

# Material Product Data Sheet

## Type 316L Austenitic Stainless Steel Powders for Additive Manufacturing

### Powder Products:

**MetcoAdd™ 316L-A, MetcoAdd 316L-D**

### 1 Introduction

MetcoAdd™ 316L is a family of austenitic powders that are similar in chemistry to EN 1.4404 and UNS S316603.

These materials are designed for processing in Laser Powder Bed Fusion (PBF-LB), Electron Beam Powder Bed Fusion (PBF-EB or Directed Energy Deposition (DED) additive manufacturing systems. MetcoAdd 316L series products have been rigorously engineered specifically to meet the demanding requirements for additive manufacturing.

Room temperature static properties of PBF-LB processed, as-built, material coupons have been shown to be comparable to those of AMS 5424.

For reference purposes Oerlikon Metco has processed MetcoAdd 316L-A using fixed parameters and 40 µm (0.0016 in) layer thickness to provide the typical as-built properties provided in Section 3 of this document. Additional testing has been performed by an extensive network of consortia and customer partners on a broader range of machine types. Properties may be optimized based on application-specific requirements.

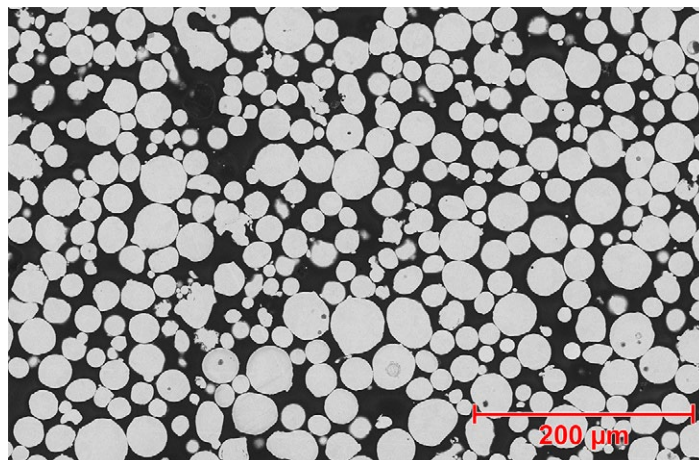
#### 1.1 Typical Uses and Applications

- Aerospace: Clamping elements and heat exchangers
- Medical: Surgical tools and orthopedic implants
- Transport: Maritime components
- Tooling: Pressure injection dies and molds
- Consumer: Jewelry and watch components

### Quick Facts

Classification	Alloy, iron-based
Chemistry	FeCrNiMoC
Manufacture	Inert gas atomized
Morphology	Spheroidal
Apparent Density	> 4 g/cm <sup>3</sup> (typical)
Solidus	1390 ± 10 °C (2534 ± 18 °F)
Liquidus	1448 ± 10 °C (2638.4 ± 18 °F)
Process	Laser Powder Bed Fusion (PBF-LB) Electron Beam Powder Bed Fusion (PBF-EB) Directed Energy Deposition (DED) <sup>a</sup>

<sup>a</sup> For additive manufacture printing build-up and/or repair only.



Typical cross-section of MetcoAdd 316L-A gas-atomized powder that demonstrates the spherical outer morphology and the fully dense inner structure of MetcoAdd 316L products.

## 2 Material Information

### 2.1 Chemical Composition

Product	Weight Percent (nominal)					
	Fe	Cr	Ni	Mo	C	Other
MetcoAdd 316L-A	Balance	18	12	2	< 0.03	< 1.0
MetcoAdd 316L-D	Balance	18	12	2	< 0.03	< 1.0

### 2.2 Particle Size Distribution and Hall Flow

Product	Nominal Range (µm)	D90 (µm)	D50 (µm)	D10 (µm)	Hall Flow (s/50 g)
MetcoAdd 316L-A	-45 +15 µm	46	30	19	< 20
MetcoAdd 316L-D	-106 +45 µm	N.R.	N.R.	N.R.	N.R.

Nominal range size analysis 45 µm or above measured by sieve (ASTM B214), analysis below 45 µm by laser diffraction (ASTM C 1070, Microtrac).  
Fractional analysis (D90, D50, D10) are nominal values by laser diffraction  
Hall flow (ASTM B213).  
N.R. = Not Reported

### 2.3 Key Selection Criteria

- Choose the product with the particle size distribution best suited for the additive manufacturing system that will be used.
- MetcoAdd 316L-A has been engineered for the manufacture of stainless steel components using SLM.
- The powder is optimized so that the required component mechanical properties can be obtained after post heat-treatment processing.
- MetcoAdd 316L-A is designed for the manufacture of a wide range of components using powder bed additive manufacturing or direct laser deposition processes. Examples are as cited in Section 1.1 of this document.
- MetcoAdd 316L products are field-proven to repeatability and reliably produce dense printed parts.
- Powder beds of MetcoAdd 316L series powders are stable and resist agglomeration.

