

Meltio Tool Steel H11

Material Group: Tool Steels

A chromium-based steel alloy, it's one of the most commonly used tool steels, thanks to its outstanding impact toughness. H11 is widely used for hot tooling applications, in the manufacturing of dies, and in aerospace applications.

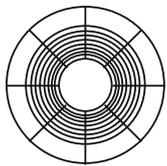
Nomenclature Standards

EN ISO 14343 - A _____ S Fe3
Material N° _____ 1.2606

Chemical Composition

C	Si	Mn	Cr	Mo	V	W
0.35	1.1	0.4	5.5	1.2	0.25	1.3

Spool Specs



Diameter	1 mm
Weight	15 kg
Volume	1920 cm ³
Density	7.81 g/cm ³
Spool Type	BS300

Applications



Aerospace industries



Tools and prototypes

Mechanical Properties

Results show Meltio's wire LMD 3D printed specimens to perform at the same level as conventional manufacturing methods, with low deviations and near isotropic properties between vertical (XZ) print orientations.

		Tensile Strength (MPa)	Yield Strength (MPa)	Elongation (%)	Hardness (HV-30)
Wrought Properties		1990	1650	9	558
Meltio as Built	XZ	1771.34	1170.14	3.46	561
Meltio Post Temper Heat - Treatment	XZ	2086	1735	12	558

Heat Treatment

HT.1 Annealing

- Heat up to 820°C hold for 4h
- Slow cooldown in oven

HT.2 Hardening

- Heat up to 1025°C for 1h
- Forced air cooling

HT.3 Tempering

First tempering

- Heat up to 550°C for 1h
- Air cooling

Second tempering

- Heat up to 550°C for 1h
- Air cooling

Printing Parameters Used

Print Speed	Deposition Width	Layer Height	Laser Power
300 mm/min	1 mm	1.2 mm	1100 W

Tomography

In this tomography we can observe the internal structure of the material and see its good density, absence of porosity or internal defects that put at risk the structure of the sample.

The resolution used for the CT inspection is 24 micrometros por pixel.



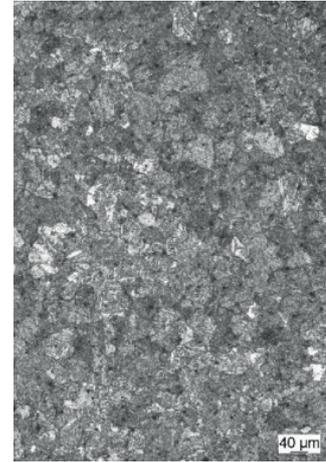
Metallography

The microstructure in "As Build " state for H11 is composed mostly of tempered martensite, fresh martensite and helded austenite. The morphology of the grains vary in dependance on the orientation of the paths, it's possilbe to identify columnnar grains that follow the direction of the solidification front of the meltpool. After the heat treatment the presence of austenite has been reduced drastically, leaving all the martensite tempered. The grain size has been refined during the process showing an equiaxial morphology.

Before Heat Treatment



After Heat Treatment



Shielding gas: Argon > 99.996% purity.

Machine Used: Meltio M450

Laser System: 6x200W Fiber coupled diode lasers. 976nm wavelength.

* Data represent tycal reference values from Worught and Cast material classification compared to Meltio (M450) vertical (XZ) specimens extracted from 3D printed walls and tensile tested according to UNE EN ISO 6892-1

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