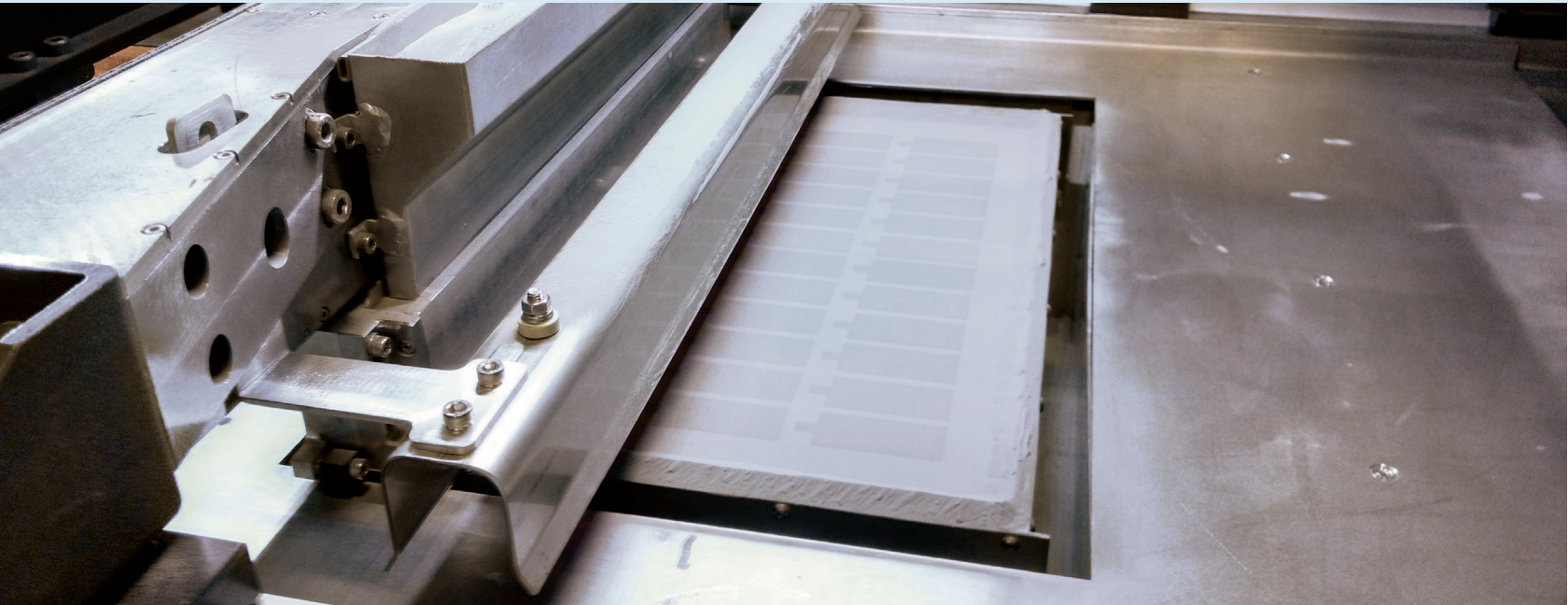




FORMETRIX™

## BLDRmetal® Binder Jet Products J-10, J-11 and Bronze A



### Binder Jet Process

**Binder Jet 3D printing is a proven process for economically manufacturing high complexity and customized parts.**

In this additive manufacturing powder bed process, a binder is used to selectively “print” the desired part shape, first by adhesively joining the metal particles to produce a green part.

After the jetting process, the binder is burned out and the part is sintered. An infiltrant, typically bronze, is melted and drawn into the part to fill the spaces in the sintered metal powder skeleton and create a dense part. The resulting part properties are determined by the interaction of the metal powder and the infiltrant.

