AUBERT&DUVAL

Stellar X15TN

Powder for Additive Manufacturing

STELLAR

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

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

KEY PROPERTIES

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

Data for quenched and tempered material.

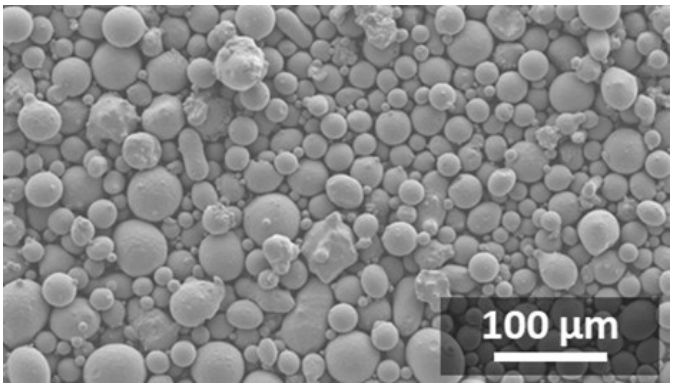
POWDER CHARACTERISITICS

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

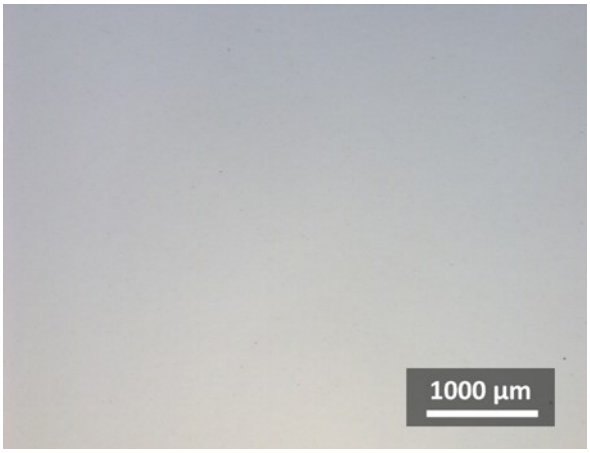
Processing parameters for EOS M290	
Laser power	240 W
Spot diameter	73 µm
Scan speed	700 mm/s
Layer thickness	50 µm
Hatch distance	100 µm
Base plate temperature	160°C
Shielding gas	Nitrogen

The as-build hardness is around 42 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

