

# METAL ADDITIVE MANUFACTURING

## PRODUCT DATASHEET



AMETEK Specialty Metal Products is committed to meeting the demands of Additive Manufacturing (AM) for mass-production of industrial components. We have engineered economic powders of mainstream stainless steel, nickel, and cobalt alloys for non-rotor-grade components made by Laser Powder Bed, Binder Jet, and Cold Spray processes.

### PRODUCTS AND SIZES

We offer several different alloys and size distributions specifically tailored for different additive manufacturing processes and machines.

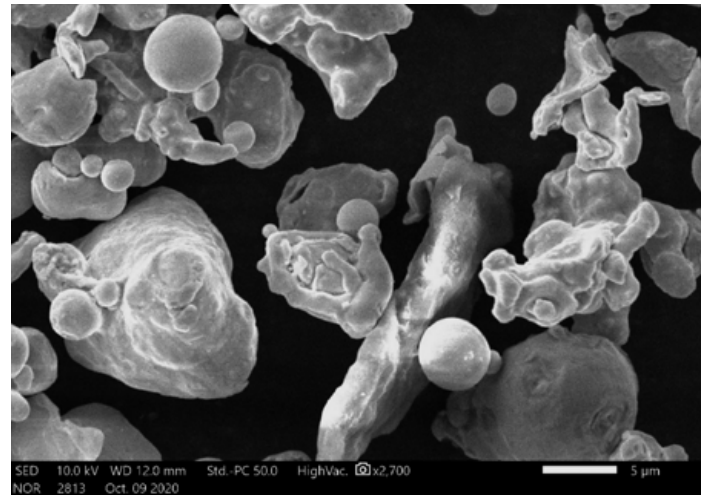
**Grades:** The most common materials produced include 316L (including A240 grade), 304L, and 17-4PH®. We also offer specialty austenitic and ferritic stainless steels, as well as a selection of nickel and cobalt alloys.

**Sizes:** The above grades are offered in a variety of sizes suitable for various processes.

**Laser Powder Bed:** -325M/+15µm (preferred), -270M/+20µm, additional custom sizes.

**Binder Jet:** -270M, -325M, -400M, and MIM (d90<22µm) sizes, with high Apparent Density / High Tap Density / High flow versions available.

**Cold Spray:** -325M, -400M, -500M, -25µm/+10µm, and -20µm/+5µm sizes.



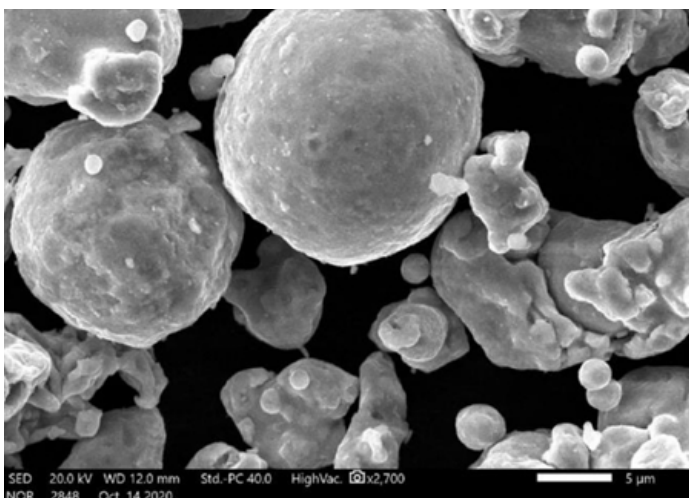
### ADVANTAGES

Our water atomized powders for AM offer exceptional value for materials suitable for industrial applications. Our stainless, nickel, and cobalt alloy powders are more economical than Vacuum Induction Gas Atomized (VIGA) powders, and at a scale matching powder metallurgy materials (millions of pounds annually).

We combine the benefits of high volume, highly economic water atomization with 50 years of powder engineering experience to generate rounded, high flow, high Apparent Density and Tap Density materials.

#### Key benefits include:

- High-quality supplier of atomized fine metal
- Water atomized powders with size distributions and morphologies optimized for AM
- Exceptional overall value for non-rotor-grade parts



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### APPLICATIONS

Our powders have been tested in a variety of different processes including Laser Powder Bed, Binder Jet and Cold Spray.

### LASER POWDER BED

Our Laser Powder Bed products are engineered to maximize flowability and Apparent Density. In water atomized materials, this means that the preferred size is -325M/+15 $\mu$ m powder as it offers the highest typical Hall Flow rates and packing densities.

