



U.S. Army Research, Development and Engineering Command

Powder Specification For Cold Spray

ARL

TECHNOLOGY DRIVEN. WARFIGHTER FOCUSED.

Dennis Helfritch
TKC Global at
U.S. Army Research Laboratory
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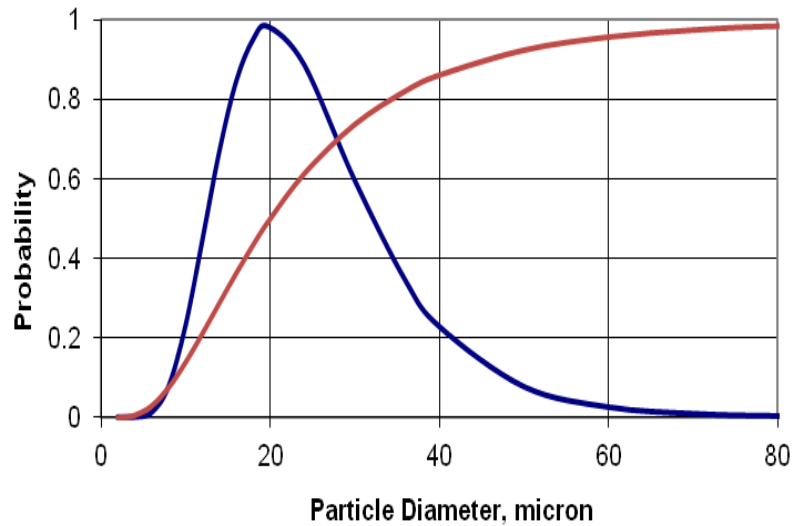
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- Chemical composition
- Size distribution
- Particle shape
- Impurities
- Flowability

Size Distribution

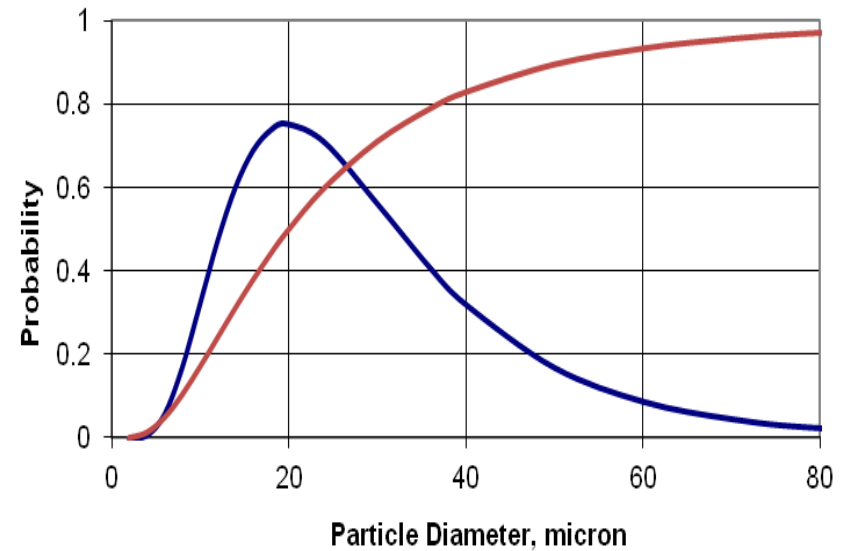
Powders with limited spread in diameters are best

