proto3000

Material data sheet

EOS StainlessSteel 316L

EOS StainlessSteel 316L is a corrosion resistant iron based alloy which has been optimized especially for processing on EOSINT M280 systems.

This document provides information and data for parts built using EOS StainlessSteel 316L powder (EOS art.-no. 9011-0032) on the following system specifications:

- EOSINT M280 400W System with PSW3.6 and Parameter Set 316L_Surface 1.0
- EOSINT M280 200W System with PSW3.6 and Parameter Set 316L_Surface 1.0

Description

The parts built from EOS StainlessSteel 316L have chemical composition corresponding to ASTM F138 "Standard Specification for Wrought 18Cr-14Ni-2.5Mo Stainless Steel Bar and Wire for Surgical Implants (UNS S31673)". This kind of stainless steel is characterized having a good corrosion resistance and evidence that there are no leachable substances in cytotoxic concentrations.

This material is ideal in

- Lifestyle/Consumer - watches, other jewellery, spectacle frames, decorations, functional elements in electronic housing and accessories
- Automotive/Industrial – non-corroding common material, food and chemical plants
- Aerospace/Turbine industry – entry-level material for Laser Sintering Technology, mounting parts, brackets, heat exchangers

Parts built from EOS StainlessSteel 316L can be machined, shot-peened and polished in as-built or stress relieved (AMS2759) states if required. Solution annealing is not necessary because the mechanical properties of as-built state are showing desired values (ASTM A403). