AUBERT&DUVAL

STELLAR
Metal powders by AUBERT & DUVAL

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

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

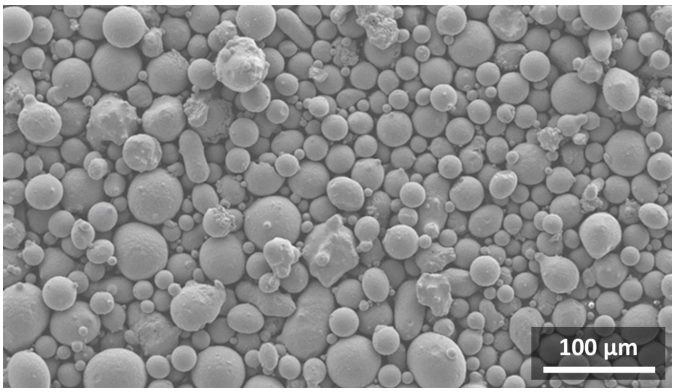
Property	Unit	20°C
Density	g/cm^3	7.7
Thermal conductivity	W/(m*K)	23
Thermal expansion at 20-100°C	10^{-6} K^{-1}	10.4
Specific heat	kJ/(kg°C)	450
Young modulus	MPa	200

Data for quenched and tempered material.

POWDER CHARACTERISTICS

Particle size distributions:

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

Contact: powder@aubertduval.com

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PRINTING BY LPBF

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 or Argon

PRINTING BASE PLATE

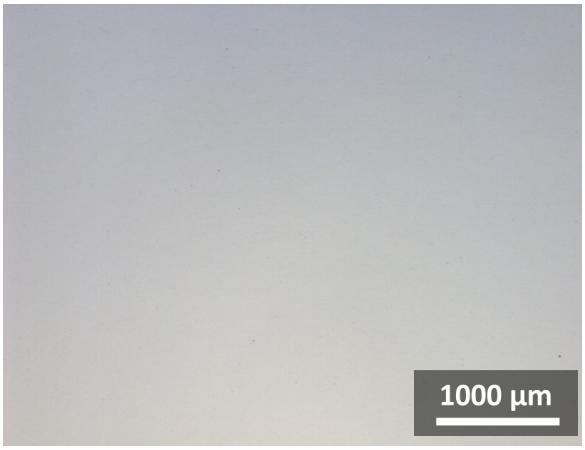
Stellar X15TN® can be printed directly onto a base of AISI 420/ X30Cr13.

High carbon low alloyed steels such as C45 should be avoided.

CLEANLINESS AND POROSITY

Typical values with optimal process parameters.

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



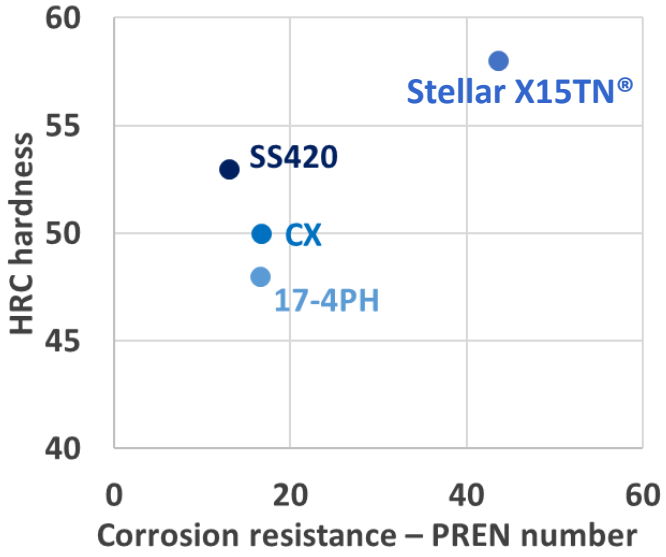
Unetched microstructure (as-built) with optimal printing parameters

STRESS RELIEVING

The hardness as-printed is below 44 HRC.
Stress relieving should be done at 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.

CORROSION RESISTANCE

The Pitting Resistance Equivalence Number (PREN) is theoretical number used to rank the corrosion resistance of stainless steels.



TENSILE STRENGTH AFTER QUENCHING

Heat treatment		
Stress relieving	500°C/2h	500°C/2h
Quenching	1050°C / 30 min	1075°C / 30 min
Cryogenic treatment	No	-80°C / 2h
Temper	2 x 650°C / 2h / Air	2 x 550°C / 2h / Air
Tensile properties (at 0,5%/min)		
UTS (MPa)	1240	1830
YS (MPa)	990	1480
A (%)	14	11
E-module (GPa)	220	220

