Meltio Titanium 64

Ti-6Al-4V / ER Ti-5 / S Ti 6402c / 3.7165

Ti64 is a popular and widely used alloy due to its excellent combination of strength, low density, and corrosion resistance. It is used in a variety of industries, including aerospace, and chemical processing, due to its properties. Its high strength-to-weight ratio makes it a preferred choice for lightweight applications.

General Properties

Wire Diameter	Weight on Spool	Spool Type	Wire Coating	Melting Point	Wire Density	Recom. Build plate	Drive Wheels	Inertization[4]
1.0 mm	7.5 kg	BS300	Uncoated	1674 ºC	4.4g/cm³	Titanium	1.0 V-Groove	Full chamber

Standard Chemical Composition

Ti	Al	V	Fe	C	N	H	O
Bal.	5.5- 6.75	3.5-4.5	0.4 max	0.08 max	0.05 max	0.015 max	0.2 max

Specification: ASTM B265

ISO/ASTM 52942:2020: Group E [6]

Tested Print Profiles

Laser	Profile name	Meltio TRL[5]	Laser Power [W]	Energy Density [J/mm3]	Deposition Rate [g/h]	Volume rate [cc/h]	Relative Density [%]	Max Pore/Defect [µm]	Oxygen Content
976 nm	Verified Density	Proven	1100	122.22	144	32.5	99.90	-	0.250 - 0.450
450 nm	Rev 30 2025-05-06	Qualified	1000	47.61	360	75.62	99.87	376 / 550	0.095 - 0.213
	Rev 10 2025-06-23	Qualified	1400	48.07	461	104.82	-	-	-

* 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	Infrared Laser				Blue Laser 1.0kW			
		Heat Treatment - 1		As Printed		Heat Treatment - 2		As Printed	
		XY	XZ	XY	XZ	XY	XZ	XY	XZ
Ultimate Tensile Strength [MPa]	895	802 ± 7	788 ± 12	-	-	852 ± 11	850 ± 11	958 ± 12	962 ± 12
Yield Strength [MPa]	828	727 ± 17	693 ± 16	-	-	740 ± 9	699 ± 9	852± 11	854 ± 11
Elongation [%]	10	7 ± 1	9 ± 1	-	-	12.50 ± 0.5	14.13 ± 0.5	11.75± 0.5	9.50 ± 0.5
Hardness [HV-30]	-	-	311	303	-	-	-	332	-

** The structural Properties of the Blue Laser 1.0kW were carried out with Rev 6 2024-10-17.*

Reference Standards

	Cast *(ASTM B367)*	Cast *(ASTM F1108)*	Wrought *(ASTM A381)*	Wrought *(ASTM F1472)*
Ultimate Tensile Strength [MPa]	895	860	895	930
Yield Strength [MPa]	825	758	828	860
Elongation [%]	6	8	10	10
Hardness [HV-30]	-	342	-	349

Fatigue [2]

ASTM E466 (XZ)	Infrared Laser		Blue Laser	
	Heat Treated *(A.H)*	Heat Treated (HIP)	As Printed	Heat Treated
Stress Range [Mpa]	450	530	WIP	WIP
Nº of Cycles (Nf)	1x10^7			
Stress Ratio (R)	-1			

Meltio Titanium 64

Ti-6Al-4V / ER Ti-5 / S Ti 6402c / 3.7165

Internal Structure [3]

Micrography

The observed microstructure is composed of acicular martensite embedded in the beta phase. The columnar shape of the grains extends along the manufacturing direction due to epitaxial growth of the original beta phase. In the XY section, the microstructure appears as polyhedral grains of α´ + β, with alpha phases at grain boundaries.

IR Laser

As-printed XY
100x Magnification

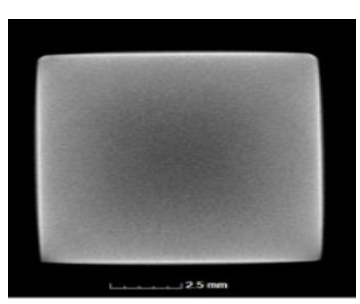
HT XY
100x Magnification

Blue Laser

As-printed XY
100x Magnification

Tomography

CT Scan of 3D printed sample part in Ti64 using IR Laser without detectable voids or defects. Resolution of 24 µm per pixel.



3D / Top
View

Front View

Meltio Titanium 64

Ti-6Al-4V / ER Ti-5 / S Ti 6402c / 3.7165

1.Structural Properties

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.

