

BLT-CuCrZr

→ General Description

Microalloyed on the basis of pure copper, CuCrZr achieves a perfect balance of physical and mechanical properties by means of precipitation hardening. Unlike pure copper, CuCrZr can be used both as load-bearing and structural materials, and has a wide range of applications in heat sinks and conductive coils. Heat treatment has a significant impact on the performance of CuCrZr. The appropriate heat treatment process can be selected according to the working conditions of the application to match the required mechanical and physical properties. Direct aging heat treatment provides high mechanical properties and good thermal and electrical conductivity; solution and ageing treatment provides high thermal and electrical conductivity and moderate mechanical properties.

→ Main Characteristics

- Good Mechanical Properties
- High Hardness
- Good Electrical and Thermal Conductivity
- Performance can be Regulated by Heat Treatment

→ Typical Applications

- Rocket Engine Combustion Chambers
- Transportation Rail Power Contact Lines
- Large Scale Integrated Circuit Lead Frames
- Important Components of Thermonuclear Fusion Reactors

→ Powder Properties

The chemical composition of BLT CuCrZr powder is reported in the table below:

Element	Cr	Zr	Cu
Wt./%	0.5 ~ 1.5	0.02 ~ 0.30	Bal.

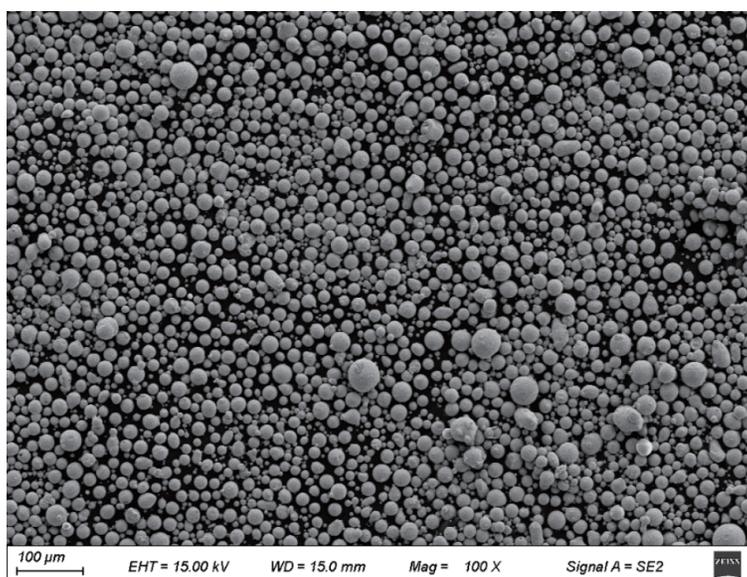
The particle size distribution of BLT CuCrZr powder is shown as follows, which was tested by the laser particle size analyzer:

Particle size distribution	DV(10)	DV(50)	DV(90)
15 μ m ~ 45 μ m	15 μ m \leq DV(10) \leq 25 μ m	25 μ m \leq DV(50) \leq 35 μ m	45 μ m \leq DV(90) \leq 55 μ m
15 μ m ~ 53 μ m	15 μ m \leq DV(10) \leq 25 μ m	25 μ m \leq DV(50) \leq 40 μ m	45 μ m \leq DV(90) \leq 60 μ m

Other physical properties

Properties	Flowability s/50g	Sphericity	Hollow powder ratio %
Technical requirement	\leq 30	\geq 0.85	\leq 5

