

Meltio Nickel 625

Inconel 625 / ERNiCrMo-3 / S Ni 6625 / 2.4831

Nickel 625 is a superalloy that offers excellent strength, corrosion resistance, and heat resistance. It is a popular material choice in a wide range of applications, including aerospace, chemical processing, and naval industry, where it can withstand high temperatures and harsh environments. Among superalloys, Nickel 625 excels for its weldability, making it an ideal choice for cladding or repair of components working at high temperatures or requiring increased corrosion protection.

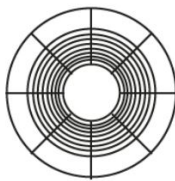
Properties	Weldability, High Temperature Resistance and High Corrosion Resistance
Applications	Aerospace, Chemical Processing, Naval and Oil & Gas

Wire Chemical Composition	Ni	C	Si	Mn	Cr	Fe	Mo	Nb	S
Weight Percent [%]	Bal.	0.02	0.2	0.2	22.0	1.0	9.0	2.5	0.01

Wire Density
8.20 g/cm ³

Melting Point		
1565 - 1625 K	1290 - 1350 °C	2350 - 2460°F

Spool Specs



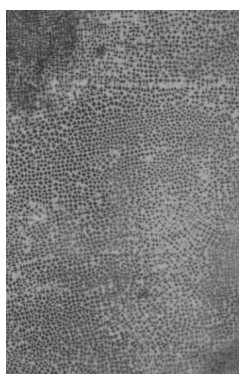
Meltio Materials are tightly spooled and packaged to ensure the best compatibility with Meltio systems.

Wire Diameter	1.0 mm
Weight on Spool	15 kg
Volume on Spool	1829 cm ³
Spool Type	BS300
Wire Coating	Uncoated

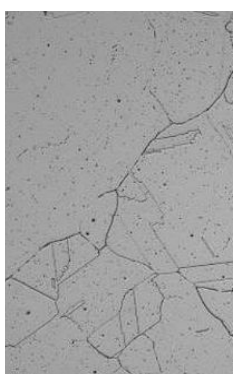
Relative density as 3D printed	> 99.7%
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Micrography

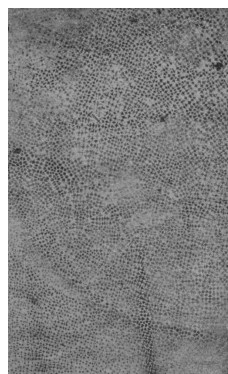
The micrographs shows no significant micro-structural defects. Grains exhibit diverse sizes and no preferential orientation. Notable features include the presence of twins from thermal treatment, enhancing strength and toughness.



Gen I As-printed XY
100x Magnification



Gen I HT XY
100x Magnification

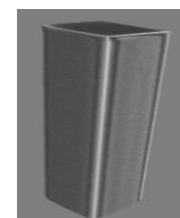
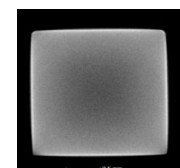


Gen II As-printed XY
100x Magnification

Published
in Q4
Gen II HT XY
100x Magnification

Tomography

Computed Tomography Scan of 3D printed sample part in Ni 625 without detectable voids or defects. Resolution of 24 µm per pixel.



3D / Top View



Front View

*Tests Carried Out In IDONIAL
info@idonial.com

*Tests Carried Out in CETEMET
i+d+i@cetemet.es

*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/mm ³]	Deposition Rate [g/h]
IR	1100	976	6.6	10.0	1.2	1.0	10.08	137.5	220
Blue	1000	450	10.0	10.0	1.2	1.0	15.3	83.3	346

Heat Treatment

To achieve the best mechanical properties Nickel 625 should be heat-treated after 3D printing. The standard heat treatment process for Nickel 625 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 could be compromised.

Solution Annealing

Protective atmosphere Heat up to 1150°C	Hold for 2h Fast cooling to RT
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Age Hardening

Protective atmosphere Heat up to 700°C in 1h Hold at 700°C during 24h	Cooling in oven to RT
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*Typical Parameters for a Sample of 160x60x30 mm

Mechanical Properties

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

	Wrought Properties (ASTM B446)	ASTM E8M	
		Meltio XZ Properties (HT.1 + HT.2 + HT.3)	
Ultimate Tensile strength (UTS) [MPa]	827	739 ± 19	IR
		Published in Q4	Blue
Yield strength [MPa]	414	323 ± 15	IR
		Published in Q4	Blue
Elongation [%]	30	58.4 ± 3.9	IR
		Published in Q4	Blue

*Tests Carried Out In IDONIAL
info@idonial.com

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	
	Wrought Properties (ASTM B446)	Meltio Properties (HT.1 + HT.2 +HT.3)	
Hardness [HV10]	220	160 ± 3	IR
		Published in Q4	Blue
		*Tests Carried Out in CETEMET i+d+i@cetemet.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.

Charpy V-Notch Test

The Charpy V-notch test is a standardised high strain rate test that determines the amount of energy absorbed by a material during fracture. The energy absorbed is a measure of the notch toughness of the material. The results obtained with Meltio Ni 625 show the high performance of the alloy even at low temperatures.