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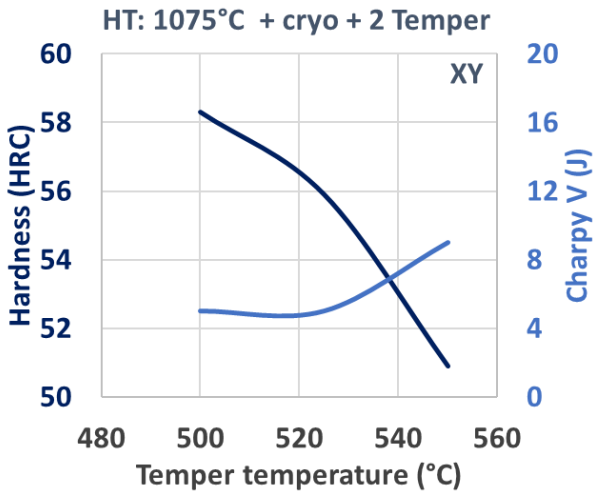
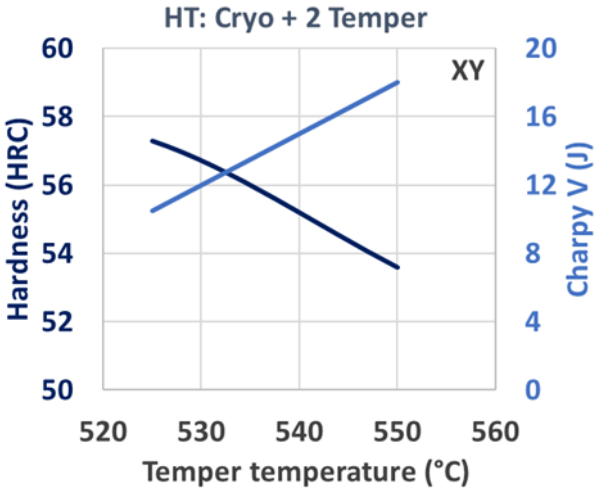
HARDNESS AFTER QUENCHING

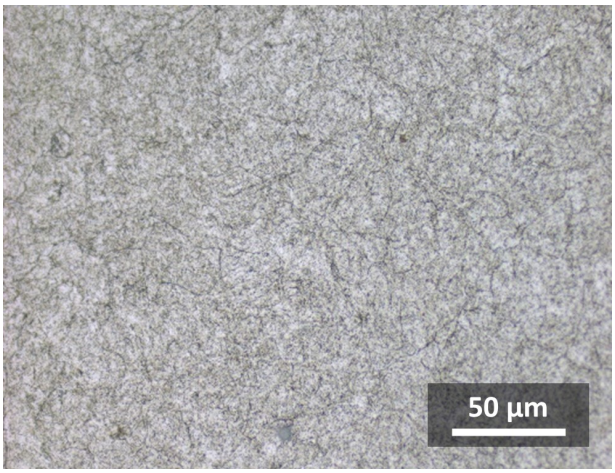
- Austenitizing at 1075°C/30min followed by oil or gas quenching.
- Cryogenic treatment at -80°C/2h
- Double temper to chosen hardness



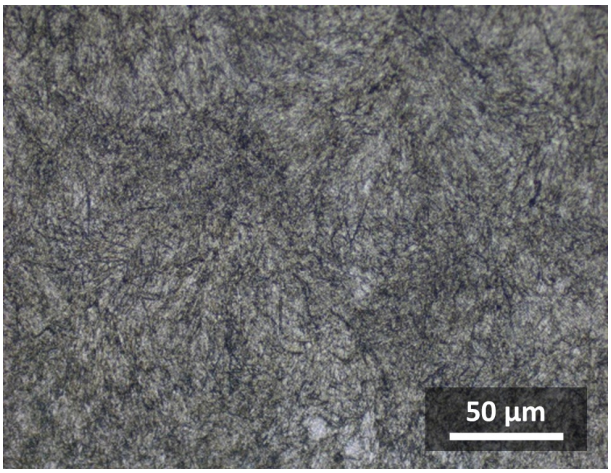
HARDNESS WITHOUT QUENCHING

- Cryogenic treatment at -80°C/2h
- Double temper to chosen hardness





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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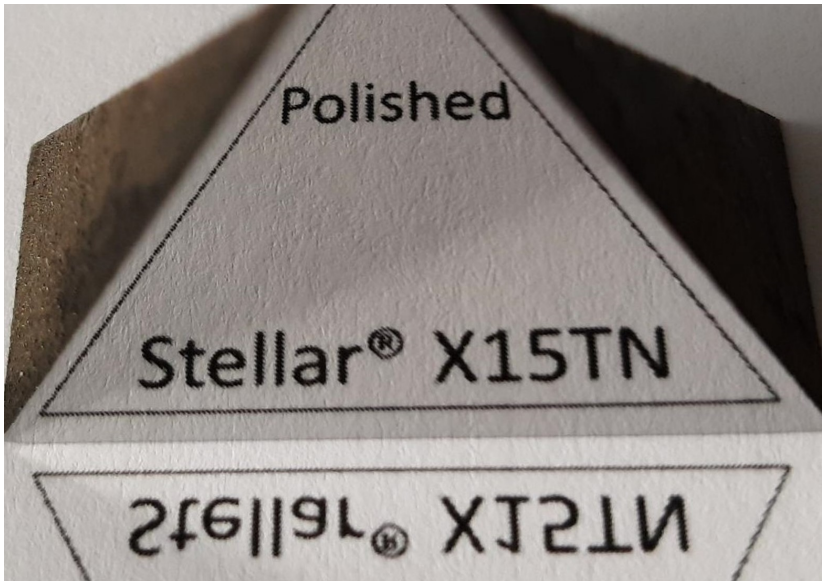
POLISHABILITY

The high hardness, cleanliness and density give an excellent polishability.



GRADE COMPARISON

Comparison of additively manufactured materials heat treated to 53 HRC.

AM steel	Hardness	Impact toughness	Corrosion resistance	Printability
Stellar®X15TN	53 (max 58)			
Type 420 / 1.2083	53 (=max)			
18Ni300 / 1.2709	53 (=max)			

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