Asgaard Metals

Data sheet - Binder Jetting

THOR15

T15 | 1.3202 | HS12-14-5 | T12015

THOR15 is a high-performance tungsten type high-speed tool steel for Binder Jetting. THOR15 powder has been qualified for Binder Jetting due to its superior flowability, green strength, and good sinterability (up to approx. 99.5%). With a hardness of up to 67 HRC and the ability to withstand high temperatures, it can be used in various applications.

Classical hot work tool steel applications:

- High-speed cutting tools
- Heavy-duty finishing tools
- Stamping dies

Automotive and aerospace applications:

- Bearings, gears, and valves
- Turbine disks and fuel injectors

CHEMICAL COMPOSITION	
ELEMENT	*MASS FRACTION (W.-%)*
Fe	Balance
C	1.6 – 1.7
W	12 – 12.5
V	5 – 5.5
Co	5 – 5.5
Cr	4 – 4.5
Mn	0.4 – 0.5
Si	0.4 – 0.5
Ni	0.3 – 0.4

PHYSICAL PROPERTIES	
Density	8.23 g/cm^3
Melting range ($T_{solidus}$ – $T_{liquidus}$)	1238 - 1326°C
Thermal conductivity	20.9 W/mK at 100°C
Thermal expansion	9.9 x 10^{-6}/°C at 20 – 200°C

POWDER CHARACTERISTICS	
Nomenclature	0 – 25 µm
Particle Size Distribution, ASTM B822	D10 = 8.9 µm, D50 = 16.6 µm, D90 = 28.2 µm
Apparent density	4.53 g/cm^3
Tapping density	5.27 g/cm^3
Hausner ratio, ASTM B527-15	1.16
Flow character	Good

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MECHANICAL PROPERTIES OF PRINTED PARTS		
PROPERTIES	*AS-BUILT*	*HEAT-TREATED*
Rockwell hardness, ISO6508-1	53 HRC	Up to 67 HRC
Vickers hardness, ISO6507-1	$HV_{0.5} = 550 \pm 5$	$HV_{0.1} \leq 1070 \pm 5$

BINDER JETTING PROCESS CHAIN	
QUALIFIED PROCESS PARAMETERS	*EXAMPLE*
System	ExOne Innovent+
Binder, drop volume and saturation	AquaFuse, 30pL, 80%
Layer thickness	45 µm
Curing	180°C for 24 hours in ambient atmosphere
Debinding	500°C for 3 hours in argon atmosphere
Sintering	1200°C for 2 hours in $N_2 - H_2$ atmosphere

HEAT TREATMENT
EXAMPLE
• Austenization at 1230°C for 10 minutes followed by oil quenching • Triple tempering at 540°C for 1 hour each

THOR15 has been qualified for Binder Jetting in collaboration with ExOne (Desktop Metal) and the Technical University of Denmark (DTU). More data is available upon request.

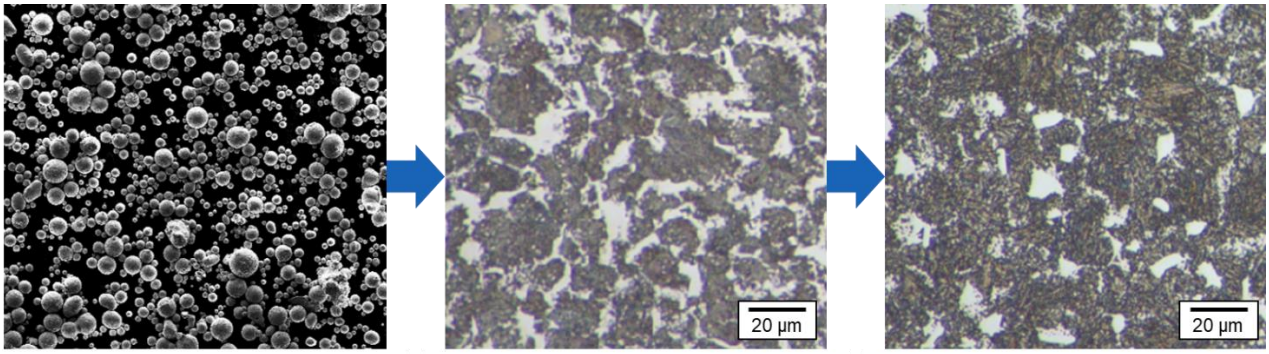

Figure 1: Left: Secondary electron microscopy image of TH15 powder showing spherical morphology and low degree of satellites, middle: Light optical microscopy image of TH15 microstructure after sintering showing close to full density, and right: refined microstructure with homogenously distributed carbides after heat treatment. Etched with Nital.