→ SEM Micrograph of the Powders



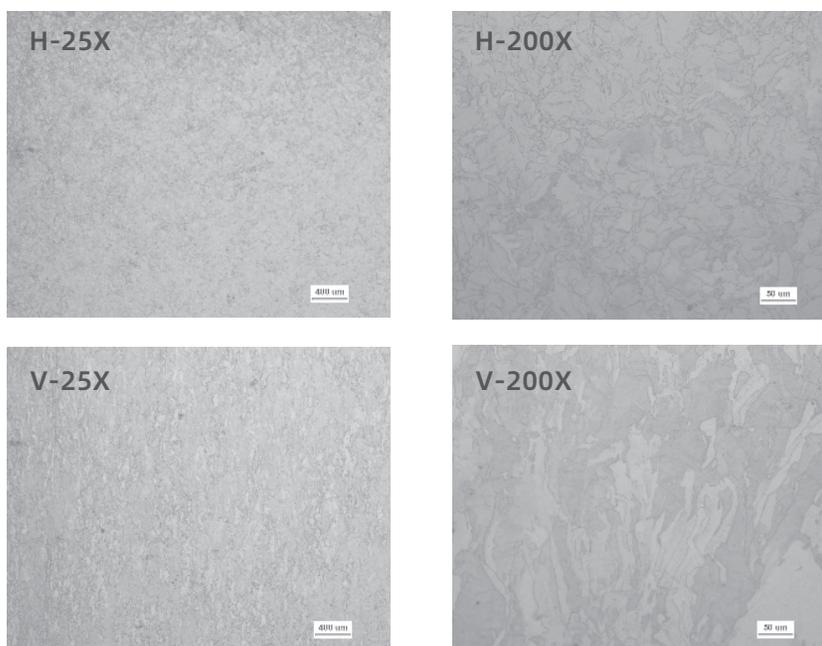
→ Part Performance

Inert gas	Layer thickness μ m	Surface roughness μ m		
		Upper skin (45°)	Down skin (45°)	Vertical plane
Argon	40	17-19	17-19	13-15

→ Heat Treatment Process

Aging: Hold at 430 °C for 6 hours followed by furnace cooling.

→ Microstructure in Heat Treated Condition



→ Mechanical Properties in As-Manufactured Condition

Condition	Temperature °C	Direction	Ultimate tensile strength R_m /MPa	Yield strength $R_{p0.2}$ /MPa	Elongation at break A/%
As-manufactured	Room temperature	Horizontal	285±15	215±15	35±5
		Vertical	255±15	195±15	35±5

Note: The number of samples in each mechanical property test is 30.

Tensile testing standards follow ASTM E8/E8M. Specimens subjected to testing are in the machined-state. The data in the mechanical properties table applies to 3D printing equipment types such as BLT-A300, BLT-A320, BLT-A400, BLT-S310, BLT-S400, BLT-S450, BLT-S600, BLT-S615, BLT-S800.

→ Mechanical Properties in Heat Treated Condition

Condition	Temperature °C	Direction	Ultimate tensile strength R_m /MPa	Yield strength $R_{p0.2}$ /MPa	Elongation at break A/%
Heat treated	Room temperature	Horizontal	600±20	500±10	22±3
		Vertical	520±20	460±10	25±3

Note: The number of samples in each mechanical property test is 30.

Tensile testing standards follow ASTM E8/E8M. Specimens subjected to testing are in the machined-state. The data in the mechanical properties table applies to 3D printing equipment types such as BLT-A300, BLT-A320, BLT-A400, BLT-S310, BLT-S400, BLT-S450, BLT-S600, BLT-S615, BLT-S800.

→ Hardness

Condition	HV1
As-manufactured	100±10
Heat treated	185±10

Note: The number of samples in each hardness test is 10.

