Meltio Mild Steel ER70-S

ER70S-6 / S 42 4 M21 3Si1 / AWS A5.18

ER70-S, also known as low alloy carbon steel or mild steel, is a highly versatile material due to its strength, ductility, and low cost. It is used in many applications, including construction, automotive and manufacturing. Its excellent weldability and machinability make it easy to work with, while its high ductility and toughness make it suitable for structural applications.

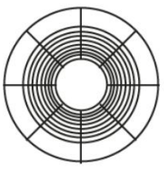
Properties	Low Cost, Easily Machined, Highly Ductile and Magnetic
Applications	Manufacturing, Tools and prototypes and Automotive industries

Wire Chemical Composition	Fe	C	Mn	Si	S	P
Weight Percent [%]	Bal.	0.07	1.45	0.85	0.02	0.01

Wire Density
7.8 g/cm³

Melting Point		
1700 - 1760 K	1425 - 1485ºC	2600 - 2700°F

Spool Specs



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

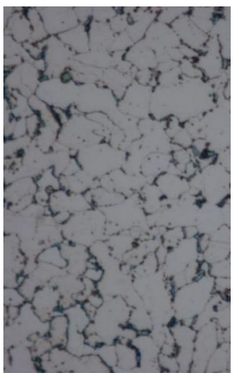
Wire Diameter	1.0 mm
Weight on Spool	15 kg
Volume on Spool	1923 cm³
Spool Type	BS300
Wire Coating	Uncoated

Relative density as 3D printed IR Laser	99.19%

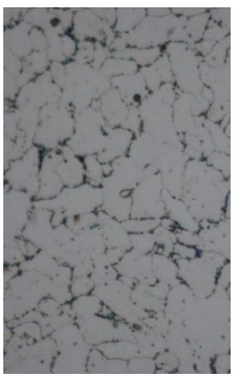
Micrography

The investigation reveals that the microstructure of the ER70-S specimens consists of a ferritic matrix intermixed with pearlite at the grain boundaries, wherein the interlayers exhibit larger grain sizes owing to the heat generated during material deposition.

As-printed XY
100x Magnification



As-printed XY
1000x Magnification

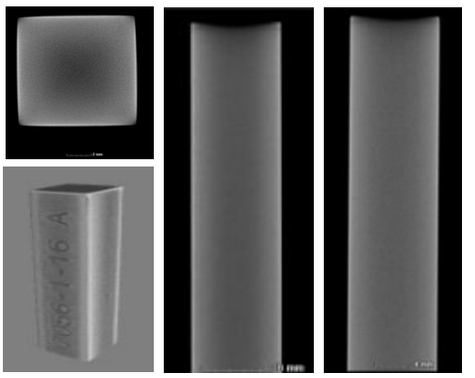


As-printed XZ
1000x Magnification

IR Laser
Test Carried Out In ADIMME *aidimme@aidimme.es*

Tomography

Computed Tomography Scan of 3D printed sample part in ER70-S without detectable voids or defects. Resolution of 24 µm per pixel.



3D / Top View

Left View

Front View

IR Laser
Test Carried Out In CATEC *info@catec.aero*

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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	18.72
Blue laser 450 nm	**Solid 1.1x1.3 Rev 35 2025-01-13**	1000	7	15.0	1.1	1.3	13.28	99.9	281	36.02

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Heat Treatment

With ER70-S it is not mandatory to perform a heat-treatment after 3D printing for general use case applications. A Normalizing heat treatment can be applied to ER70-S to improve its microstructure and mechanical properties. By eliminating unstable constituents such as acicular ferrite and bainite, a more uniform and homogeneous microstructure is achieved, leading to a better distribution of pearlite and ferrite. This results in increased ductility and toughness, as well as a reduction in the anisotropy of the material.

Normalization

Protective atmosphere Heat up to 900°C	Maintain for 2h Cooling in air 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	**Cast Properties (ASTM A352)**	**Wrought Properties (ASTM A36)**	**Meltio XY Properties IR Laser (As printed)**	**Meltio XZ Properties IR Laser (As printed)**
Ultimate Tensile strength (UTS) [MPa]	560	415 - 585	400 - 550	598 ± 5	525 ± 12
Yield strength [MPa]	480	205	250	484 ± 8	402 ± 37
Elongation [%]	25	24	23	71 ± 1	15 ± 9
				Tests 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.

			UNE EN ISO 6507-1
	Cast Properties (ASTM A352)	**Wrought Properties (ASTM A36)**	**Meltio Properties IR Laser (As printed)**
Hardness [HV-30]	160	127	175
			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 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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