

SPEE3D



SPEE3D
Copper Professional

Copper Professional

COMPOSITION %

Copper	99.7 %	Oxygen	0.05 % (max)
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DESCRIPTION

Copper professional is one of the many validated standard materials SPEE3D offers. It is higher in hardness than conventionally manufactured copper, whilst also being highly ductile and malleable. Copper professional also has very high electrical and thermal conductivity and good corrosion resistance useful for a variety of applications.

With SPEE3D's cold process, it is easy to make a complex part of pure copper quickly with good mechanical properties. Our process results in an annealed cold-sprayed copper product with superior yield strength and vastly improved machinability compared with traditional copper products. SPEE3D strictly controls the quality of powders which have been optimized for our AM process.

KEY PROPERTIES

- Ductile and malleable
- Good corrosion resistance
- Very high electrical and thermal conductivity
- Significantly better machinability compared to conventional copper
- Non-sparking
- Anti-biofouling/anti-microbial

MARKETS

- Industrial
- Power distribution
- Transportation
- Marine
- Space

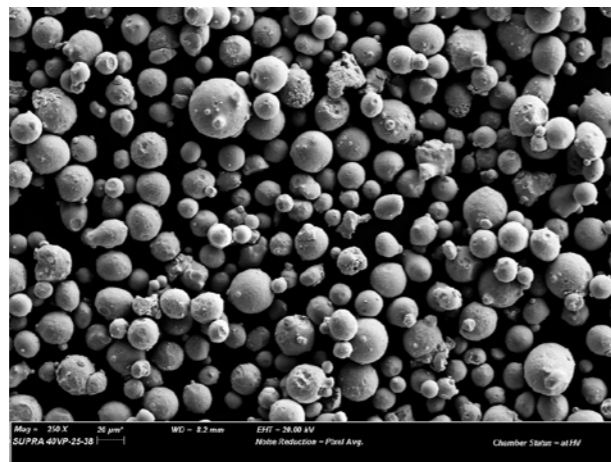
APPLICATIONS

- Busbars
- Cable clamps
- Electrical connectors
- Heatsinks
- Molds
- Anti-microbial coatings and parts
- Heat exchangers
- Non-sparking tooling and parts
- Electro-discharge machining tooling

SPEE3D POWDER PROPERTIES

Part Number	Copper Professional
Application	Cold spray
Maximum Particle Size	Maximum 1% > 50 μm^1
Minimum Particle Size	Maximum 4% < 14 μm^1
Atomization (If Applicable)	Nitrogen gas Atomized
Apparent Density (G/Cm3)	3.9
Hall Flow 2.5mm (Sec)	< 25 ²

¹ ISO 4497 Determination of particle size by dry sieving
² ISO 3923/1 Metallic powders - Funnel method

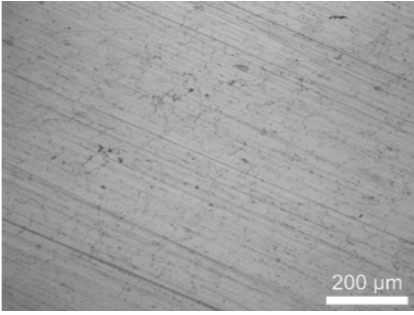
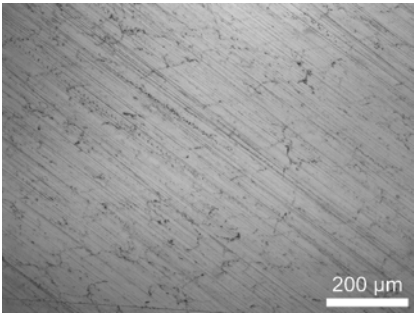