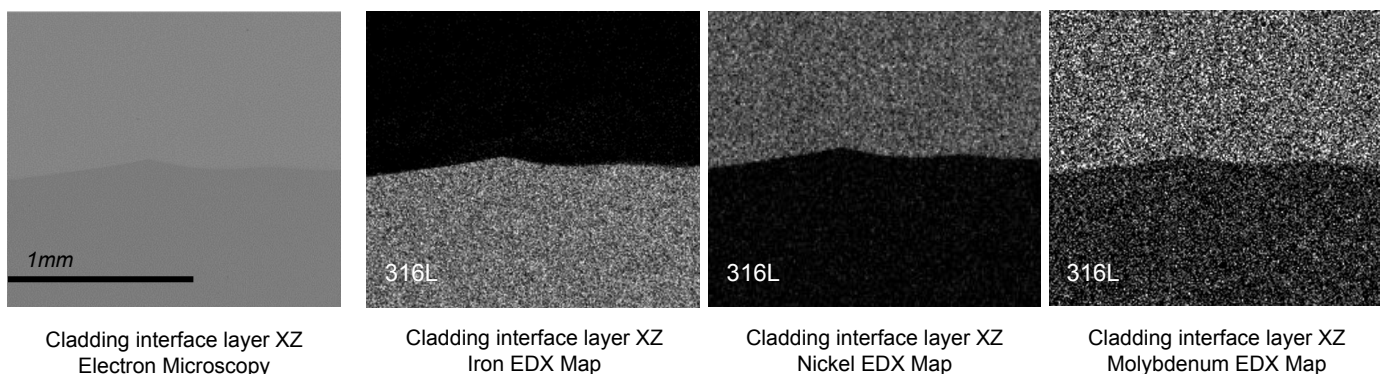
	ASTM E23	
	Meltio XZ Properties (HT.1 + HT.2 + HT.3)	
Temperature [°C]	- 60	IR
Energy Absorbed [J]	230 ± 10	IR & Blue
	Published in Q1 of 2025	Blue
		*Tests Carried Out In IDONIAL info@idonial.com

Cladding and Dual Material Applications

Nickel 625 is highly resistant to wear, deformation and heat, which makes it an excellent material for cladding or dual material applications where not the entire component requires these properties. Nickel 625 has excellent weldability and can be used to form a dense and well-bonded coating layer that provides high wear resistance as well as excellent corrosion and temperature resistance.

Elemental Mapping

Elemental (EDX) Mapping is employed to characterize the dilution of the two materials. Meltio used as deposited Stainless Steel 316L as the substrate without post processing. Results show low dilution between the materials.



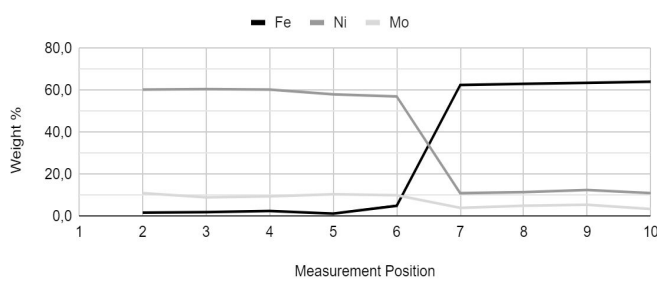
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Elemental Distribution

Composition Mapping of Nickel 625 Cladding on SS316L. Measurements were spaced 150 μm. Apart with measurement 5 coinciding with the interface of the two materials.

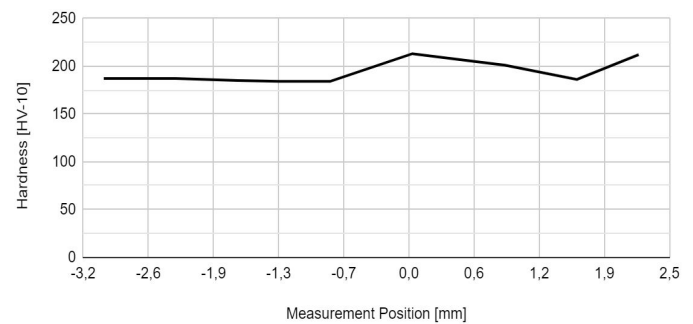
Measurement [Position]	Nb [wt%]	Mo [wt%]	Mn [wt%]	Fe [wt%]	Ni [wt%]
1	3.5	11.0	0.5	1.8	60.3
2	3.8	9.0	0.1	2.0	60.5
3	4.0	9.5	0.5	2.5	60.3
4	6.5	10.5	0.8	1.3	58.0
Interlayer					
5	4.0	10.0	0.5	5.0	57.0
6	0.5	4.0	1.5	62.5	11.0
7	1.5	5.0	1.0	63.0	11.5
8	0.5	5.5	1.5	63.5	12.5
9	0.5	3.5	1.5	64.0	11.0
10	1.0	4.0	1.5	64.5	11.5



Hardness Profile

Hardness was measured across the material transition and results indicate that a single cladding layer is sufficient to achieve good and stable properties.

Hardness [HV10]	Distance [mm]	Material [txt]
212	2.2	Nickel 625
186	1.6	
201	0.9	
213	0.0	Interlayer
184	-0.8	Stainless Steel 316L
184	-1.3	
185	-1.7	
187	-2.3	
187	-3.0	



* Meltio's work on material characterization is carried out using the Meltio M450 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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