

# Stellar X15TN

## Powder for Additive Manufacturing



### MATERIAL OVERVIEW

Stellar X15TN is a cobalt-free, martensitic stainless steel with high hardness, adapted for additive manufacturing. It is suitable for applications where high strength is required in abrasive or corrosive environments such as:

- Plastic injection tools with conformal cooling
- Cutting tools with requirements of high corrosion resistance
- Surgical instruments
- Glassware molds

### KEY PROPERTIES

Property	Unit	20°C
Density	g/cm <sup>3</sup>	7.7
Thermal conductivity	W/(m*K)	23
Thermal expansion at 20-100°C	10 <sup>-6</sup> K <sup>-1</sup>	10.4
Specific heat	kJ/(kg°C)	450
Young modulus	MPa	200

Data for quenched and tempered material.

### CHEMICAL COMPOSITION

	Cr	Mo	V	C	N
Mini	15.0	1.5	0.2	0.37	0.13
Maxi	16.5	1.9	0.4	0.45	0.25

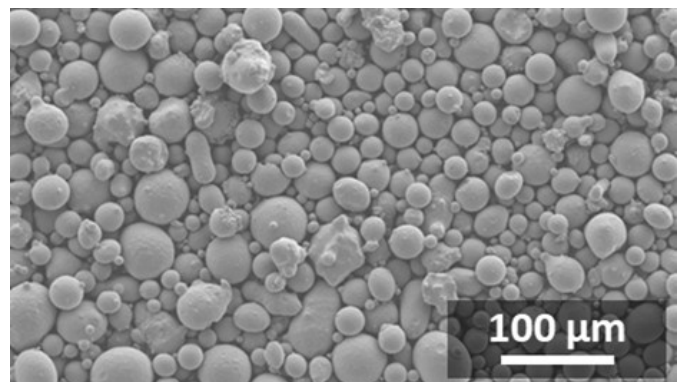
### POWDER CHARACTERISTICS

Laser Powder Bed Fusion (LPBF): 15-53 μm

Electron Beam Melting (EBM): 45-106 μm

Directed energy deposition (DED): 45-106 μm

Custom size distributions available on request



Typical powder morphology

## PRINTABILITY

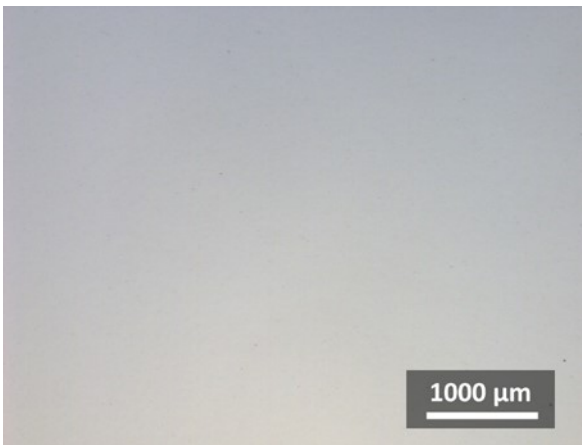
Processing parameters for EOS M290	
Laser power	240 W
Spot diameter	73 µm
Scan speed	700 mm/s
Layer thickness	50 µm
Hatch distance	100 µm
Base plate temperature	160°C
Shielding gas	Nitrogen

The as-build hardness is around 38 HRC.

## CLEANLINESS AND POROSITY

Typical values with optimal process parameters.

