

# 420 Stainless Steel Infiltrated with Bronze



ExOne's 3D Printed 420 Stainless Steel infiltrated with Bronze is a matrix material composed of 60% stainless steel and 40% bronze infiltrant. This material offers good mechanical properties, is available in both an annealed and non-annealed condition, is able to be machined, welded and polished, and offers excellent wear resistance.

## Applications

This material system is ideally suited for parts exposed to highly abrasive environments such as pump components, and parts for down-hole drilling and mining equipment. Additional applications include industrial components, molds, tooling, art objects and decorative hardware.

## Composition

Stainless Steel: Alloy 420

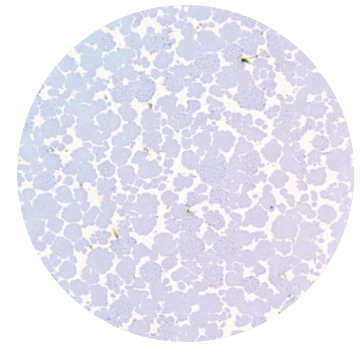
Bronze: 90% Cu / 10% Sn

## Printing

Using binder jetting technology, ExOne's state-of-the-art 3D Printing machines produce parts directly from CAD models by precisely controlling the jetting of binder onto a powder bed, and then subsequently spreading new layers of powder. This process is repeated until the part is completed. This 3D Printing process offers increased design flexibility, reduced manufacturing cost and shortened lead times.

## Post Processing

After printing is complete, the parts are cured in an oven, which enables the parts to be handled. After curing, the parts are sintered and infiltrated with bronze above 1100°C. Cool down can be varied to control the machinability and hardness of the material.



420 SS / Bronze



Printed part

## Typical Material Properties

Material Properties	Test Method	420SS / Bronze	
		Annealed	Non-Annealed
Tensile Strength			
Ultimate Strength	ASTM E8	72 ksi (496 MPa)	99 ksi (682 MPa)
Yield Strength (0.2% offset)		62 ksi (427 MPa)	66 ksi (455 MPa)
Elastic Modulus		21.4 Mpsi (147 GPa)	21.4 Mpsi (147 GPa)
Elongation		7.0%	2.3%
Poisson Ratio		0.3	0.3
Hardness		ASTM E18	93 HRb
Fractional Density	MPIF 42	95%+	95%+
Density		0.284 lbs/in <sup>3</sup> (7.86 g/cm <sup>3</sup> )	0.284 lbs/in <sup>3</sup> (7.86 g/cm <sup>3</sup> )
Machinability		Conventionally machinable	Refer to ExOne for recommendations
Weldability		Use silicone bronze rod & TIG weld	Use silicone bronze rod & TIG weld
Thermal Conductivity	ASTM E1530	13 BTU/hr ft °F (22.6 W/m <sup>2</sup> °K)	13 BTU/hr ft °F (22.6 W/m <sup>2</sup> °K)
Specific Heat	ASTM E1263	0.114 BTU/lb °F (478 J/kg°K)	0.114 BTU/lb °F (478 J/kg°K)
Thermal Expansion Coefficient	ASTM E228	7.4 x 10 <sup>-6</sup> /°F (13.4 x 10 <sup>-6</sup> /°K)	7.4 x 10 <sup>-6</sup> /°F (13.4 x 10 <sup>-6</sup> /°K)

## Surface Finish

After sintering:    ≈ 600 μin R<sub>a</sub> (15 μm R<sub>a</sub>)  
 Bead blasting:    ≈ 300 μin R<sub>a</sub> (7.5 μm R<sub>a</sub>)  
 Barrel finishing:   ≈ 50 μin R<sub>a</sub> (1.25 μm R<sub>a</sub>)



Printed part, raw finish



Printed part, polished

## Available Finishes

Gold Plated  
Nickel Plated

Antique Bronze Patina  
Wheat Penny Patina

Damascus Steel Patina  
Medieval Pewter Patina

Anti-corrosion treatments are also available.

*The data and other information (Information) presented in this Data Sheet are provided by and are proprietary information of The ExOne Company (ExOne). ExOne presents this Information in the good faith belief that it is substantially accurate as of the date provided on this document. The Information is based upon utilizing ExOne's 3D printing machines and proprietary processes and technology. The material properties included in the Information are representative of materials so processed and do not constitute minimum specification standards. Materials processed on machines other than ExOne's and/or with different processes and/or technology may differ as to their properties. ExOne's research and developments efforts are ongoing and ExOne reserves the right to revise the information at any time without notice. ExOne does not provide any warranties or other obligations hereby, and will only provide such warranties or other obligations, if any, either in a definitive purchase contract executed by ExOne or in its standard terms and conditions of sale contained in an order acknowledgement.*

For information about ExOne systems, materials and applications, contact an ExOne **Production Service Center** or visit [www.ExOne.com](http://www.ExOne.com)

**The ExOne Company**  
127 Industry Boulevard  
North Huntingdon, PA 15642

MIDWEST: +1 877 745 1580

EUROPE: +1 877 745 1580

SOUTH: +1 281 931 0011

ASIA: +1 281 931 0011

MID-ATLANTIC: +1 877 773 9663

NORTHWEST: +1 253 394 0357