Material data sheet

EOS NickelAlloy IN625

EOS NickelAlloy IN625 is a heat and corrosion resistant nickel alloy powder which has been optimized especially for processing on EOSINT M systems.

This document provides information and data for parts built using EOS NickelAlloy IN625 powder (EOS art.-no. 9011-0022) on the following system specifications:

- EOSINT M 270 Dual Mode with PSW 3.5 and EOS Original Parameter Set IN625_Surface 1.0

Description

Parts built from EOS NickelAlloy IN625 have chemical composition corresponding to UNS N06625, AMS 5666F, AMS 5599G, W.Nr 2.4856, DIN NiCr22Mo9Nb. This type of alloy is characterized by having high tensile, creep and rupture strength. Conventionally cast or wrought components in this type of nickel alloy have typically excellent fatigue and thermalfatigue properties combined with good oxidation resistance.

EOS NickelAlloy IN625 is expected to have good corrosion resistance in various corrosive environments. Especially sea-water applications require high pitting and crevice corrosion resistance, stress-corrosion resistance against chloride-ions, high tensile and corrosion-fatigue strength. However, corrosion resistance has not been verified yet and therefore it is recommended to conduct relevant corrosion tests and studies prior to use in specific corrosive environment.

Parts built from EOS NickelAlloy IN625 can be heat treated and material properties can be varied within specified range. Parts can be machined, spark-eroded, welded, micro shot-peened, polished and coated in both as-built and in heat treated conditions. Due to the layerwise building method, the parts have a certain anisotropy - see Technical Data for examples.

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Technical data

General process data

Typical achievable part accuracy [1]	
- small parts approx. □ 40 – 60 µm	approx. □ 1.6 – 2.4 x 10^{-3} inch
- large parts	□ 0.2 %
Min. wall thickness [2]	approx. 0.3 - 0.4 mm approx. 0.012 – 0.016 inch
Surface roughness [3]	
- after shot-peening R_a 4 – 6.5 µm, R_z 20 - 50 µm	R_a 0.16 – 0.26 x 10^{-3} inch, R_z 0.78 – 1.97 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]	2 mm³/s (7.2 cm³/h) 0.44 in³/h

[1] Based on users' experience of dimensional accuracy for typical geometries, e.g. □ 40 µm (0.0016 inch) when parameters can be optimized for a certain class of parts or □ 60 µm (0.0024 inch) when building a new kind of geometry for the first time. Part accuracy is subject to appropriate data preparation and post-processing, in accordance with EOS training.

[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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Physical and chemical properties of parts

Material composition	Ni (balance □ 58.00 wt-%) Cr (20.00 - 23.00 wt-%) Mo (8.00 - 10.00 wt-%) Nb (3.15 - 4.15 wt-%) Fe (□ 5.00 wt-%) Ti (□ 0.40 wt-%) Al (□□0.40 wt-%) Co (□ 1.0 wt-%) C (□ 0.10 wt-%) Ta (□ 0.05 wt-%) Si, Mn (each □ 0.50 wt-%) P, S (each □ 0.015 wt-%)
Relative density	approx. 100 %
Density	min. 8.4 g/cm³ min. 0.30 lb/in³

Mechanical properties of parts at 20 °C (68 °F)

	As built	Stress relieved [6]
Tensile strength [5]		
- in horizontal direction (XY)	typ. 990 ± 50 MPa typ. 144 ± 7 ksi	min. 827 MPa (120 ksi) typ.1040 ± 100 MPa (151 ±15 ksi)
- in vertical direction (Z)	typ. 900 ± 50 MPa typ. 131 ± 7 ksi	min. 827 MPa (120 ksi) typ. 930 ± 100 MPa (135 ±15 ksi)
Yield strength, Rp0.2% [5]		
- in horizontal direction (XY)	typ. 725 ± 50 MPa typ. 105 ± 7 ksi	min. 414 MPa (60 ksi) typ. 720 ± 100 MPa (104 ±15 ksi)
- in vertical direction (Z)	typ. 615 ± 50 MPa typ. 89 ± 7 ksi	min. 414 MPa (60 ksi) typ. 650 ± 100 MPa (94 ±15 ksi)
Modulus of elasticity [5]		
- in horizontal direction (XY)	typ. 170 ± 20 GPa typ. 25 ± 3 Msi	typ. 170 ± 20 GPa typ. 25 ± 3 Msi
- in vertical direction (Z)	typ.140 ± 20 GPa typ. 20 ± 3 Msi	typ. 160 ± 20 GPa typ. 23 ± 3 Msi

Elongation at break [5]		
- in horizontal direction (XY)	typ. (35 ± 5) %	min. 30 %, typ. (35 ± 5) %
- in vertical direction (Z)	(42 ± 5) %	min. 30 %, typ. (44 ± 5) %
Hardness [7]		approx. 30 HRC (287 HB)

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

[6] Stress relieve: anneal at 870 °C (1600 °F) for 1 hour, rapid cooling

[7] Rockwell C (HRC) hardness measurement according to EN ISO 6508-1 on polished surface. Note that measured hardness can vary significantly depending on how the specimen has been prepared.

Thermal properties of parts

Maximum operating temperature for parts under load	approx. 650 °C approx. 1200 °F
Oxidation resistance to [8]	980 °C 1800 °F

[8] Based on literature of conventional Ni-alloy with identical chemistry

Abbreviations

typ. typical
min.
minimum
approx.
approximately wt
weight

Notes

The data are valid for the combinations of powder material, machine and parameter sets referred to on page 1, when used in accordance with the relevant Operating Instructions (including Installation Requirements and Maintenance) and Parameter Sheet. Part properties are measured using defined test procedures. Further details of the test procedures used by EOS are available on request.

The data correspond to our knowledge and experience at the time of publication. They do not on their own provide a sufficient basis for designing parts. Neither do they provide any agreement or guarantee about the specific properties of a part or the suitability of a part for a specific application. The producer or the purchaser of a part is responsible for checking the properties and the suitability of a part for a particular application. This also

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applies regarding any rights of protection as well as laws and regulations. The data are subject to change without notice as part of EOS' continuous development and improvement processes.