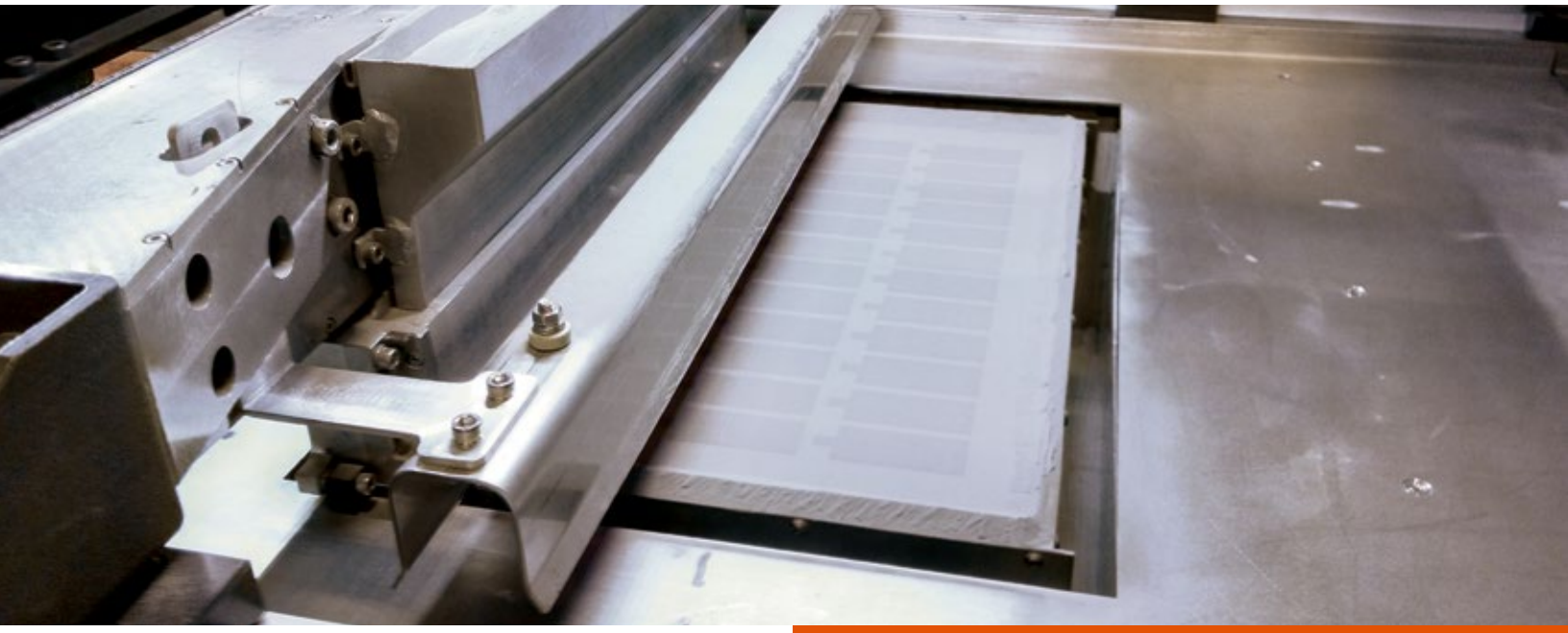
NANOSTEEL

STEEL. REDEFINED.®

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



Binder Jet Process

Binder Jetting is an additive manufacturing powder bed process, where 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.

Binder Jet Benefits

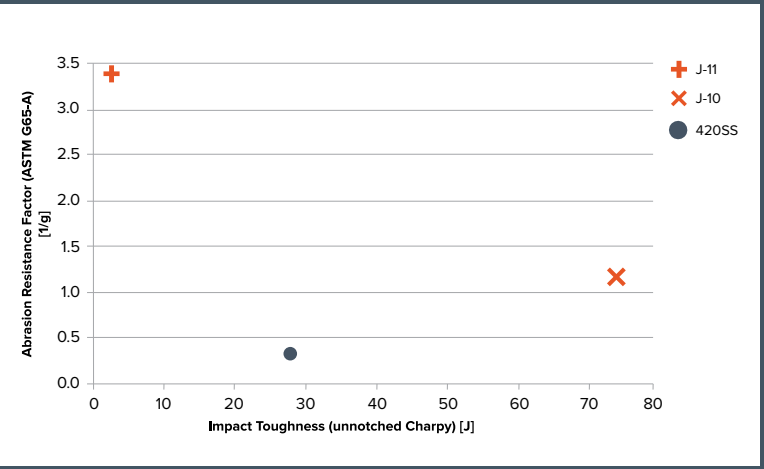
Binder Jet 3D printing is a proven process for economically manufacturing high complexity and customized parts.

