma nickel matrix. Under higher magnification, the presence of intermetallic phases and gamma prime has been noted.

Gen I As-printed XY
100x Magnification



Gen I HT XY
100x Magnification



Gen II As-printed XY
100x Magnification

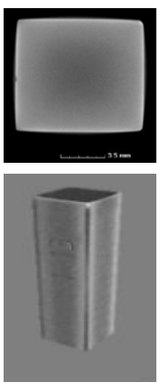
Published in Q4

Gen II HT XY
100x Magnification

*Test Carried Out In IDONIAL
info@idonial.com

Tomography

Computed Tomography Scan of 3D printed sample part in Inconel 718 without detectable voids or defects. Resolution of 24 µm per pixel.



3D / Top View

Front View

*Test Carried Out In CATEC
info@catec.aero

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Parametrization for Verified Density Profiles

The following fully dense printing parameters were obtained, based on a printed block of 30x60x20 mm. A sample from this block of 10x10x60 mm was extracted using EDM, and was analyzed using CT Scan on an external lab. Please use the provided “Materials Handbook” to know better the printing parameters relation and their effect on part density. These printing parameters are available in our slicers Meltio Horizon and Meltio Space.

	Laser Power [W]	Laser Wavelength (nm)	Velocity [mm/s]	Argon Flow [l/min]	Layer Height [mm]	Layer Width [mm]	Wire Speed [mm/s]	Input Energy Density [J/mm3]	Deposition Rate [g/h]
IR	1100	976	7.5	10.0	1.0	1.0	9.6	146.6	201
Blue	1000	450	12.5	10.0	1.2	1.0	19.1	66.7	443

Heat Treatment

To achieve the best mechanical properties Nickel 718 should be heat-treated after 3D printing. The standard heat treatment process for Nickel 718 involves two steps: Solution Annealing and Age Hardening. Solution annealing removes internal stresses that have been formed during 3D printing. Machining may take place before or after the solution annealing. Once the component has been age hardened its machinability is compromised.

Solution Annealing

Protective atmosphere Heat up to 1100ºC	Hold for 1h Cooling in water to RT

Age Hardening

Protective atmosphere Heat up to 760ºC in 2h Hold at 760ºC during 8h	Cool down to 650ºC in 1h50’ Hold at 650ºC during 8h Cooling in oven to RT

**Typical Parameters for a Sample of 160x60x30 mm*

Mechanical Properties

Results show that specimens printed using Meltio’s wire-laser metal 3D printed perform at the same level as samples made with conventional manufacturing methods. Tensile testing is carried out in the less favorable XZ direction to ensure the values are applicable across complete part.

			UNE EN ISO 6892-1					
	Cast Properties *(AMS 5383)*	**Wrought Properties *(AMS 5662)***	**Meltio XY properties *(S.A. + A.H.)***	**Meltio XZ properties *(S.A. + A.H.)***	**Meltio XY properties *(S.A.)***	**Meltio XZ properties *(S.A.)***	**Meltio XZ Properties *(As printed)***	
Ultimate Tensile strength (UTS) [MPa]	802	1241	1256 ± 11	1208 ± 49	1016 ± 28	925 ± 86	833 ± 50	**IR**
			Published in Q4					**Blue**
Yield strength [MPa]	758	1034	1025 ± 7	980 ± 2	660 ± 10	631 ± 10	537 ± 32	**IR**
			Published in Q4					**Blue**
Elongation [%]	5	10	11 ± 1	10 ± 5	18 ± 6	15 ± 2	25 ± 3	**IR**
			Published in Q4					**Blue**
			**Test Carried Out In CETEMET* i+d+i@cetemet.es					

The following Mechanical Properties were obtained, based on a printed block of 160x30x70 mm using the Verified Density Parametrization, from it 16 ASTM E8M samples were extracted using EDM and were analyzed by an external laboratory.

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			UNE EN ISO 6507-1			
	Cast Properties ***(AMS 5383)***	**Wrought Properties** ***(AMS 5662)***	**Meltio Properties** ***(S.A. + A.H.)***	**Meltio Properties** ***(S.A.)***	**Meltio Properties** ***(As printed)***	
Hardness **[HV30]**	342	350	332	285	245	**IR**
			Published in Q4		248	**Blue**

**Tests Carried Out in CETEMET*
i+d+i@cetemet.es
**Test Carried Out In the University of Jaen (UJA)*
info@strainanalysisuja.es

Based on a printed block of 30x60x20 mm using Verified Density Parametrization. A sample from this block of 10x10x60 mm was extracted using EDM, and was analyzed by an external lab.

** Meltio's work on material characterization is carried out using the Meltio M450 and M600 and it remains under constant development. Specifications provided herein may not reflect the latest state of our research. For further information and questions please contact us via info@meltio3d.com.*

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