→ Part Density

Condition	Density g/cm ³
Heat treated	8.90±0.01

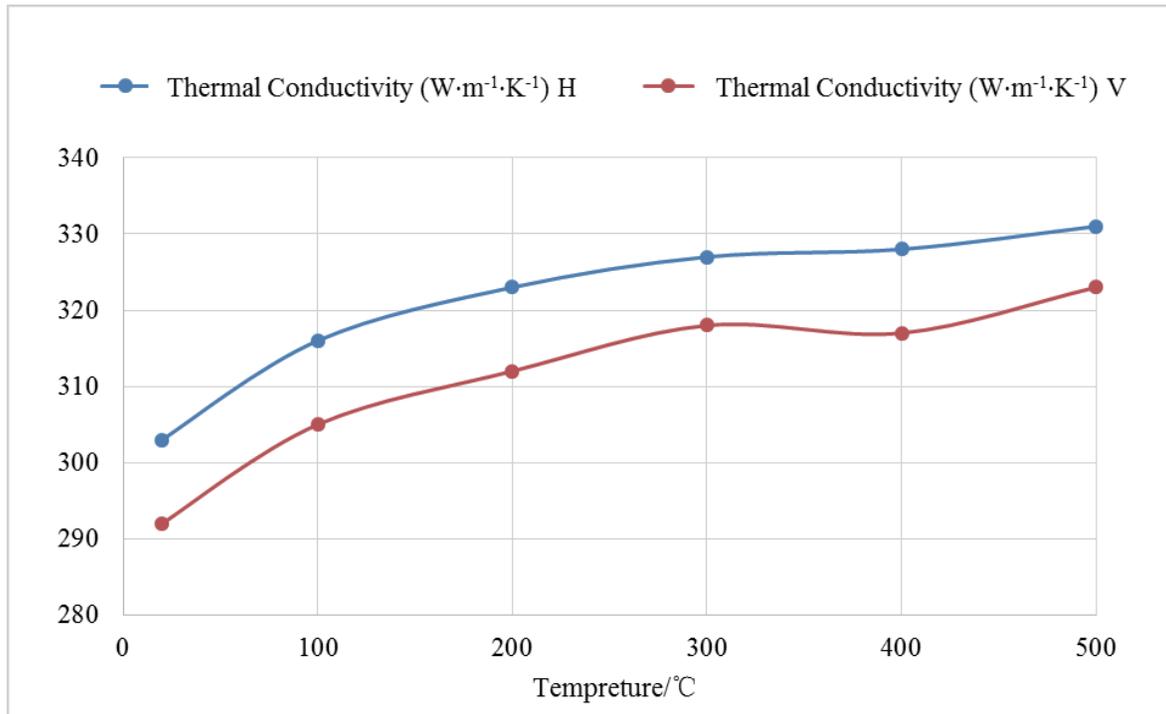
Note: The number of samples in each density test is 5.

→ Electrical Conductivity in Heat Treated Condition

Condition	Electrical conductivity %IACS
Heat treated	68

→ Thermal Conductivity in Heat Treated Condition

Condition	Temperature °C	Thermal conductivity W·m ⁻¹ ·K ⁻¹	
		Horizontal	Vertical
Heat treated	20	303	292
	100	316	305
	200	323	312
	300	327	318
	400	328	317
	500	331	323

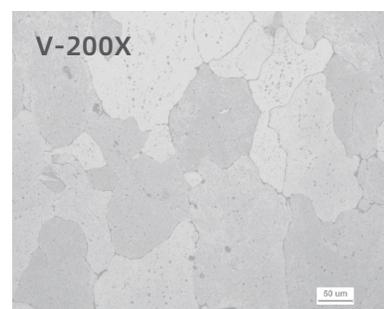
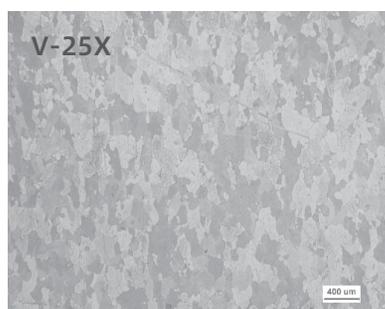


→ **Heat Treatment Process**

Solution: Hold at 980 °C for 2 hours followed by furnace cooling.

Aging: Hold at 430 °C for 6 hours followed by furnace cooling.

→ **Microstructure in Heat Treated Condition**



→ Mechanical Properties in Heat Treated Condition

Condition	Temperature °C	Direction	Ultimate tensile strength R_m /MPa	Yield strength $R_{p0.2}$ /MPa	Elongation at break A/%
Heat treated	Room temperature	Horizontal	260±10	115±10	36±5
		Vertical	250±10	105±10	40±5

Note: The number of samples in each mechanical property test is 30.

