Meltio Material Datasheet

Meltio Stainless Steel 17-4PH

17-4PH / ER 630 / 1.4542 / UNS S17400

17-4PH is a precipitation-hardening martensitic stainless steel with excellent mechanical properties and corrosion resistance. It is a versatile material with high strength, good toughness, and good resistance to stress corrosion cracking, making it ideal for a wide range of applications in the aerospace and chemical industries.

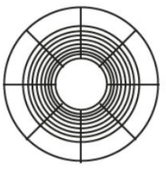
Properties	High Strength, Low Weight, Corrosion Resistance and Heat Treatable
Applications	Aerospace, Chemical Industries, Oil & Gas, Defense and Naval

Wire Chemical Composition	Fe	C	Ni	Si	Mn	Cr	Mo	Nb	Cu
Weight Percent [%]	Bal.	0.02	4.7	0.4	0.5	16.5	0.2	0.23	3.4

Wire Density
7.75 g/cm³

Melting Point		
1677 - 1713 K	1404 - 1440 ºC	2559 - 2624°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	1935 cm³
Spool Type	BS300
Wire Coating	Uncoated

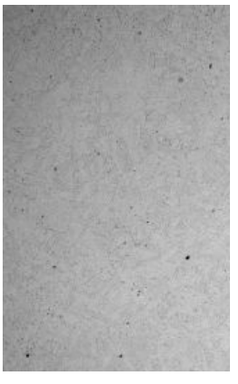
Relative density as 3D printed with IR Laser	99.90%

Micrography

The as printed microstructure of 17-4 PH stainless steel is heterogeneous and mostly martensitic with some retained austenite.
Solution Annealing and Age Hardening results in a significantly refined grain structure with a predominantly martensitic microstructure and equiaxed morphology.

As-printed XZ
100x Magnification

As-printed XZ
1000x Magnification

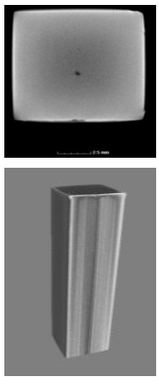


HT.1+ HT.2
1000x Magnification

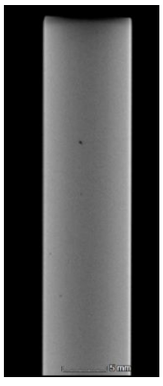
IR Laser
Tests Carried Out In IDONIAL *info@idonial.com*

Tomography

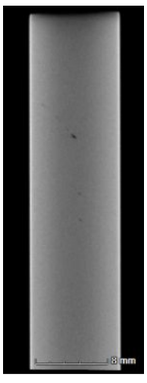
Computed Tomography Scan of 3D printed sample part in 17-4PH showing small detectable voids. Resolution of 24 µm per pixel.



3D / Top View



Left View



Front View

IR Laser
Test Carried Out In SERMET3D *info@sermet3d.com*

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Deposition Parameters

The following printing parameters were obtained through rigorous testing. The **Infrared Profile** was derived from a 30 × 60 × 20 mm printed block, from which a 10 × 10 × 60 mm sample was extracted using EDM and analyzed via CT scan in an external laboratory. The **Blue Profile** was obtained from three scenarios (30 × 60 × 20 mm, 55 × 70 × 70 mm, and 250 × 250 × 30 mm) to ensure reliable unattended printing with maximum quality and energy density. Internally, samples were tested using Liquid Penetrant Testing (LPT) to evaluate surface-breaking defects on newly exposed internal surfaces after sectioning. Additional analyses, including Micrography, CT scan, and Structural testing, are conducted by an external lab.

These profiles are valid for 90% of solid parts, with a minimum part size of 30 × 30 mm. Their performance depends on geometry, overhangs, material, thickness, and base material. Profiles serve as a reference for specific applications, but operator expertise remains essential for achieving optimal print quality for the specific application. Adjustments may be necessary to overcome challenges or deviations from standard shapes.

The **Blue Profiles are under continuous development**, with updates released at least quarterly to enhance performance and reliability. The data presented reflects the current state, and improvements are ongoing. In case of doubts about performance or specific requirements, please contact the **Meltio Process Team** for guidance.

These printing parameters are available in **Meltio Horizon** and **Meltio Space** slicers latest release.

Technology	Revisión name	Laser Power [W]	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]	Volume rate [cc/h]
IR Laser 976 nm	**V.D.**	1100	7.5	10.0	1.0	1.0	9.6	146.6	196	25.29
Blue laser 450 nm	**Solid 1x1.2 Rev21 2024-12-13**	1000	6	15.0	1.0	1.2	9.95	111.11	251	32.38

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Heat Treatment

To achieve the best mechanical properties, 17-4PH should be heat-treated after 3D printing. The standard heat treatment process for 17-4PH involves two steps: Solution Annealing and Age Hardening. Solution annealing removes internal stresses of the metal that have been formed during 3D printing and Age Hardening will upgrade the mechanical properties. Machining may take place before or after the solution annealing depending on part tolerance requirements.

Solution Annealing

Heat up to 1000ºC-1050ºC	Hold 1 hour Cooling to RT

Age Hardening

Heat up to 480ºC-500ºC	Hold 3 hour Slow Cooling 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 process perform at the same level as samples made with conventional manufacturing methods. Results show low deviations and near isotropic properties in the as printed state without the application of heat-treatments.

			UNE EN ISO 6892-1	
	Wire Properties	**Wrought Properties (ASTM 1472)**	**Meltio XZ Properties IR Laser (S.A + A.H)**	**Meltio XZ Properties IR Laser (As Printed)**
Ultimate Tensile strength (UTS) [MPa]	990	1310	1391 ± 7	1017 ± 15
Yield strength [MPa]	870	1170	1243 ± 8	815 ± 17
Elongation [%]	9	10	10 ± 3	14 ± 0.1
			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.

		UNE EN ISO 6507-1	
	Wrought Properties (ASTM 1472)	**Meltio Properties IR Laser (S.A + A.H)**	**Meltio Properties IR Laser (As Printed)**
Hardness [HV-30]	388	393	258
		Tests Carried Out In IDONIAL info@idonial.com	

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 current work on material characterization is carried out using the Meltio 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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