Material data sheet – FlexLine

EOS NickelAlloy HX

EOS NickelAlloy HX is a nickel metal alloy powder intended for processing on EOS DMLS systems.
This document provides information and data for parts built using EOS NickelAlloy HX powder (EOS art.-no. 9011-0023) on the following specifications:

- EOS DMLS system M400-4
- EOSYSTEM: EOSPRINT v.1.5/HCS v.2.4.14
- EOS Parameter set HX FlexLine 40µm

Description

EOS NickelAlloy HX is a nickel-chromium-iron-molybdenum alloy in fine powder form. Its composition corresponds to UNS N06002. While the wrought and cast versions of the alloy generally are solution annealed, the laser sintered version has a high strength and good elongation already in the as-built condition. Solution annealing of the laser sintered material will homogenize the microstructure, relax internal stresses and increase the elongation, while slightly decreasing the strength.

This type of alloy is characterized by having high strength and oxidation resistance also at elevated temperatures, and is often used up to 1200°C. Therefore its applications can be found in aerospace technology, gas turbine parts, etc.

Parts built from EOS NickelAlloy HX can be heat treated and material properties can be varied within specified range. In both as-built and solution heat treated states the parts can be machined, spark-eroded, welded, micro shot-peened, polished, and coated if required. Unexposed powder can be reused.

Technical Data

Powder properties

The chemical composition of the powder is reported in the table below.

Material composition	Element	Min	Max
	Ni		Balance
	Cr	20.5	23.0
	Fe	17.0	20.0
	Mo	8.0	10.0
	W	0.2	1.0
	Co	0.5	2.5
	C	–	0.1
	Si	–	1.0
	Mn	–	1.0
	S	–	0.03
	P	–	0.04
	B	–	0.01
	Se	–	0.0050
	Cu	–	0.5
	Al	–	0.5
	Ti	–	0.15

Max. particle size

Particles > 63μm [1]	max. 0.5 wt.-%

[1]   Sieve analysis according to ASTM B214.

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General process data

Layer thickness	40 μm
Volume rate [2]	16.8 mm³/s (60.8 cm³/h)

[2] The volume rate is a measure of build speed during laser exposure of the skin area. The total build speed depends on this volume rate and many other factors such as exposure parameters of contours, supports, up and downskin, recoating time, Home-In or LPM settings.

Physical and chemical properties of parts

Part density [3]	min. 8.2 g/ cm³
Surface roughness after shot peening [4]	R_a 4-6.5 μm; R_z 20-50 μm

[3] Weighing in air and water according to ISO 3369.
[4] Measurement according to ISO 4287. The numbers were measured at the horizontal (up-facing) and all vertical surfaces of test cubes. Due to the layerwise building the roughness strongly depends on the orientation of the surface, for example sloping and curved surfaces exhibit a stair-step effect.

Tensile data at room temperature [5, 6]

	As built	Heat treated [7]
Ultimate tensile strength, R_m	770 MPa	710 MPa
Yield strength, $R_{p0.2}$	610 MPa	345 MPa
Elongation at break, A	31 %	45 %

[5] The numbers are average values and are determined from samples with horizontal and vertical orientation.
[6] Tensile testing according to ISO 6892-1 B10, proportional test pieces, diameter of the neck area 5 mm (0.2 inch), original gauge length 25 mm (1 inch).
[7] Heat treatment procedure: According to AMS2773 and AMS5390: Solution anneal at 1177°C for 1 hour, followed by rapid air cooling to below 60°C.
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Abbreviations

min.   minimum
max.   maximum
wt.   weight

Legal notes

The quoted values refer to the use of this material with above specified EOS DMLS system, EOSYSTEM software version, parameter set and operation in compliance with parameter sheet and operating instructions. All measured values are average numbers. Part properties are measured with specified measurement methods using defined test geometries and procedures and. Further details of the test procedures used by EOS are available on request. Any deviation from these standard settings may affect the measured properties.

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