Meltio ERCuNiAl (Marine Bronze)

ERCuNiAl / G CU 6328 (CuAl9Ni5Fe3Mn2) / 2.0923

Copper-Nickel-Aluminum wire is designed for high strength and durability. It offers excellent mechanical properties and corrosion resistance, ideal for demanding environments. This alloy ensures optimal performance in applications requiring wear and corrosion resistance.

General Properties

Wire Diameter	Weight on Spool	Spool Type	Wire Coating	Melting Point	Wire Density	Recom. Build plate	Drive Wheels	Inertization[3]
1.0 mm	15 kg	BS300	Uncoated	1100 ºC	8.00 g/cm³	304 Steel	1.0 V-Groove	Local

Chemical Composition

Cu	AL	Mn	Fe	Ni
Bal.	9	1.5	3.2	4.5

Tested Print Hollow Profiles

Laser	Profile name	Laser Power [W]	Energy Density [J/mm3]	Deposition Rate [g/h]	Volume rate [cc/h]	Relative Density [%]	Max Pore/Defect [µm]
976 nm	**Verified Density**	1100	146.6	196	24.81	-	-
450 nm	**Rev 35 2025-04-24**	1000	83.33	341	42.5	99.98	70/-
	Rev 3 2025-06-06	1400	51.02	882	110	-	-

* Printing profiles available in our official Slicers: **Meltio Horizon** for standalone Printers and **Meltio Space** for Laser Integration Kits.
** Profiles developed for the 1.4Kw blue head will be available for Meltio Space for laser integration kits.

Structural Properties [1]

ASTM E8/E8M UNE EN ISO 6892-1 UNE EN ISO 6507-1	Wire	Blue Laser			
		Heat Treatment		As Printed	
		XY	XZ	XY	XZ
Ultimate Tensile strength [MPa]	690	WIP	WIP	778 ± 60	725 ± 80
Yield strength [MPa]	280	WIP	WIP	498 ± 13	435 ± 20
Elongation [%]	16	WIP	WIP	21 ± 8	22 ± 13
Hardness [HV-10]	-	-	-	-	191

Reference Standards

	Wrought *(ASTM B283/B283M-24)*
Ultimate Tensile strength [MPa]	565
Yield strength [MPa]	255
Elongation [%]	32
Hardness [HV-10]	152

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Internal Structure [2]

Micrography

The images show an acicular α-phase with Widmanstätten morphology in bright tones, alongside darker regions of retained martensite β'. Needle size variations suggest thermal effects from layer overlap. At higher magnifications, dispersed precipitates, possibly k-phases, are observed