Porosity	0.03%
Biggest pore size	30 µm
Cleanliness	DIN 50602 K0<1



Microstructure (as-built) with optimal printing parameters

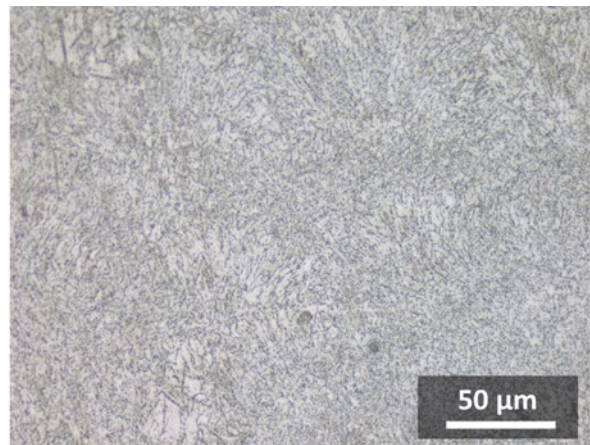
## STRESS RELIEVING

The hardness as-printed is around 42 HRC. Stress relieving should be done at 400-500°C. A higher temperature will cause secondary hardening and make the material difficult to machine. A lower stress relieving temperature might not remove the thermal stresses enough.

## HEAT TREATMENT FOR BEST CORROSION RESISTANCE

- Austenitizing at 1050°C/30min followed by oil or gas quenching.
- Cryogenic treatment at -80°C/2h
- Single temper at 180°C

Hardness	58 HRC
Charpy V	4 J



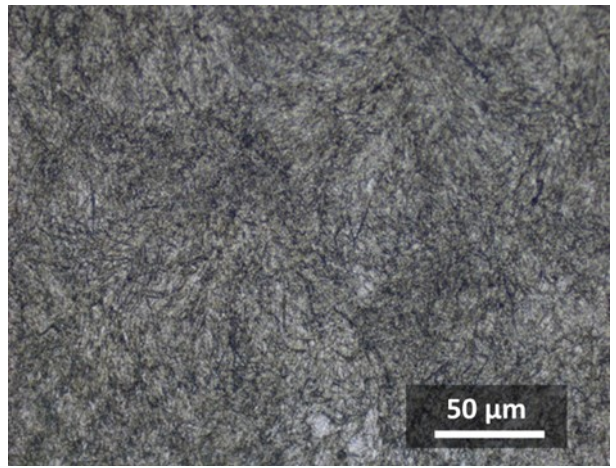
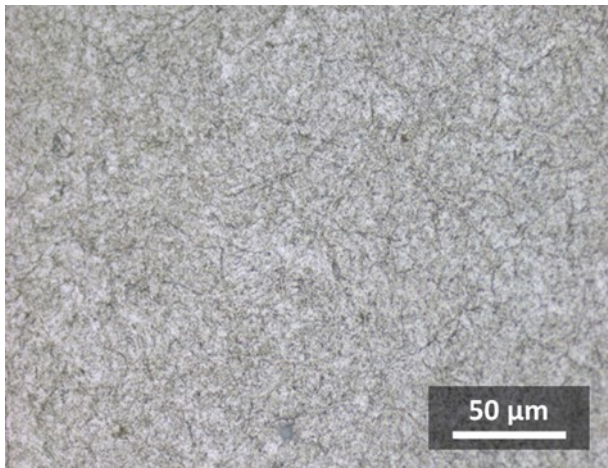
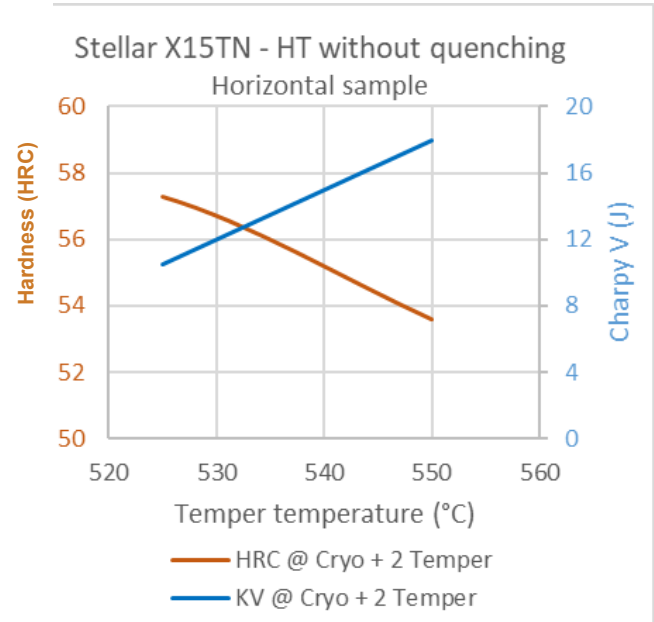
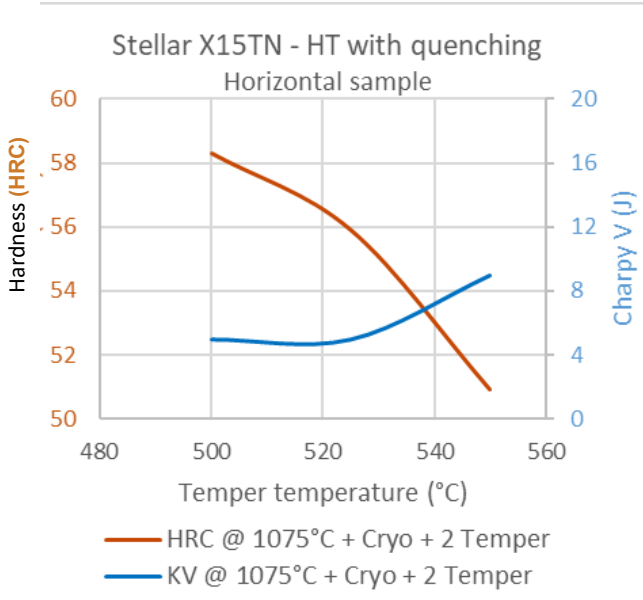
Microstructure (as-built) with optimal printing parameters