### 2.4 Related Products

- Oerlikon Metco offers a number of other steel powders for additive manufacturing applications, including 15-5PH and 17-4PH stainless steels, maraging steels and hot-work tools steels.
- In addition to steel powders, Oerlikon Metco offers other nickel-, cobalt- and titanium-based materials for additive manufacturing. Please contact your Oerlikon Metco account representative for more information.
- For thermal spray and laser cladding applications, please see the appropriate datasheet for 316L materials or contact your Oerlikon Metco account manager for more details.

### 2.5 Specifications

Product	Specification (similar to)
MetcoAdd 316L-A	EN 1.4404 UNS S31603
MetcoAdd 316L-D	EN 1.4404 UNS S31603

### 3 Key Processing Information

#### 3.1 Typical As-Built Properties (MetcoAdd 316L-A) <sup>a,b,c</sup>

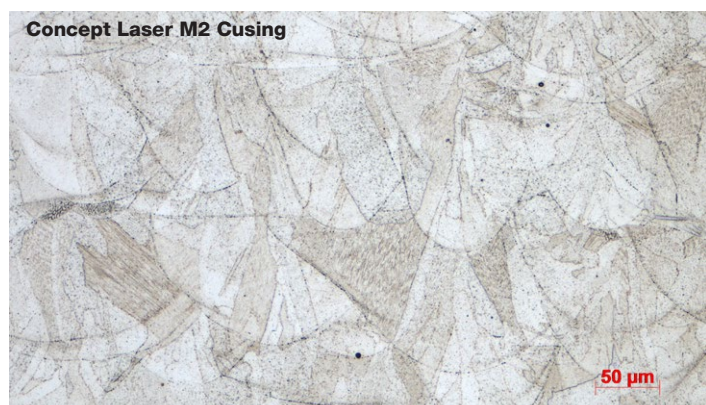
Specification		Concept Laser M2 Cusing	EOS M290
Ultimate Tensile Strength (MPa), XY/Z	ASTM E8	670 ± 2 / 635 ± 9	677 ± 7 / 609 ± 2
Yield Strength (MPa), XY/Z		548 ± 15 / 491 ± 4	562 ± 12 / 500 ± 3
Elongation at break %, XY/Z		45 ± 2 / 44 ± 8	45 ± 3 / 59 ± 1
Hardness (VHN <sub>300g</sub> )	ASTM E384-17	216 ± 23	228 ± 6
Relative Density %	Internal specification	> 99.6%	> 99.8%

<sup>a</sup> Data is shared for reference purposes only and is not sufficient to design or certify parts. No warranty or guarantee is made or implied for these results.

<sup>b</sup> Bounds are based on one standard deviation of each population with ten samples per orientation and machine. Test specimens were 6.35 mm (0.25 in) diameter round bars machined from coupons of 75 x 75 x 13 mm (3 x 3 x 0.5 in). Direction XY data is an average of both X and Y horizontal build orientations.

<sup>c</sup> The process parameters and heat treatments of AM builds produced with other powder cuts (316L-D) and or AM processes (DED and PBF-EB) may be optimized based on application specific requirements.

#### 3.2 As-Built Microstructure, Vertical Build Direction (MetcoAdd 316L-A)



#### 3.3 Additive Manufacturing Services

Oerlikon AM is an excellent source for pilot and production run additive manufacturing services and is ready to serve

your needs. Please contact your Oerlikon Metco account manager for more information or contact Oerlikon AM directly through their web site at [www.oerlikon.com/am](http://www.oerlikon.com/am).

### 4 Commercial Information

#### 4.1 Ordering Information and Availability

Product	Order No.	Package Size	Availability	Distribution
MetcoAdd 316L-A	1093739	10 lb (approx. 4.5 kg)	Stock	Global
MetcoAdd 316L-D	1305325	10 lb (approx. 4.5 kg)	Stock	Global

#### 4.2 Handling Recommendations

- Store in the original container in a dry location.
- Tumble contents gently prior to use to prevent segregation.
- Open containers should be stored in a drying oven or humidity controlled environment to prevent moisture pickup.

#### 4.3 Safety Recommendations

See the SDS 50-1990 (Safety Data Sheet) in the localized version applicable to the country where the material will be used. SDS are available from the Oerlikon web site at [www.oerlikon.com/metco](http://www.oerlikon.com/metco) (Resources – Safety Data Sheets).

Information is subject to change without prior notice.