Material data sheet

EOS NickelAlloy HX

EOS NickelAlloy HX is a heat and corrosion resistant metal alloy powder intended for processing on EOS M 290 systems.

This document provides information and data for parts built using EOS NickelAlloy HX powder (EOS art.-no. 9011-0023) on the following system specifications:

- EOS M 290 400W with EOSPRINT 1.x and EOS Parameter set HX_Performance 2.0

Description, application

EOS NickelAlloy HX raw material 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 melted material manufactured of this powder 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.

Standard laser processing parameters results in full melting of the entire geometry, typically with 40 µm layer thickness. 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.

EOS GmbH - Electro Optical Systems

Robert-Stirling-Ring 1
D-82152 Krailling / München

Telephone: +49 (0)89 / 893 36-0
Telefax: +49 (0)89 / 893 36-285
Internet: www.eos.info

Technical data*

General process data

	EOS NickelAlloy HX
Typical achievable part accuracy [1]	
- small parts	approx. ±50-80 µm (± 0.0020 – 0.0031 inch)
- large parts	approx. ± 0.2 %
Min. wall thickness [2]	typ. 0.4 - 0.5 mm (0.016 – 0.020 inch)
Layer thickness	40 µm
Surface roughness [3]	
- after shot-peening (horizontal / vertical)	R_a 3 – 6.5 µm, R_z 10 - 30 µm R_a 0.12 – 0.25 x 10^{-3} inch, R_z 0.39 – 1.18 x 10^{-3} inch
- after polishing	R_z up to < 0.5 µm R_z up to < 0.02 x 10^{-3} inch (can be very finely polished)
Volume rate [4]	4.2 mm^3/s (15.2 cm^3/h) 0.93 in^3/h

[1] Based on users' experience of dimensional accuracy for typical geometries, e.g. ± 50 µm when parameters can be optimized for a certain class of parts or ± 80 µm when building a new kind of geometry for the first time. Part accuracy is subject to appropriate data preparation and postprocessing.

[2] Mechanical stability is dependent on geometry (wall height etc.) and application

[3] Due to the layerwise building, the surface structure depends strongly on the orientation of the surface, for example sloping and curved surfaces exhibit a stair-step effect. The values also depend on the measurement method used. The values quoted here given an indication of what can be expected for horizontal (up-facing) or vertical surfaces.

[4] Volume rate is a measure of build speed during laser exposure. The total build speed depends on the average volume rate, the recoating time (related to the number of layers) and other factors such as DMLS-Start settings.

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D-82152 Krailling / München

Physical and chemical properties of parts*

	EOS NickelAlloy HX		
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	2.4
	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
Relative density with standard parameters	approx. 100 %		
Density with standard parameters	min. 8.2 g/cm3 min. 0.296 lb/in³		

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Mechanical properties of parts (at room temperature)*

	As built
Ultimate tensile strength [5]	
- in horizontal direction (XY)	typ. 820 ± 50 MPa
- in vertical direction (Z)	typ. 675 ±50 MPa
Yield strength, Rp0.2% [5]	
- in horizontal direction (XY)	typ. 630 ±50 MPa
- in vertical direction (Z)	typ. 545 ±50 MPa
Young's modulus [5]	
- in horizontal direction (XY)	typ. 195 ±20 GPa
- in vertical direction (Z)	typ. 175±20 GPa
Elongation at break [5]	
- in horizontal direction (XY)	typ. 27 ±8 %
- in vertical direction (Z)	typ. 39 ±8 %

[5] Tensile testing according to ISO 6892-1:2009 (B) Annex D, proportional test pieces, diameter of the neck area 5 mm (0.2 inch), original gauge length 25 mm (1 inch).

Abbreviations

typ.	typical
min.	minimum
approx.	approximately
wt	weight

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D-82152 Krailling / München

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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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