## HYBRID PRINTING

Stellar X15TN can be printed directly onto a base of AISI 420/ X30Cr13. The base material can be hardened to >42 HRC to ensure that it does not deform during the printing.

**HEAT TREATMENT WITH QUENCHING**

**HEAT TREATMENT WITHOUT QUENCHING**



Microstructure after heat treatment at 500°C/2h + 1075°C/30min + cryogenic treatment at -80°C + 2 x 525°C/2h for a hardness of 56 HRC.

Microstructure after heat treatment at 500°C/2h + cryogenic treatment at -80°C + 2 x 550°C/2h for a hardness of 53.6 HRC.

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## **CORROSION RESISTANCE**

Salt spray test according to NF X 41-002 comparing Stellar X15TN and X105CrMo17 (440C)

- Aspect of the surface after 96 h salt spray (NaCl) exposure
- For both grades, heat treatment cycle: 1050°C Oil / -80°C / 180°C

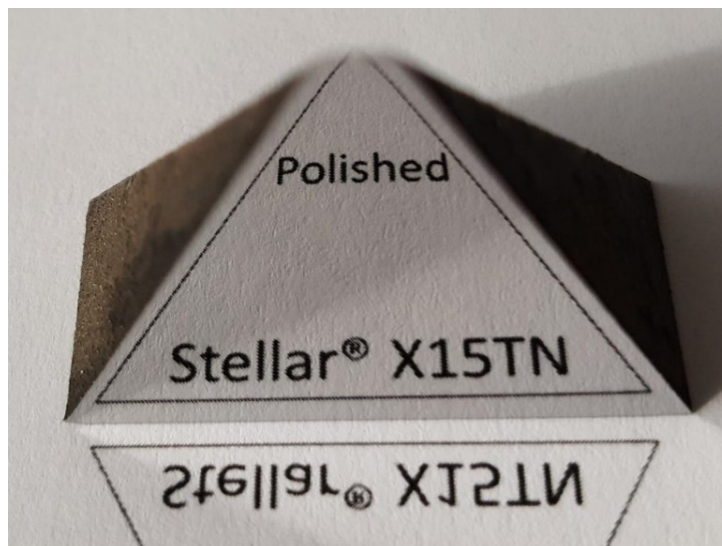


X15TN











X105CrMo17

## **POLISHABILITY**



## **GRADE COMPARISON**

Comparison of additively manufactured materials heat treated to similar hardness.

AM steel	Hardness	Impact toughness	Corrosion resistance	Thermal conductivity
Stellar X15TN	53 (max 58)			
Type 420 (1.2083)	49 (=max)			
Maraging 1.2709	53 (=max)			

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