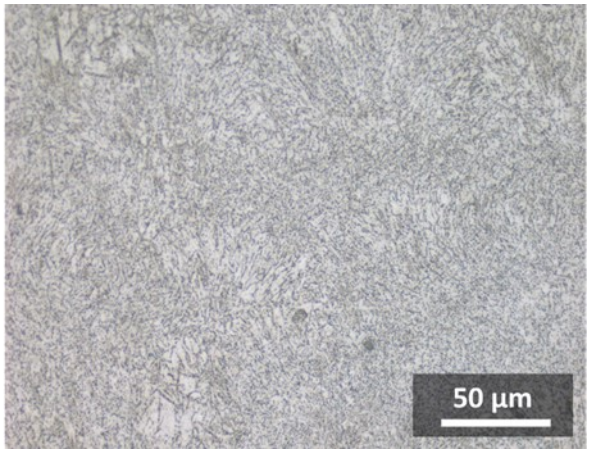
STRESS RELIEVING

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

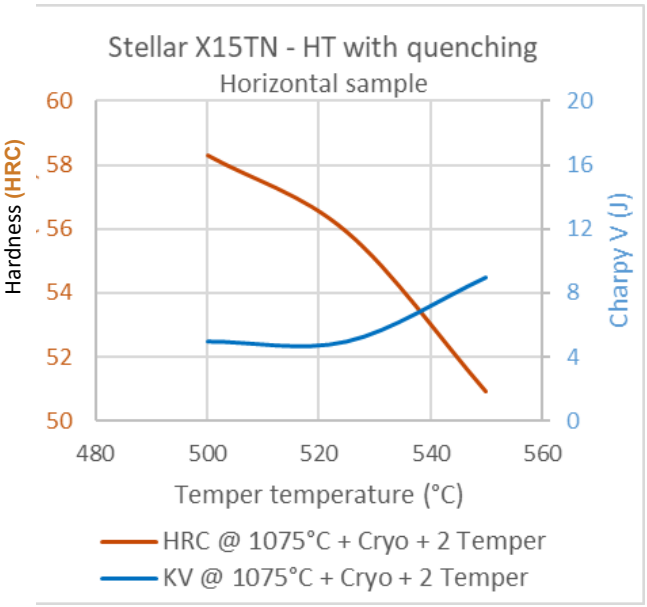


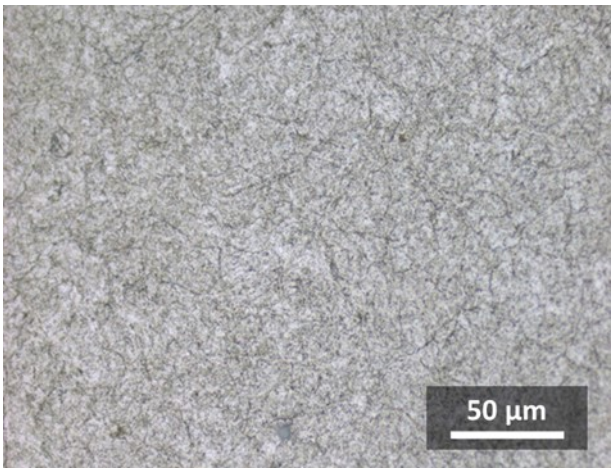
Microstructure (as-built) with optimal printing parameters

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.

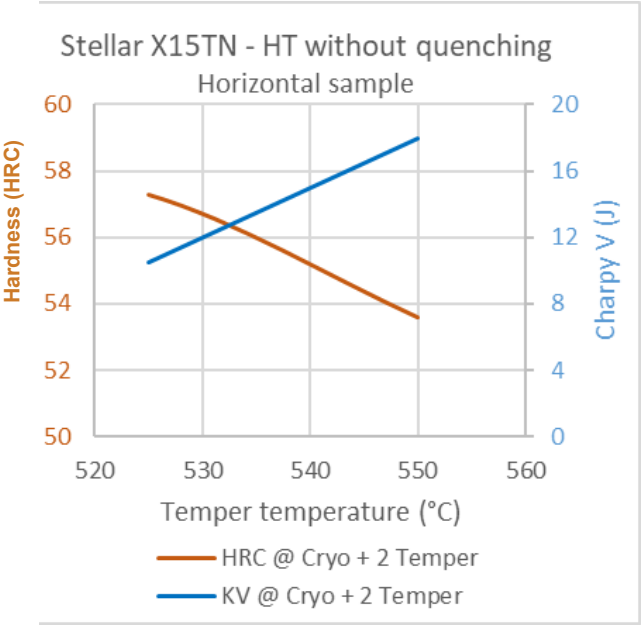
HEAT TREATMENT WITH QUENCHING

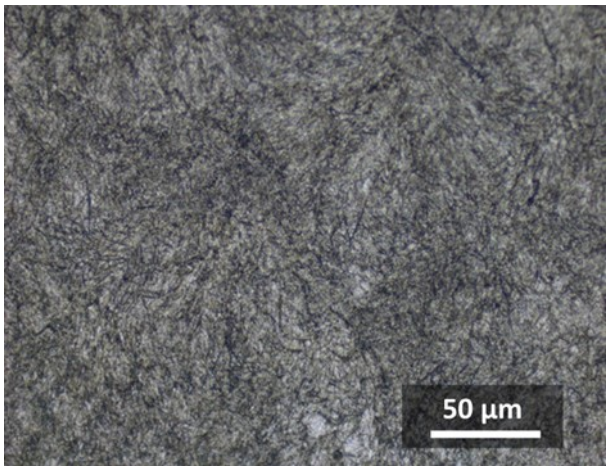




Microstructure after heat treatment at 500°C/2h + 1075°C/30min + cryogenic treatment at -80°C + 2 x 525°C/2h for a hardness of 56 HRC.

HEAT TREATMENT WITHOUT QUENCHING





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

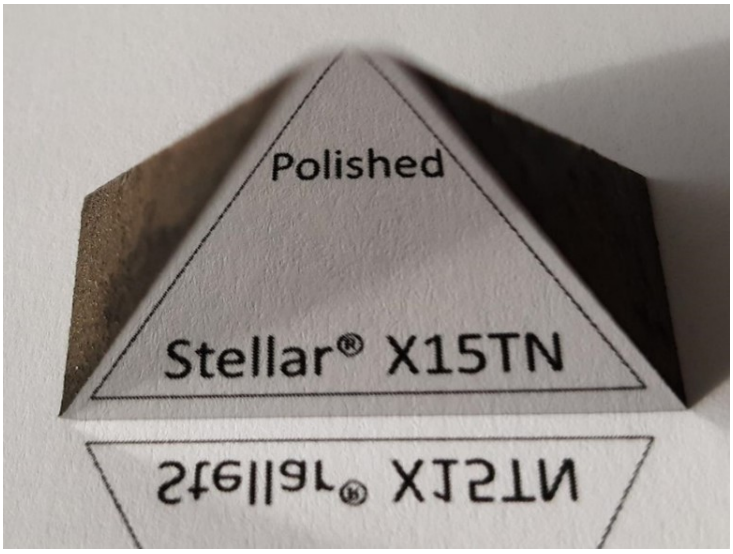
Salt spray test according to NF X 41-002 comparing Stellar X15TN and X105CrMo17 (440C)

- 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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