Particle Size Distribution



SD = 1.5
DE % = 23.4

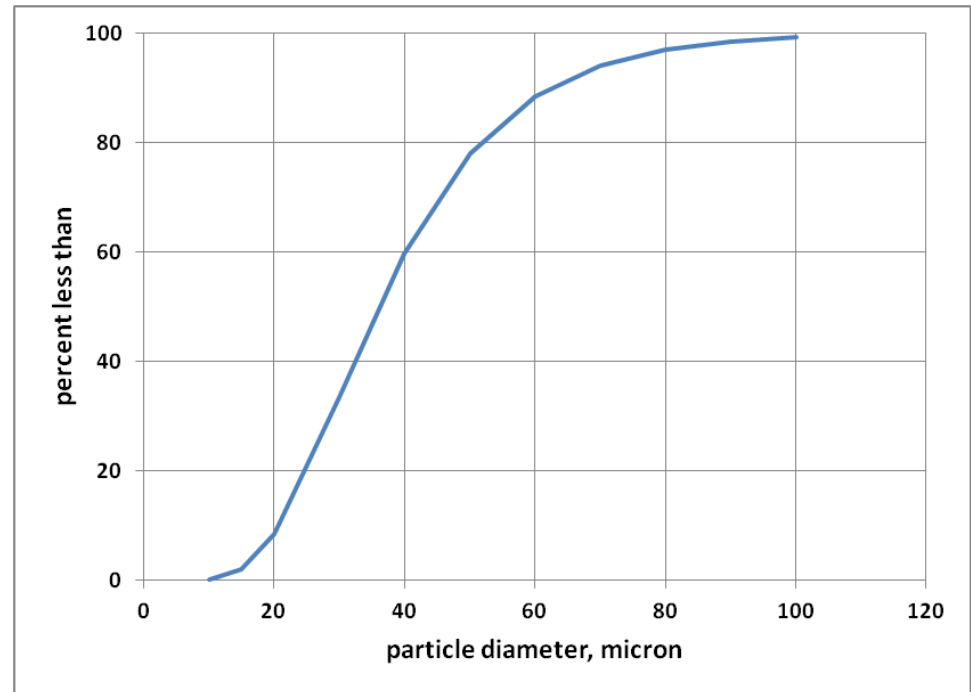
Particle Size Distribution



SD = 1.7
DE % = 11.2

Example Distribution

Particle Size, μm	% by mass	
	Min	Max
106	100	--
90	99	--
53	75	90
38	45	65
20	2	15
10	--	1



Note, reduced fines results in better flowability and minimum nozzle fouling

ASTM B822- Standard Test Method for Particle Size Distribution of Metal Powders and Related Compounds by Light Scattering

ASTM B214 - Standard Test Method for Sieve Analysis of Metal Powders

Primary impurities are:

