

# Material Product Data Sheet

## Type 316L Austenitic Stainless Steel Powders

### Powder Products:

**Metco™ 41A, Metco 41C, Diamalloy 1003, Diamalloy™ 1003-1, MetcoClad™ 316L-SI**

### 1 Introduction

Stainless steel 316L offers the highest degree of corrosion protection and provides very good strength at high temperatures. Oerlikon Metco's stainless steel powders are austenitic, nickel chromium stainless steel materials similar to Type 316L (UNS S31603 / AISI Type 316L).

Oerlikon Metco offers both gas and water atomized powders with fully customized specifications in various particle size distributions to fit different applications. They provide excellent results for a variety of processes such as laser cladding and powder-fed thermal spray processes.

Coatings of these materials contain enough molybdenum to guarantee particularly high resistance to pitting and crevice corrosion in chloride environments, and they also exhibit high impact resistance and tensile strength at elevated temperatures. They produce thermal sprayed coatings that are bright, dense and resistant to corrosion and wear. These coatings can easily be machined to a very good finish with ordinary steel tools. Room temperature static properties of PBF-LB processed, as-built, material coupons have been shown to be comparable to those of AMS 5424.

#### 1.1 Typical Uses and Applications

##### ■ Thermal Spray (Metco 41 and Diamalloy 1003 series):

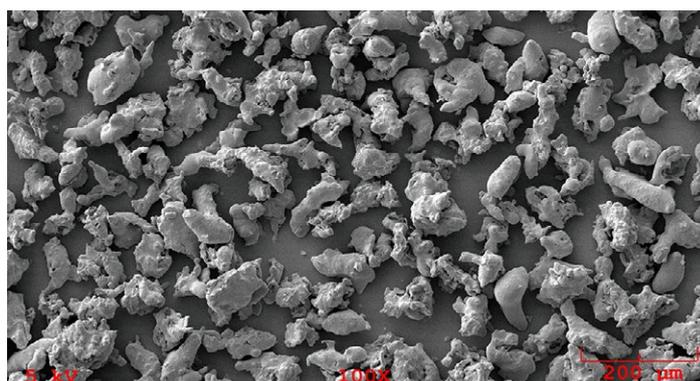
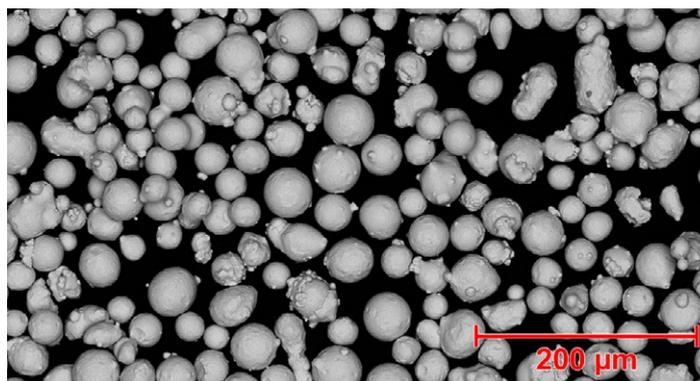
- Corrosion resistance: printing rolls, pump plungers, shafts, seal rings, impellers and hydraulic rams
- Cavitation resistance: hydroturbine wear rings, diesel engine cylinder liners, pumps
- Low temperature particle erosion resistance: exhaust fans, hydraulic valves, cyclone dust collectors, dump valve plugs and seats
- Salvage and restoration: for mismachined or worn steel parts

##### ■ Laser Cladding (MetcoClad 316L-Si):

- Heavy equipment
- Food equipment exposed to chloride ions
- Hydraulic pumps and hydroturbines
- Roll covers in the printing industry
- Shafts in marine applications
- Repair and restoration of steel parts

### Quick Facts

Classification	Alloy, iron-based
Chemistry	Austenitic steels (see section 2.1)
Manufacture	Inert gas or water atomized
Morphology	Spheroidal or irregular
Purpose	Corrosion and erosion protection
Service Temperature	≤ 540 °C (1000 °F)
Process	Atmospheric plasma spray, combustion powder Thermospray™, HVOF, Laser Cladding



SEM photomicrographs showing typical inert gas atomized morphology (top) and water atomized morphology (bottom) for products in this datasheet.

## 2 Material Information

### 2.1 Chemical Composition

Product	Nominal Chemical Composition (wt. %)							
	Fe	Cr	Ni	Mo	Si	Mn	C	Other
Metco 41A	Balance	17	12	2.5	2.3	---	0.03	N.R.
Metco 41C	Balance	17	12	2.5	2.3	---	0.03	N.R.
Diamalloy 1003	Balance	17	12	2.5	2.3	---	0.03	N.R.
Diamalloy 1003-1	Balance	17	12	2.5	2.3	---	0.03	N.R.
MetcoClad 316L-SI	Balance	17	12	2.5	2.3	1.0	0.03	≤ 0.5

N.R. = Not Reported

### 2.2 Particle Size Distribution, Morphology, Manufacturing Method and Hall Flow

Product	Nominal Particle Size Distribution	Morphology	Manufacturing Method
Metco 41A	-90 +45 µm	Spheroidal	Gas Atomized
Metco 41C	-106 +45 µm	Irregular	Water Atomized
Diamalloy 1003	-45 +11 µm	Spheroidal	Gas Atomized
Diamalloy 1003-1	-53 +20 µm	Spheroidal	Gas Atomized
MetcoClad 316L-SI	-106 +44 µm	Spheroidal	Gas Atomized

Upper particle size determined by sieve analysis, lower particle size analysis by laser diffraction (Microtrac).