SEM image of Copper Professional powder

ADDITIVE MANUFACTURING PROCESS

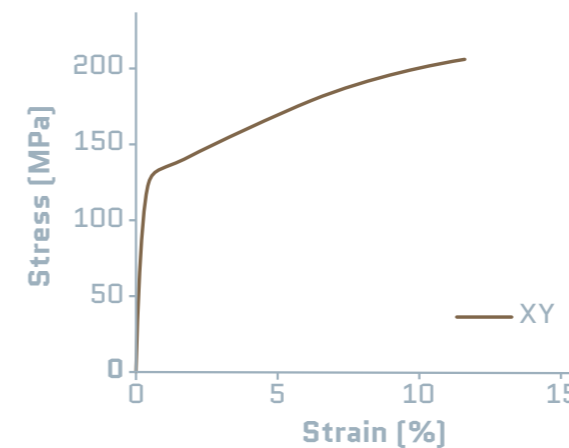
SP3D Cold Spray process as built	Copper Professional is sprayed at 550°C and 30 bar using PHASER. Refer to SPEE3D Sprayed Parameters document for more details.
Recommended Stress Relief, Solution Anneal and Age (SR/Sol/Age)	We recommend that this material is annealed at 500°C for 1.5 hours and air cooled. Refer to SPEE3D SOP for more details.
Machinability	Material has exceptional machinability.

TYPICAL MICROSTRUCTURES

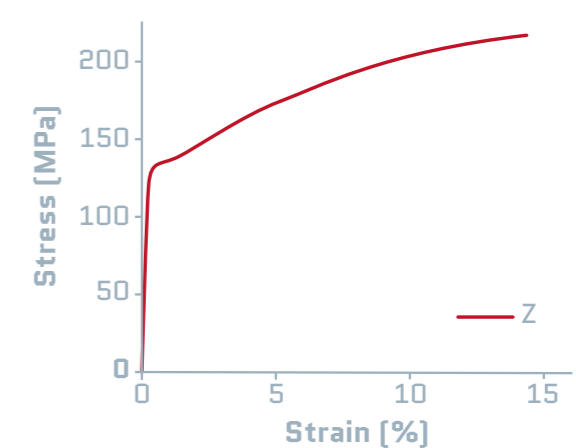
Condition	Longitudinal (Z Plane)	Notes
As built		Density up to 99.8%
After heat treatment		Mean density up to 99.8%

TYPICAL TENSILE TEST 316L COPPER PROFESSIONAL – SP3D

TENSILE CURVE XY



TENSILE CURVE Z



MECHANICAL PROPERTIES

	CAST (reference) CC040A spec ¹	SPEE3D PRINTED Copper Professional ²
Yield Strength (MPa) ³	40	XY = 130 (min)
		Z = 130 (min)
Ultimate Tensile Strength (MPa) ³	150	XY = 170 (min)
		Z = 150 (min)
Elongation at break (min %) ³	25	XY = 10 (min)
		Z = 10 (min)
Hardness (min HV5) ⁴	40	60 (typ)
Electrical Conductivity (%IACS) ⁵	86-98	95 (typ)
Thermal Conductivity (W/m.K) ⁶	372	380 (typ)

ASTM Information:

1. From standard EN 1982:2008.
2. Material heat treated and annealed according to SPEE3D SOP standard operating procedure.
3. Specimens tested according to ASTM E8.
4. Specimen tested according to ASTM E92-17.
5. Value calculated from electrical conductivity according to ISO15548-1.
6. Specimen tested according to ASTM C177

Listed designations are for reference purposes only. Composition and mechanical properties may vary. End-use material performance is impacted (+/-) by certain factors including but not limited to part geometry and design, application and evaluation conditions.

Abbreviations:

XY = The XY direction is defined as the direction along a print layer.

Z = The Z direction is defined as the direction perpendicular to the print layer, normal to the XY plane.



ROCKET NOZZLE LINER

Part Print Weight: 17.9kg/39.4lbs

Print Time: 3.2 hours



CABLE CLAMP

Part Print Weight: 970g/2.1lbs

Print Time: 24 minutes



Print More Metals, Faster

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To the fullest extent permitted by law, we are not liable for any loss or damage including direct, indirect, punitive, incidental, special, consequential damages or any damages whatsoever arising from the use of our products, our process, our printer, and our technology.

Our full terms and conditions apply and can be found on our website at www.spee3d.com/terms-and-conditions/.

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COVER: The cover shows a possible part that can be printed using SPEE3D's Copper Professional material. To learn more about this part contact our materials team at contact@spee3d.com.

This material datasheet is up to date as of April 2023

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