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 270 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 Installation Mode Xtended with PSW 3.4 and default job IN625_020_default.job
- EOSINT M 270 Dual-Mode with PSW 3.5 and EOS Original Parameter Set IN625_Surface 1.0

Description, application

EOS NickelAlloy IN625 is a nickel based heat resistant alloy. Its composition corresponds 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 thermal-fatigue 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 has not been verified yet for laser processed EOS IN625 Alloy and therefore it is recommended to conduct relevant corrosion tests and studies prior to use in specific corrosive environment.
Standard processing parameters use full melting of the entire geometry, typically with 20 µm layer thickness. 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. Unexposed powder can be reused.

Potential applications: Aero and land based turbine engine parts, exhaust systems, fuel systems, Marine applications, Chemical and process industry parts, Oil well, petroleum and natural gas industry parts

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Technical data

General process data

	EOS NickelAlloy IN625
Minimum recommended layer thickness	20 µm 1.6 mil
Typical achievable part accuracy [1]	
- small parts [1]	± 40 – 60 µm ± 16 - 24 mil
- large parts	± 0.2 %
Min. wall thickness [2]	0.3 - 0.4 mm 8 - 20 mil
Surface roughness	
- after shot-peening	R_a 4 - 6,5 µm, R_y 20 - 50 µm R_a 0.16 – 0.25, R_z 0.78 – 1.95 mil
- after polishing	R_z up to < 0.5 µm R_z up to < 0.02 mil (can be very finely polished)
Volume rate [3]	
- standard parameters (full density)	2 mm^3/s (7.2 cm^3/h) 0.44 in^3/h

[1] Based on users' experience of dimensional accuracy for typical geometries, e.g. ± 40 µm when parameters can be optimized for a certain class of parts or ± 60 µm when building a new kind of geometry for the first time.

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

[3] 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

	EOS NickelAlloy IN625
Material composition	Ni (balance, ≥ 58.00) 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 with standard parameters	approx. 100 %
Minimum density with standard parameters	*8.4* g/cm3 *0.30* lb/in3

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Mechanical properties of parts (Room temperature)

	As built	Stress relieved [5]
Ultimate tensile strength [4]		
- in horizontal direction (XY)	typ. 990 MPa ± 50 MPa (143 ksi ± 7 ksi)	min. 827 MPa (120 ksi) typ.1040 MPa ±100 MPa (151 ksi ±15 ksi)
- in vertical direction (Z)	typ. 900 MPa ± 50 MPa (130 ksi ± 7 ksi)	min. 827 MPa (120 ksi) typ. 930 MPa ±100 MPa (135 ksi ±15 ksi)
Yield strength, Rp0.2% [4]		
- in horizontal direction (XY)	typ. 725 MPa ± 50 MPa (105ksi ± 7 ksi)	min. 414 MPa(60 ksi) typ. 720 MPa ±100 MPa (104 ksi ±15 ksi)
- in vertical direction (Z)	typ. 615 MPa ± 50 MPa (89 ksi ± 7 ksi)	min. 414 MPa (60 ksi) typ. 650 MPa ±100 MPa (94 ksi ±15 ksi)
Young's modulus		
- in horizontal direction (XY)	typ.170 GPa ± 20 GPa (24,7 msi ± 3 msi)	typ. 170 GPa ± 20 GPa (24,7 msi ±3 msi)
- in vertical direction (Z)	typ.140 GPa ± 20 GPa (20,3 msi ± 3 msi)	typ. 160 GPa ±20 GPa (23,2msi ±3 msi)
Elongation at break		
- in horizontal direction (XY)	typ. 35 % ± 5 %	min. 30% typ. 35 % ± 5 %
- in vertical direction (Z)	42% ± 5 %	min. 30% typ. 44 % ± 5 %
Hardness		approx. 30 HRC (287 HB)

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

[5] Stress Relieve, Anneal at 870°C (1600°F) for 1 hour, rapid cooling

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Thermal properties of laser-sintered parts

	EOS NickelAlloy IN625
Coefficient of thermal expansion	
RT-200°C	xxx m/m°C (xx x 10^{-6} in/in°F)
RT-500°C	xxx m/m°C (xxx x 10^{-6} in/in°F)
Maximum operating temperature for parts under load	650 °C 1200 °F
Oxidation resistance to (based on literature of conventional Ni-alloy with identical chemistry)	980 °C 1800 °F

The quoted values refer to the use of these materials with EOSINT M 270 systems according to current specifications (including the latest released process software PSW and any hardware specified for the relevant material) and operating instructions. All values are approximate. Unless otherwise stated, the quoted mechanical and physical properties refer to standard building parameters and test samples built in vertical orientation. They depend on the building parameters and strategies used, which can be varied by the user according to the application.
The data are based on our latest knowledge and are subject to changes without notice. They are provided as an indication and not as a guarantee of suitability for any specific application.
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