

Material Product Data Sheet

Precipitation Hardenable 17-4PH Type Stainless Steel Powders for Additive Manufacturing

Powder Products:

MetcoAdd™ 17-4PH-A, MetcoAdd 17-4PH-D

1 Introduction

MetcoAdd™ 17-4PH is a family of martensitic, precipitation-hardening stainless steel powders with chemistry similar to AMS 5643.

Room temperature static properties of PBF-LB processed and heat treated material coupons have been shown to be comparable to those of AMS 5643 in the H900 state.

For reference purposes Oerlikon has processed MetcoAdd 17-4PH-A using fixed parameters and 40 µm layer thickness to provide data in Section 3.1. 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.

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 17-4PH series products have been rigorously engineered specifically to meet the demanding requirements for additive manufacturing.

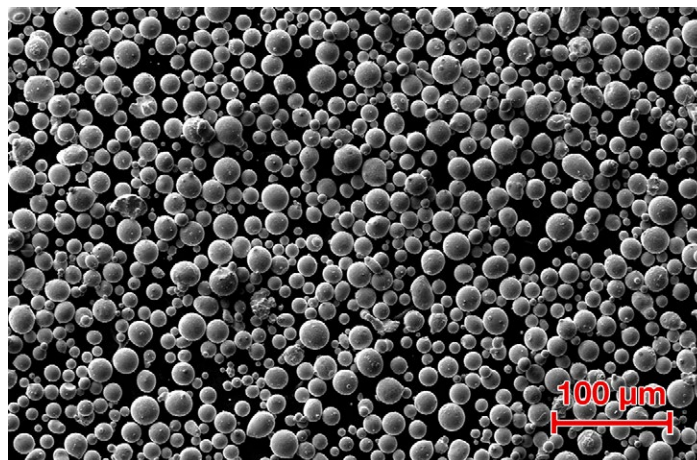
1.1 Typical Uses and Applications

- Aerospace
- Chemical processing
- Nuclear and oil / petrochemical refining
- General metalworking
- Surgical parts

Quick Facts

Classification	Alloy, iron-based
Chemistry	FeCrNiCu
Manufacture	Inert gas atomized (Argon)
Morphology	Spheroidal
Apparent Density	> 4.0 g/cm ³ (typical)
Solidus	1456 ± 10 °C (2652.8 ± 18 °F)
Liquidus	1491 ± 10 °C (2716.8 ± 18 °F)
Process	Laser Powder Bed Fusion (PBF-LB) Electron Beam Powder Bed Fusion (PBF-EB) Directed Energy Deposition (DED) ^a

^a For additive manufacture printing build-up and/or repair only



Typical photomicrograph MetcoAdd 17-4PH-A gas-atomized powder that demonstrates the spherical outer morphology of MetcoAdd 17-4PH products.

2 Material Information

2.1 Chemical Composition

Product	Weight Percent (nominal)						
	Fe	Cr	Ni	Cu	Nb+Ta	C	Other
MetcoAdd 17-4PH series	Balance	17	4.5	4.0	0.3	< 0.07	< 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 17-4PH-A	-45 +15 µm	45	30	19	< 16
MetcoAdd 17-4PH-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 17-4PH-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-treatment processing.
- MetcoAdd 17-4PH-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 17-4PH products are field-proven to repeat-ability and reliably produce dense printed parts.
- Powder beds of MetcoAdd 17-4PH 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 Type 415 and Type 316L 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.

2.5 Specifications

Product	Specification (similar to)
MetcoAdd 17-4PH-A	AMS 5643 UNS S17400
MetcoAdd 17-4PH-D	AMS 5643 UNS S17400

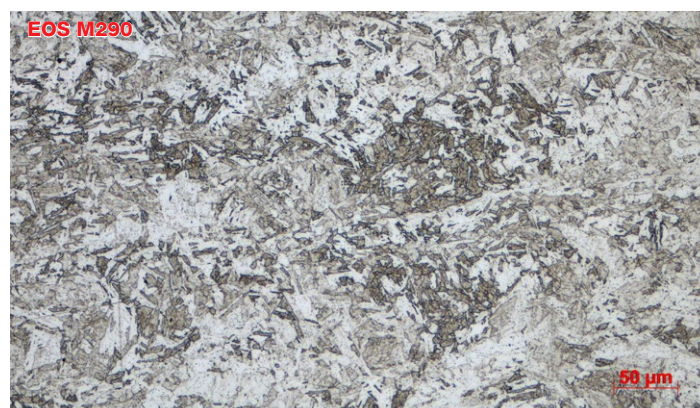
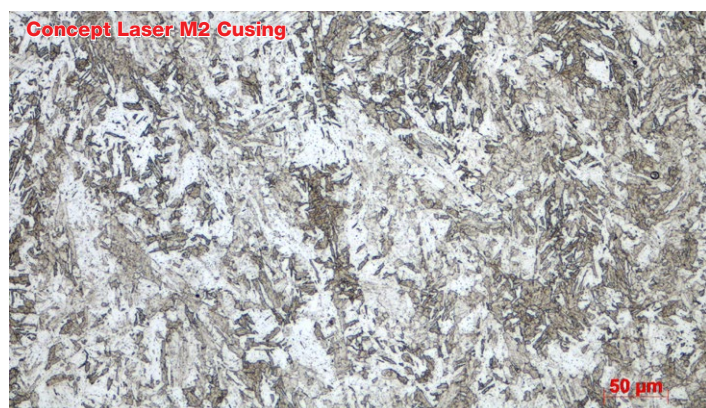
3 Key Processing Information

3.1 Typical As-Built Properties (MetcoAdd 17-4PH-A) ^{a,b,c,d}

Specification		Concept Laser M2 Cusing	EOS M290
Ultimate Tensile Strength (MPa), XY/Z	ASTM E8	1425 ± 6 / 1431 ± 3	1430 ± 5 / 1434 ± 5
Yield Strength (MPa), XY/Z		1297 ± 11 / 1310 ± 3	1304 ± 5 / 1316 ± 5
Elongation at break %, XY/Z		11 ± 1 / 8 ± 2	12 ± 0 / 10 ± 1
Hardness (VHN _{300g})	ASTM E384-17	451 ± 7	451 ± 6
Relative Density %	Internal specification	> 99.9%	> 99.9%

- ^a 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.
^b 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.
^c Argon atmospheric heat treatment. Solutionize at 1038 °C (1900 °F) for 1 hr. Air cool. Age at 492 °C (900 °F) for 1 hr.
^d The process parameters and heat treatments of AM builds produced with other powder cuts (17-4PH-D) and/or AM processes (DED and PBF-EB) may be optimized based on application specific requirements.

3.2 Post Heat Treatment, Vertical Build Direction (MetcoAdd 17-4PH-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.

4 Commercial Information

4.1 Ordering Information and Availability

Product	Order No.	Package Size	Availability	Distribution
MetcoAdd 17-4PH-A	1093744	10 lb (approx. 4.5 kg)	Stock	Global
MetcoAdd 17-4PH-D	1305324	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 50-2005 (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 (Resources – Safety Data Sheets).

Information is subject to change without prior notice.