	17-4PH <sup>®</sup> POWDERS		316L POWDERS	
Typical	AD (g/cc)	Hall Flow (s/ 50 g)	AD (g/cc)	Hall Flow (s/ 50 g)
-325M/+15 $\mu$ m	~3.9	~18	~4.0	~16
-270M/+20 $\mu$ m	~3.7	~20	~3.7	~21
-200M/+5 $\mu$ m	~4.0	~22	~4.2	~21

Our 17-4PH<sup>®</sup> and 316L powders have been printed on several different machines, producing dense parts at standard machine parameters. Yield strength, tensile strength, elongation, and reduction of area tested intermediate to cast and wrought values.



### BINDER JET

Perhaps the most interesting AM application for water atomized powders is Binder Jet. The economics of Binder Jet are dictated heavily by powder cost due to the relatively low cost and high print speed of machines.

With high production capacities and low costs, Binder Jet and water atomized powder are a highly desirable combination.

Our Binder Jet materials achieve:

- Apparent Densities ~50% of fully dense
- Tap Densities ~60% of fully dense
- Hall Flows approaching 25s

Development partners printing our materials have achieved densities greater than 95% with standard sintering operations.



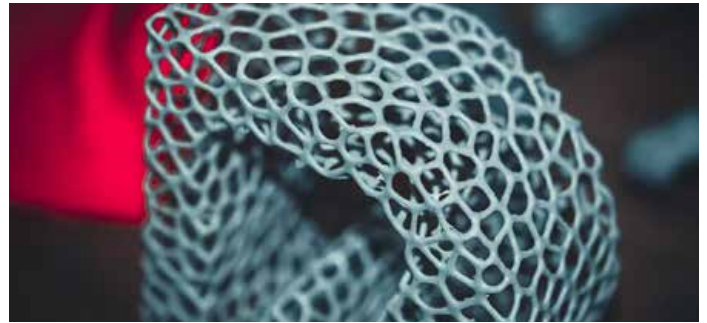
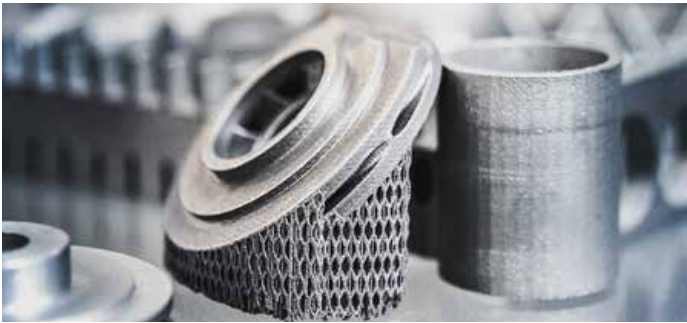
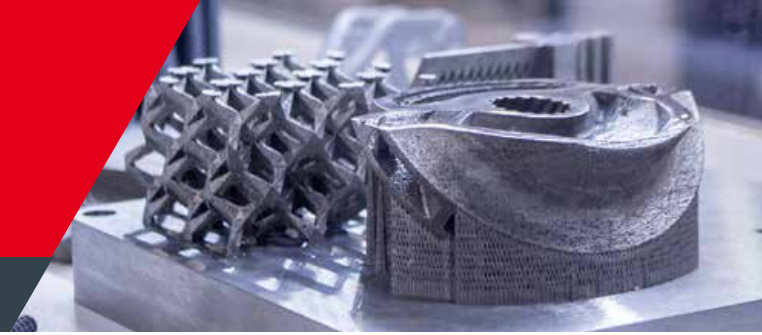
### COLD SPRAY

Water atomized powders have numerous advantages for Cold Spray. The single most important factor is that AMETEK SMP produces high quality, very fine powders in an extremely economic manner. This is due to the much lower overhead and manufacturing costs of water atomization vs. VIGA, which scale with the low yields of very fine and tight cold spray distributions.

Customers have sprayed ferritic steels, austenitic steels, and nickel. Any alloy from our portfolio can be produced in a suitable size distribution for cold spraying.

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### CHEMICAL COMPOSITION

	316L	304L	17-4PH®
Chromium	16.0 - 18.0%	18 - 20%	15.5 - 17.5%
Nickel	10.0 - 14.0%	8 - 12%	3.0 - 5.0%
Molybdenum	2.0 - 3.0%	-	-
Manganese	1.0% max	1.0% max	1.0% max
Silicon	1.0% max	1.0% max	1.0% max
Carbon	0.03% max	0.03% max	0.07% max
Sulfur	0.03% max	0.03% max	0.03% max
Phosphorus	0.045% max	0.045% max	0.04% max
Copper	-	-	3.0 - 5.0%
Niobium	-	-	0.15 - 0.40%
Iron	Balance	Balance	Balance



1085 Route 519, Eighty Four, PA 15330, United States

E: [EFsales@ametek.com](mailto:EFsales@ametek.com) | T: (+1) 724-225-8400

[www.powderclad.com](http://www.powderclad.com)

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