### Benefits

J-10

3x Wear Resistance  
3x Toughness  
10x Corrosion Resistance

J-11

10x Wear Resistance

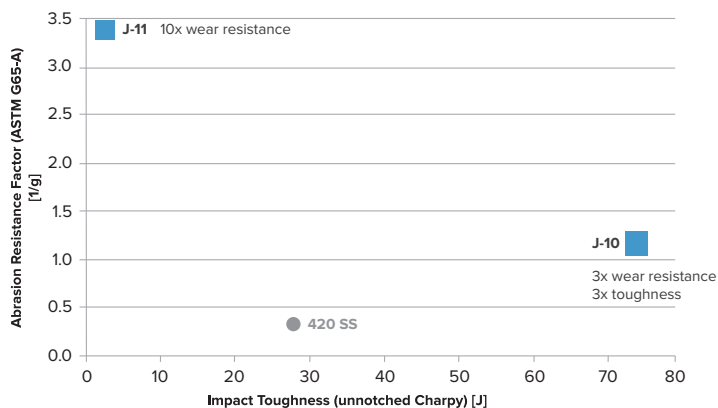
compared to bronze infiltrated 420 SS

# Powders for Binder Jet Additive Manufacturing

BLDRmetal® J-10 and J-11 are designed for building highly wear resistant industrial parts using binder jet additive manufacturing.

In the binder jet process, spherical BLDRmetal steel powders are printed and then infiltrated with bronze to create near net shape parts. When using J-10, the result is a part with 3x greater wear resistance and nearly 3x greater impact toughness than an equivalent part made with 420 stainless steel and bronze. J-11 demonstrates extreme wear resistance, 10x that of similar parts made of 420SS and bronze. Bronze quality is critical to performance. For best results, BLDRmetal Bronze A is recommended.

## COMPARISON WITH 420 SS



## Physical, Mechanical and Thermal Properties<sup>1</sup> of Bronze Infiltrated<sup>2</sup> BLDRmetal® Steel Powders

Property	J-10	J-11
Wear Resistance <sup>3</sup> (mass loss)	0.79 g	0.29 g
Elongation	16%	3%
Charpy Un-notched	75 J	N/A
Thermal Expansion Coefficient (25-100°C)	17.0 ppm/°C	12.4 ppm/°C
Thermal Conductivity (at 25°C)	21.1 W/m-K	12.5 W/m-K
Specific Heat (at 25°C)	419 J/kg-K	432 J/kg-K

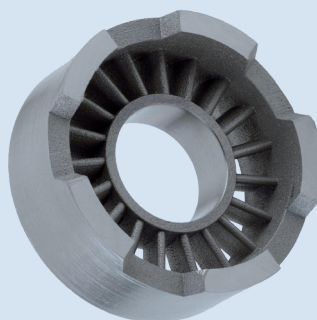
<sup>1</sup> Typical Values

<sup>2</sup> 40 wt% BLDRmetal Bronze A (Cu+10%Sn)

<sup>3</sup> ASTM G65-04 Procedure A Typical Values

## Industrial Applications Examples

Industrial applications for these wear powders include molds, dies, tools, and drilling and pump components.



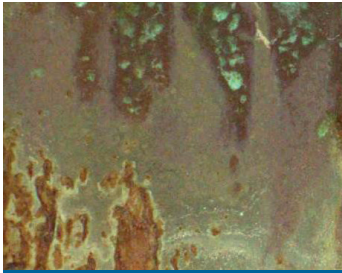
Stator for Oil & Gas Industry



Custom Tools for Avionics

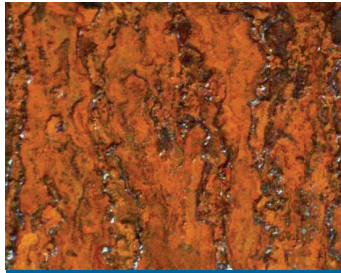
# Corrosion Characteristics

BLDRmetal® J-10\*



Mass gain= 0.049g

420 Stainless Steel\*



Mass gain= 0.605g

ASTM-B117<sup>16</sup> Salt Spray 8 days (192 hr)  
\*Infiltrated with BLDRmetal® Bronze A

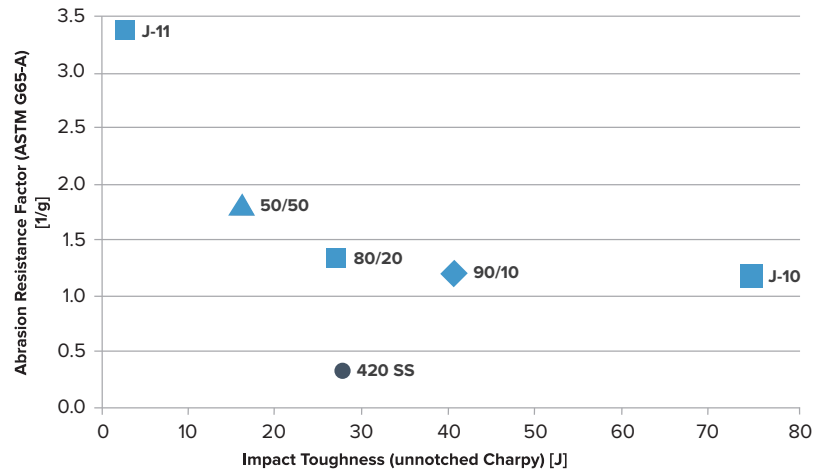
When tested in accordance with the ASTM B117 salt spray corrosion test, BLDRmetal® J-10 demonstrated **>10x the corrosion resistance** than a comparable infiltrated 420SS — while also benefiting from greater wear resistance and toughness. BLDRmetal® J-11 (not shown) demonstrated equivalent corrosion to 420SS, but with even more enhanced wear resistance.