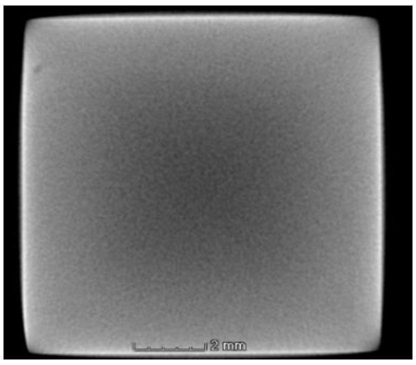
Blue Laser

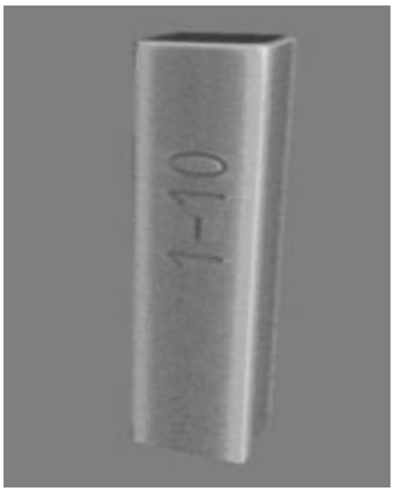
As-printed XZ
100x Magnification

As-printed XY
100x Magnification

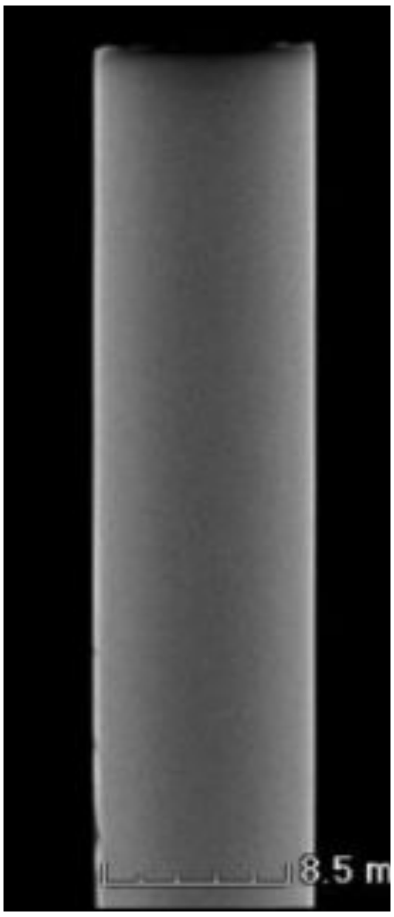
Tomography

CT Scan of 3D printed sample part in ERCuNiAl using IR Laser without detectable voids or defects. Resolution of 24 μm per pixel.





3D / Top View



Front View

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1.Structural Properties

Hardness

Based on a printed block of 30x60x20 mm using Verified Density Parametrization. A sample from this block of 10x10x60 mm was extracted using EDM. from it UNE-EN ISO 6507-1 and was analyzed by an external laboratory. (*IDONIAL* *info@idonial.com*).

2.Internal Structure

Tensile Tests

Specimens printed using Meltio's wire-laser metal 3D printed process perform at the same level as samples made with conventional manufacturing methods. Results show low deviations and near isotropic properties even in the as-printed state without the application of heat-treatments. Testing is carried out in the less favorable XZ direction to ensure the values are applicable across complete part.

Mechanical Properties were obtained, based on a printed block of 95x155x55 mm using the **Rev 35 2025-04-24** profile for the Blue laser, from it 16 ASTM E8M samples were extracted using EDM and were analyzed by an external laboratory. (*AIDIMME* *aidimme@aidimme.es*)

Micrography

The micrography were obtained from a 10x10x60 mm printed block using the **Rev 35 2025-04-24** profile for the Blue laser. The metallographic analysis followed ASTM E3-11:2017 standards, ensuring proper preparation and examination of the microstructure and were analyzed by an external laboratory. (*IDONIAL* *info@idonial.com*)

Tomography

The tomography images were obtained from a 10x10x60 mm printed block using the Verified Density Profile for IR laser and were analyzed by an external laboratory. (*SERMET3D* *info@sermet3d.com*)

Relative Density

Characterizing materials for its Blue Laser technology using 300x400x60 mm 304L steel build plates. Relative density and pore size are evaluated through micrography following NASA-STD-6030 "Additive Manufacturing Requirements for Spaceflight Systems," based on a 250x250x30 mm printed specimen. The results comply with NASA-STD-6030, showing an overall porosity fraction below 0.25% by volume and were analyzed by an external laboratory. (*IDONIAL* *info@idonial.com* , *CETEMET* *i+d+i@cetemet.es* , AIMEN *comunicacion@aimen.es*)

3.Inertization

Inertization of Meltio M600 machinery can be performed in two ways: localised inertisation or full chamber inertization. Both options are designed to ensure a controlled environment during the 3D printing process and prevent oxygen contamination of reactive materials.

Localised Inertization:
In this mode, the shielding gas is supplied locally through the shield nozzle located in the deposition head, with a flow rate of approximately 15 L/min. This method is suitable for most applications where oxygen control in the work area is necessary without requiring a completely isolated environment.

Full Chamber Inertization:
For more demanding applications, it is possible to perform a full chamber inertization. In this case, the chamber must be preconditioned before the printing process is started, reaching an oxygen concentration of 50 ppm. It is essential to control the oxygen concentration in the chamber, as reactive materials can absorb oxygen even when the part is hot, not only when it is in the melt pool.

The choice of inertisation method depends on the properties of the material to be used and the specific requirements of the printing process, ensuring the highest quality and integrity of the manufactured parts.