Tensile testing standards follow ASTM E8/E8M. Specimens subjected to testing are in the machined-state. The data in the mechanical properties table applies to 3D printing equipment types such as BLT-A300, BLT-A320, BLT-A400, BLT-S310, BLT-S400, BLT-S450, BLT-S600, BLT-S615, BLT-S800.

→ Hardness

Condition	HV1
Heat treated	85±10

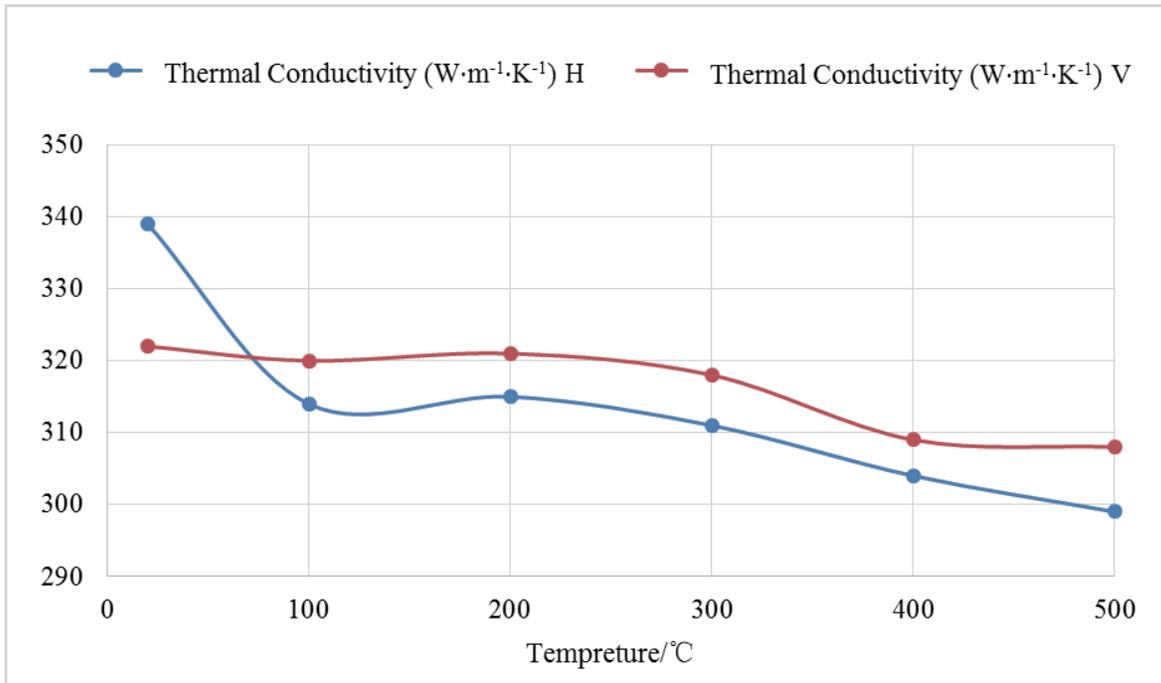
Note: The number of samples in each hardness test is 10.

→ Electrical Conductivity in Heat Treated Condition

Condition	Electrical conductivity %IACS
Heat treated	78

→ Thermal Conductivity in Heat Treated Condition

Condition	Temperature °C	Thermal conductivity $W \cdot m^{-1} \cdot K^{-1}$	
		Horizontal	Vertical
Heat treated	20	339	322
	100	314	320
	200	315	321
	300	311	318
	400	304	309
	500	299	308



+86(029)-8848 5409

+86-(0)29-88485673 ext. 8016/8017

sales.global@xa-blt.com

www.xa-blt.com/en/

No.1000 Shanglinyuan Seventh Road, Hi-tech Zone,
Xi'an City, Shaanxi Province, P.R.China 710000

 **LinkedIn**
Bright Laser Technologies-BLT

 **YouTube**
Bright Laser Technologies

 **TikTok**
@brightlaser.technologies

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