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Material Product Data Sheet
H11 Hot Work Tool Steel Powder for Additive Manufacturing

Powder Products:
MetcoAdd H11-A

1 Introduction

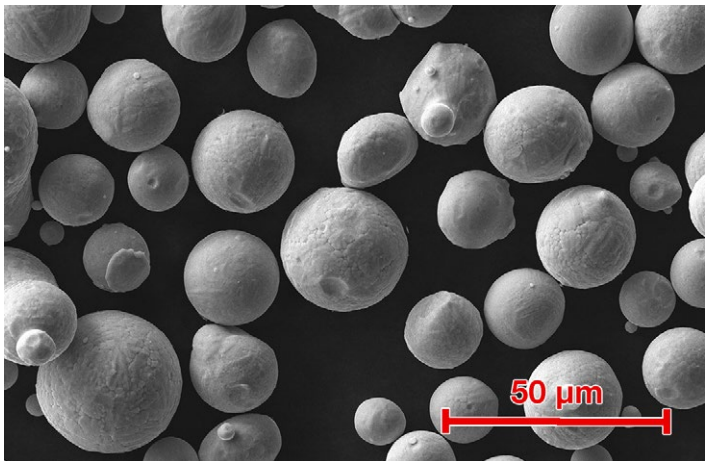
MetcoAdd™ H11-A is is martensitic, iron-chromium, air-hard-enable steel powder product with chemistry similar to UNS T20811, ASTM A681, SAE J437, AMS 6487 and Werkstoff No. 1.2343 / X37CrMoV 5-1.

Room temperature static properties of PBF-LB processed and heat treated material coupons have been shown to be comparable to those of AMS 6487.

Components manufactured using MetcoAdd H11-A and properly post-processing heat treatment can maintain their hardness, ductility and toughness at temperatures up to 538 °C (1000 °F), even under stress.

Please note:
MetcoAdd H11 series materials must be printed at elevated temperatures that are above their Ductile-to-Brittle-Transition-Temperature (DBTT) of about 200 °C (392 °F) if nearly crack-free structures are mandatory for the as-printed part. Printing at or above the Martensite Start (MS) temperature for these materials of approximately 350 °C (662 °F) is even more preferred and produces crack-free components of the highest as-printed densities.

Quick Facts	
Classification	Alloy, Fe-based
Chemistry	Fe 5Cr 1.35Mo 1Si 0.45V 0.4Mn 0.4C
Manufacture	Gas atomized (Argon)
Morphology	Spheroidal
Apparent Density	> 4 g/cm^3 (typical)
Solidus (typical)	1371 °C (2500 °F)
Liquidus (typical)	1482 °C (2700 °F)
Purpose	Additive Manufacturing
Process	Laser Powder Bed Fusion (PBF-LB)



Typical morphology of MetcoAdd H11-A gas atomized powder for additive manufacturing.

1.1 Typical Uses and Applications:

- Highly stressed structural parts such as aircraft landing gears
- Hot forging and extrusion dies
- Die casting molds

2 Material Information

2.1 Chemical Composition

Product	Weight Percent (nominal)						
	Fe	Cr	Mo	Si	V	Mn	C
MetcoAdd H11-A	Balance	4.7 – 5.50	1.10 – 1.60	0.80 – 1.25	0.30 – 0.60	0.20 – 0.60	0.33 – 0.43

2.2 Particle Size Distribution and Hall Flow

Product	Nominal Range [µm]	D90 [µm]	D50 [µm]	D10 [µm]	Hall Flow (s/50 g)
MetcoAdd H11-A	-45 +15	50	34	21	≤ 20

For the nominal range, particle 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.

2.3 Key Selection Criteria

- MetcoAdd H11-A is designed for the manufacture of components using L-PBF and offers optimized spreadability and dense packing.
- MetcoAdd H11-A powder is stable and designed to prevent undesirable agglomeration during powder-bed fusion processing.
- Choose MetcoAdd H11-A for high-stress applications where strength, ductility and toughness must be maintained at temperatures up to 538 °C (1000 °F).

2.4 Related Products

- Oerlikon Metco offers other steel powders for additive manufacturing including stainless steels, maraging steels other tools steels and more. We offer a range of iron-, nickel-, cobalt- and titanium-based additive manufacturing metal powders that have been optimized for either powder-fed or powder-bed processes. Please contact your Oerlikon Metco Account Representative for more information.

2.5 Specifications

Product	Specifications (similar to)
MetcoAdd H11-A	UNS T20811 ASTM A681 SAE J437 AMS 6487 Werkstoff No. 1.2343 / X37CrMoV 5-1

3 Key Processing Information

3.1 Typical Post Heat Treatment Properties (MetcoAdd H11-A) [a, b, c]

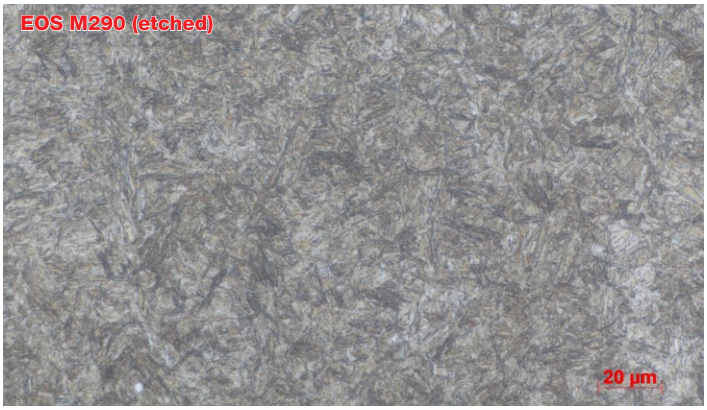
Specification		EOS M290
Ultimate Tensile Strength (MPa), XY/Z	ASTM E8	2012 ± 10 / 2002 ± 10
Yield Strength (MPa), XY/Z		1598 ± 24 / 1577 ± 35
Elongation at break %, XY/Z		8 ± 1 / 8 ± 1
Hardness (VHN_{300})	ASTM E384-17	587 ± 7
Relative Density %	Internal Specification	> 99.9

[a] Disclaimer: All data published in this datasheet has been shared for reference purposes only and is not sufficient to design or certify parts. No warranty or guarantee is made against 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 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] Stress relieve at 871 °C ± 6 °C (1600 °F ± 10 °F) for 120 min. Furnace cool to 480 °C (896 °F) at a rate <28 °C/hr (50 °F/hr) and Air cool to room temperature. Austenize at 815 °C ±6 °C (1500 °F ± 10 °F) for 15 min then heat up to 1010 °C±6 °C (1850 °F±10 °F) at 15 °C/h (27 °F/h) and hold for 30 min. Furnace cool at a rate equivalent to air cooling. Double temper at 538 °C (1000 °F) for 120 min each and air cool to room temperature.

3.2 Post Heat Treatment Microstructure, Vertical Build Direction (MetcoAdd H11-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 H11-A	1305824	10 lb (approx. 4.5 kg)	Stock	Global

4.2 Handling Recommendations

- Blend contents prior to use to prevent segregation
- Keep in the original container, or an approved alternative, tightly closed when not in use
- Powder from previously opened containers should be stored in a humidity-controlled environment

4.3 Safety Recommendations

See the SDS 50-2354 (Safety Data Sheet) in the version localized for 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).

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