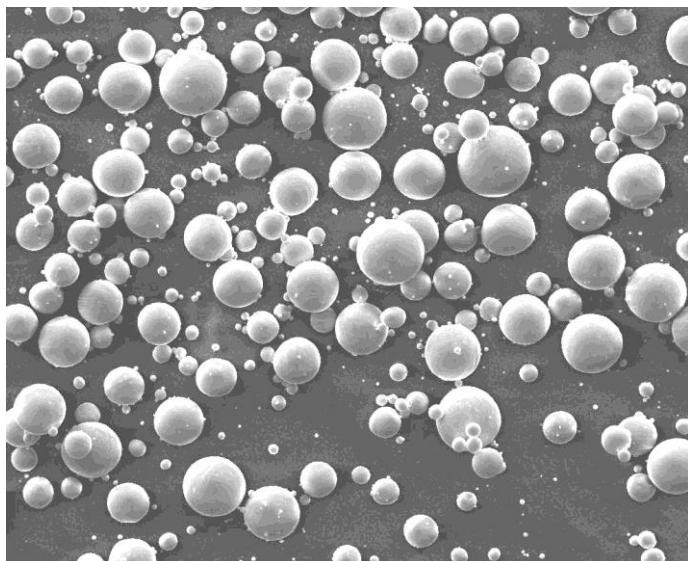
- Oxygen
- Moisture
- Volatiles

Each should be less than 0.1% - 1% by weight

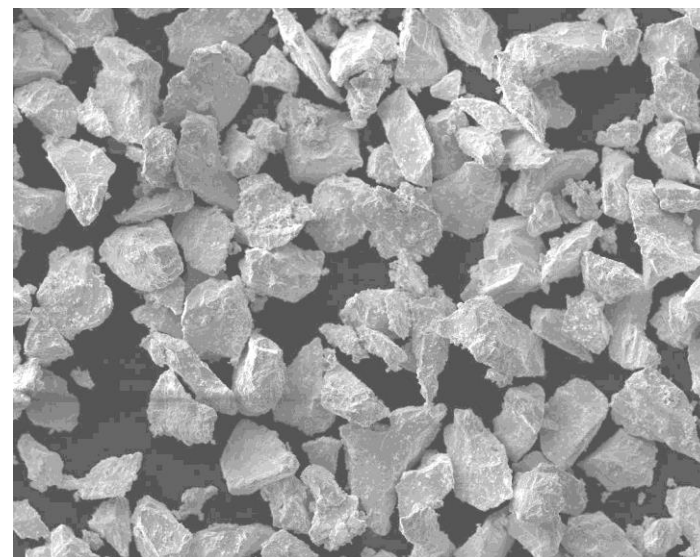
ASTM E1019 - Standard Test Methods for Determination of Carbon, Sulfur, Nitrogen, and Oxygen in Steel, Iron, Nickel, and Cobalt Alloys by Various Combustion and Fusion Techniques

ASTM E1131 - Standard Test Method for Compositional Analysis by Thermogravimetry

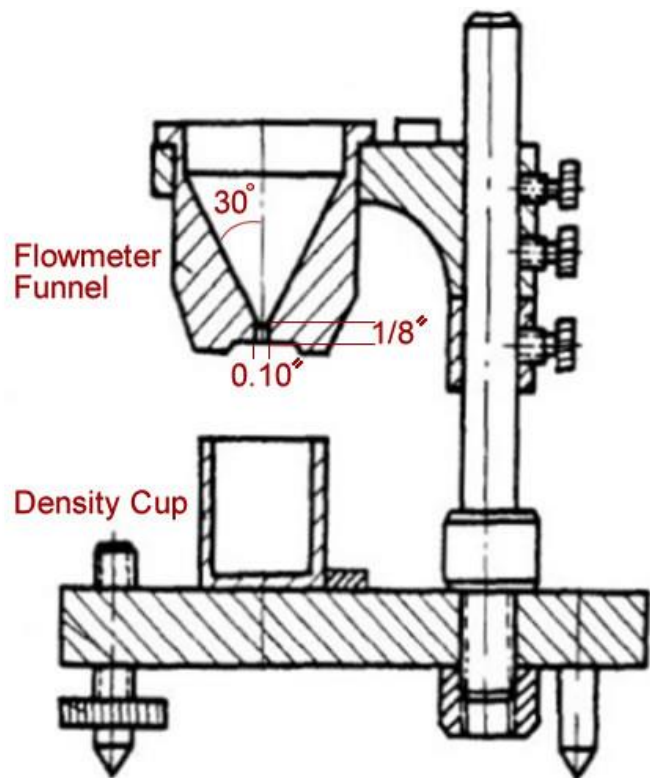
Irregular particles spray better than spherical



MMD = 20 microns
Shape factor = 1
DE = 23.4



MMD = 20 microns
Shape factor = 1.4
DE = 38.3



Typical metal powders flow through funnel at about 1 gram/second

Hall/Carney Flowmeter

ASTM B964 - Standard Test Methods for Flow Rate of Metal Powders Using the Carney Funnel

Chemical composition

ELEMENT	WT. % Class A
Chromium (Cr)	Max allowed
Copper (Cu)	Max allowed
Iron (Fe)	Max allowed
Magnesium (Mg)	Max allowed
Manganese (Mn)	Max allowed
Zinc (Zn)	Max allowed
Silicon (Si)	Max allowed
Titanium (Ti)	Max allowed
Other, max. Each	Max allowed
Other, max. Total	Max allowed
Aluminum (Al)	Minimin %

- Oxygen < x%
- Moisture & volatiles < y%
- Free of agglomerates > z microns
- Flowability > w g/s
- PSD – example previously shown



Powder Specification: MIL-I-16604



Physical Characteristics