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, at 10x the wear 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[1] of Bronze Infiltrated[2] BLDRmetal™ Steel Powders

Property	J-10	J-11
Wear Resistance[3] (mass loss)	0.79 g	0.29 g
Hardness Vickers	Steel Skeleton: 786 HV	Steel Skeleton: 818 HV
	Bronze: 208 HV	Bronze: 239 HV
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

[1] Typical Values
[2] 40 wt% BLDRmetal Bronze A (Cu+10%Sn)
[3] 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

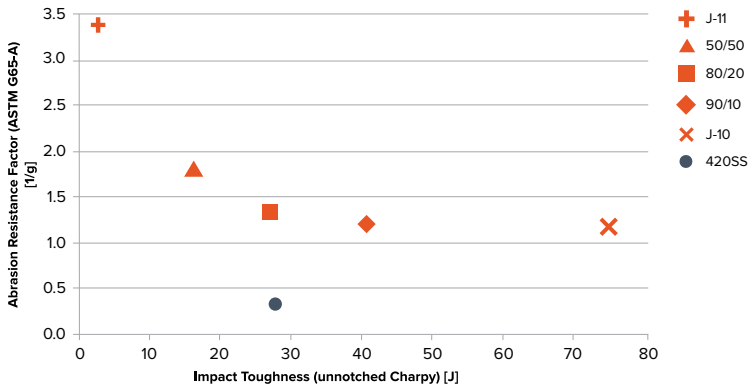
Custom Tools for Avionics

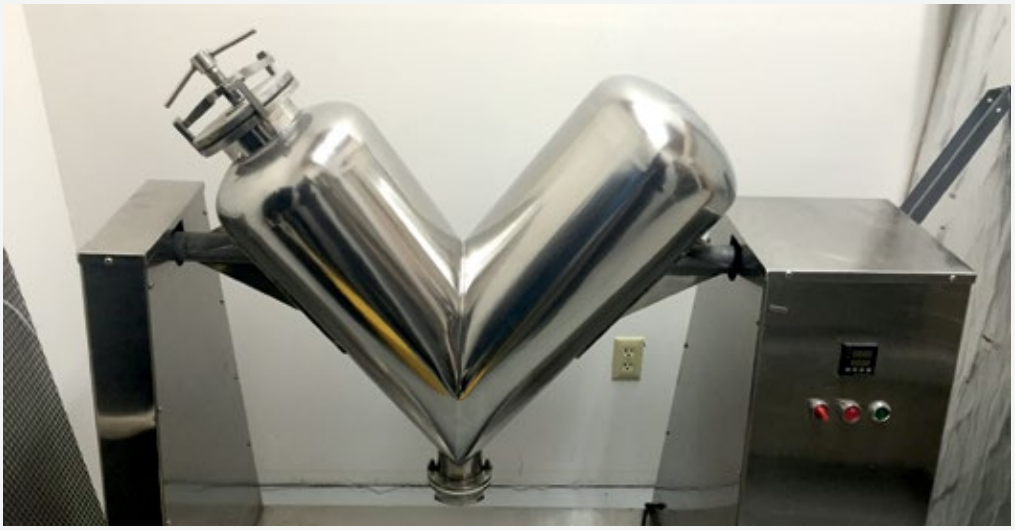
Custom Blending

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. NanoSteel 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





V-Blenders are commonly used for complete blending of powders without affecting the particle sphericity and powder flow characteristics

Physical, Mechanical and Thermal Properties[1] of Bronze Infiltrated[2] BLDRmetal™ Custom Blends of J-10/J-11

Property	90/10	80/20	50/50
Wear Resistance[3] (mass loss)	0.85 g	0.74 g	0.55 g
Hardness (steel skeleton)	570 HV	570 HV	740 HV
Elongation	11%	8%	5%
Charpy Un-notched	41 J	27 J	16 J
Tensile Strength	590 MPa	590 MPa	660 MPa

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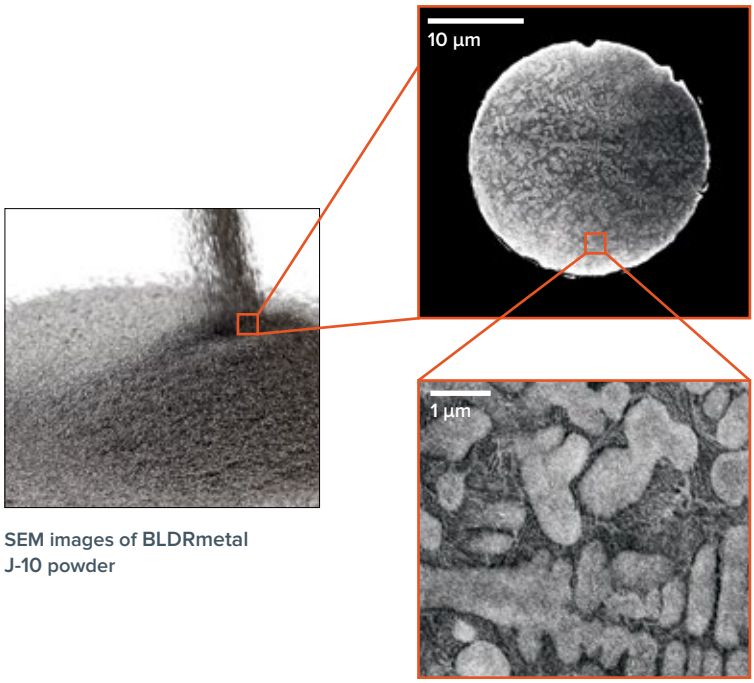
J-10, J-11 and Bronze Powder Properties

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%



SEM images of BLDRmetal J-10 powder

Powder Properties

Property	J-10	J-11
Melt Point	1215°C	1142°C
Theoretical Density	7.6 g/cm^3	
Morphology	Spherical	
Size Range	15-45 µm	

Bronze Properties

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

Standard Packaging

20 lb (9.1 kg)	40 lb (18.2 kg)	Custom quantities upon request

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www.nanosteelco.com/products/engineered-powders/additive-manufacturing-powders

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