## Custom Blending

Some applications benefit from properties that are between the wear resistance achieved with a J-11 powder and the impact toughness potential of the J-10. Formetrix has a solution: custom blends of BLDRmetal powders.

By tailoring the proportions of J-10 and J-11 powders, the final product can be designed to meet a variety of specifications.

BLDRmetal® Custom Blends of J-10/J-11



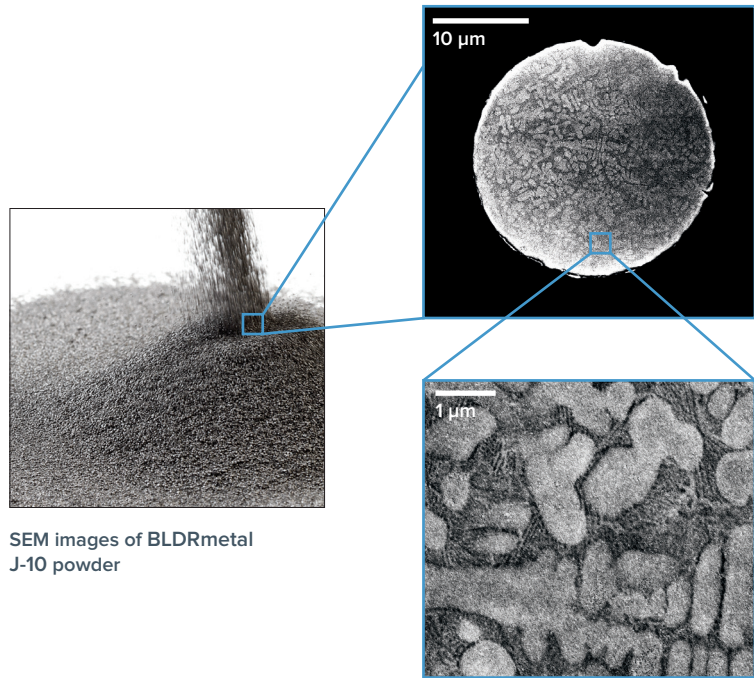
## Physical, and Mechanical Properties<sup>1</sup> of Bronze Infiltrated<sup>2</sup> BLDRmetal® Custom Blends of J-10/J-11

Property	90/10	80/20	50/50
Wear Resistance <sup>3</sup> (mass loss)	0.85 g	0.74 g	0.55 g
Elongation	11%	8%	5%
Charpy Un-notched	41 J	27 J	16 J
Tensile Strength	590 MPa	590 MPa	660 MPa

## J-10, J-11 and Bronze Powder Properties

### Powder Chemistry

Element	Max. Weight %	
	J-10	J-11
Iron (Fe)	Balance	Balance
Chromium (Cr)	19%	21%
Nickel (Ni)	14%	0.1%
Molybdenum (Mo)	0.1%	12%
Manganese (Mn)	0.1%	3%
Tungsten (W)	0.1%	7%
Silicon (Si)	5%	3%
Boron (B)	2%	3.5%
Carbon (C)	0.3%	1.4%



### Powder Properties

Property	J-10	J-11
Melt Point	1215°C	1142°C
Theoretical Density	7.6 g/cm <sup>3</sup>	
Morphology	Spherical	
Size Range	15-53 µm	

### Bronze Properties

Property	Bronze A
Chemistry	Cu + 10%Sn
Melt Point	1000-1020°C
Morphology	Spherical
Size Range	250-595 µm

### Standard Packaging

10 lb (4.5 kg)	40 lb (18.1 kg)	Custom quantities upon request
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