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.

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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

*Part properties are provided for information purposes only and EOS makes no representation or warranty, and disclaims any liability, with respect to actual part properties achieved. Part properties are dependent on a variety of influencing factors and therefore, actual part properties achieved by the user may deviate from the information stated herein. This document does not on its own represent a sufficient basis for any part design, neither does it provide any agreement or guarantee about the specific properties of a material or part or the suitability of a material or a part for a specific application.

This powder has not been developed, tested or certified as a medical device according to Directive 93/42/EEC (MDD) or Regulation (EU) 2017/745 (MDR) and is not intended to be used as a medical device, in particular for the purposes specified in Art. 2 No. 1 MDR. Insofar as you intend to use the powder as raw material for the manufacture of pharmaceutical products or medical devices (e.g. as raw material which as a material must meet the requirements of Annex 1, Chapter II MDR), the responsibility and liability for all analyses, tests, evaluations, procedures, risk assessments, conformity assessments, approval and certification procedures as well as for all other official and regulatory measures required for this purpose shall lie solely with you both with regard to the pharmaceutical product and/or medical device manufactured by you and with regard to the properties, suitability, testing, evaluation, risk assessment, other requirements for use of the powder as raw material.This also applies to applications with food contact. In this respect, the limitations of liability pursuant to our General Terms and Conditions and the system sales or material contracts shall apply.

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