Mechanical Properties were obtained, based on a printed block of 160x30x70 mm using the Verified Density Parametrization for IR Laser and a printed block of 95x155x55 mm using the **Rev 30 2025-05-06** profile for the Blue laser, from it 16 ASTM E8M samples were extracted using EDM and were analyzed by an external laboratory. IR laser were carried out by *CATEC* *info@catec.aero* and *AIDIMME* *aidimme@aidimme.es*)

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 lab. (IR laser were carried out by *CATEC* *info@catec.aero* and Blue laser were carried out by *CETEMET* *i+d+i@cetemet.es*).

Heat Treatment

Heat treatment is recommended for Ti64 to enhance its mechanical properties. Through heat treatment, the alloy becomes stronger, more ductile, and more resistant to fatigue, making it suitable for high-stress applications. Heat treatment also eliminates residual stresses and helps to refine the microstructure of the alloy, leading to improved toughness and increased resistance to crack growth. Heat treatment of Ti64 after 3D printing is a crucial step in maximizing its performance in applications.

Heat Treatment -1

Solution Annealing

Vacuum atmosphere Heat up to 920ºC	Hold for 2h Cooling to RT

Additional Treatment

Vacuum atmosphere Heat up to 460ºC	Hold for 8h Cooling inside the oven to RT

It is discarded in Heat Treatment-2.

Heat Treatment -2

Solution Annealing

Vacuum atmosphere Heat up to 920ºC	Hold for 2h Cooling to RT

2.Fatigue Life

Specimens printed using Meltio's wire-laser metal 3D printing process can withstand high fatigue cycles, performing at the same level as samples produced using conventional manufacturing methods. The results also indicate that specimens exhibit good fatigue behaviour even in the as-printed state, without the application of heat treatments.

Mechanical Properties were obtained, based on a printed pillars of 22x22x135 mm using the Verified Density Parametrization, from it 16 ASTM E466 samples were extracted using EDM and were analyzed by an external laboratory.

3.Internal Structure

Micrography

The micrography were obtained from a 10x10x60 mm printed block using the Verified Density Profile for IR laser and **Rev 30 2024-12-17** 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. (*CATEC* *info@catec.aero*)

Meltio Titanium 64

Ti-6Al-4V / ER Ti-5 / S Ti 6402c / 3.7165

Oxygen Content

Oxidation is a crucial factor that particularly affects the properties and performance of 3D printed titanium samples. Titanium has a high affinity for oxygen when exposed to air at high temperatures, which leads to embrittlement and reduced mechanical properties, such as decreased resistance to wear, fatigue, and corrosion and were analyzed by an external laboratory. (*AIDIMME* aidimme@aidimme.es)

Relative Density

Characterizing materials for its Blue Laser technology using 300x400x60 mm Titanium 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)

4.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 20 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.

5.Meltio TRL Classification System

The manufacturing process of Copper and Aluminum using Meltio's Blue Laser technology has certain limitations. Currently, thin-walled geometries (produced in a single pass) can be reliably manufactured. However, solid or bulky components present challenges due to variations in material behavior and thermal properties as the volume and mass increase. While small solid volumes of these materials can be printed, scalability remains an area of ongoing development.

Additionally, the technological readiness of Copper and Aluminum printing is currently between **Technology Readiness Level (TRL) 3 and 4,** indicating that it is still in the experimental validation and optimization stages. In contrast, other Meltio materials, such as steels, nickel and titanium alloys, have reached higher maturity levels, ranging from TRL 7 to 9, with validated applications in industrial environments.

To clearly communicate the development and readiness level of materials within the Meltio ecosystem, an internal classification system has been established, aligned with the standard Technology Readiness Levels (TRL). This framework offers a structured reference for customers, partners, and integrators regarding the current validation stage and industrial applicability of each material.

Meltio Tier	TRL	Description
Meltio Explore	1–3	Exploratory phase focused on researching new alloys and process configurations. Designed for R&D environments aiming to push the boundaries of the technology.
Meltio Develop	4–6	Active development stage. Functional results have been achieved, with evolving process parameters. Suitable for concept validation and pre-industrial applications.
Meltio Qualified	7-8	Material and process qualified for demanding applications. High repeatability and reliability, ready for integration into real-world production environments.
Meltio Proven	9	Fully validated in industrial settings. Material used in end-use parts with proven performance in actual production. Represents the highest level of technological maturity.

Meltio Titanium 64

Ti-6Al-4V / ER Ti-5 / S Ti 6402c / 3.7165

6. Material Classification (ISO/ASTM 52942:2020)

The metallic material specified in this technical data sheet is classified in accordance with ISO/ASTM 52942:2020 – Additive Manufacturing — Metallic Materials — Classification. This standard defines a harmonised system for the designation and categorisation of metallic materials used in additive manufacturing, ensuring consistent identification and traceability.

Grade Ti-6Al-4V is designated within **Group E**, corresponding to α+β titanium alloys.