N.R. = Not reported

### 2.3 Recommended Processes

Product	APS	CPS	HVOF-GF	HVOF-LF	LC
Metco 41A	●	●			
Metco 41C	●	●			
Diamalloy 1003			●	●	
Diamalloy 1003-1			●	●	
MetcoClad 316L-SI					●

**APS** = Atmospheric Plasma Spray; **CPS** = Combustion Powder Thermospray™; **HVOF-GF** = gas-fueled High Velocity Oxygen Fuel Spray; **HVOF-LF** = liquid-fueled High Velocity Oxygen Fuel Spray; **LC** = Laser Cladding

## 2.4 Key Selection Criteria

- Metco 41 series and Diamalloy 1003 series produce dense coatings that are particularly recommended for applications that require protection against corrosion, cavitation and mild particle erosion at temperatures less than 540 °C (1000 °F). In addition, these coatings work-harden in service, making them suitable for packing areas on pump shafts and bearing surfaces on motor shafts.
- Metco 41A and Metco 41C can be applied using atmospheric plasma spray or combustion powder Thermospray™. They are not designed for application using HVOF.
- Diamalloy 1003 and Diamalloy 1003-1 are designed for application using HVOF. They produce coatings that are smoother, denser and less oxidized than coatings of Metco 41 series, and are more suitable for corrosion applications.
- The high silicon content in Metco 41 series and Diamalloy 1003 series products provides enhanced oxidation and sulfidation resistance.
- MetcoClad 316L-SI is recommended for laser cladding where deposits exhibiting corrosion, pitting and cavitation resistance, creep and stress rupture at elevated temperatures are desired. It can also be used for repair or buildup of steel parts. MetcoClad 316L-SI is recommended for corrosion overlay deposits on components used in the oil, gas and marine industries.
- MetcoClad 316L-SI has low carbon content that desensitizes the clad deposit to eliminate grain boundary carbide precipitation. When applied using laser cladding, the properties are similar to, or better than, that of the bulk material because of the refined microstructure and low dilution during cladding. Silicon levels in MetcoClad 316L-SI are higher than AISI Type 316L. The higher silicon content acts as a fluxing agent that produces cleaner clad deposits. Please note that cladding parameters may have to be adjusted to accommodate the higher silicon content.

## 2.5 Related Products

- For applications where the base material is not itself corrosion resistant, the coating should be sealed with an Oerlikon Metco sealer such as Metcoseal SA or Metcoseal AP to enhance corrosion resistance.
- Superalloy powders such as Amdry 625, Diamalloy 1005, Diamalloy 1006 and nickel-chromium alloys such as Metco 43C-NS, 43F-NS and 43VF-NS should be used if better corrosion resistance is required. For chloride containing mediums, HVOF sprayed nickel alloy powders such as Diamalloy 4006 or Diamalloy 4276 are particularly recommended.
- Better wear resistance can be achieved with Metco 42C and Diamalloy 1008.
- Excellent wear resistance and fair corrosion resistance can be obtained with Metcoloy 2 and Metco 8222 wires using electric arc wire spray.
- Austenitic or nickel-base wires are an alternative, although not as corrosion resistant as their powder sprayed counterparts.
- Oerlikon Metco offers a number of nickel-based superalloy powders suitable for laser cladding deposits in corrosive media, to resist oxidation or to resist crevice corrosion and pitting.
- For harder, tougher deposits where corrosion is less of a concern, MetcoClad 538F is recommended.
- For additive manufacturing applications, please see the appropriate datasheet for 316L materials, or contact your Oerlikon Metco account manager for more details.

### 3 Key Processing Information

#### 3.1 Thermal Spray Coating Information

Specification	Typical Data <sup>a</sup>		
		Metco 41A and Metco 41C	Diamalloy 1003 and Diamalloy 1003-1
Recommended Spray Process		Atmospheric Plasma Spray or Combustion Powder Thermospray	HVOF (liquid-fuel) HVOF (gas-fuel)
Deposit Efficiency (approx.)	%	---	70 78
Porosity	vol. %	---	< 1 1 – 2
Surface Roughness Ra <sup>b</sup>	µm	---	5.3 – 6.6 5.3 – 6.6
	µin	---	210 – 260 210 – 260
Macrohardness	HR15N	---	92.5 – 93.5 71 – 72
Microhardness	HV0.3	---	320 – 390 300 – 350

<sup>a</sup> Results using Oerlikon Metco standard parameters. Considerable variation in results can be expected when using different spray processes, parameters and spray guns.  
<sup>b</sup> As-sprayed

#### 3.2 Coating Parameters

Please contact your Oerlikon Metco Account Representative for parameter availability. For specific coating application requirements, the services of Oerlikon Metco's Coating Solution Centers are available.

#### Recommended Spray Guns

Atmospheric Plasma	Combustion Powder	HVOF
Metco 9MBM	Metco 6P-II series	WokaJet series
Metco F4MB-XL Series		DiamondJet 2700
TriplexPro series		Praxair JP 5000
SimplexPro series		

### 4 Commercial Information

#### 4.1 Ordering Information and Availability

Product	Order No.	Package Size	Availability	Distribution
Metco 41A	1078423	5 kg (approx. 11 lb)	Special Order	Global
Metco 41C	1000024	5 lb (approx. 2.25 kg)	Stock	Global
Diamalloy 1003	1078421	5 kg (approx. 11 lb)	Stock	Global
Diamalloy 1003-1	1078416	5 kg (approx. 11 lb)	Stock	Global
MetcoClad 316L-SI	1079454	5 kg (approx. 11 lb)	Special Order	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.

Product	SDS No.
Metco 41A	50-110
Metco 41C	50-110
Diamalloy 1003	50-110
Diamalloy 1003-1	50-110
MetcoClad 316L-SI	50-1600

#### 4.3 Safety Recommendations

See the SDS (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.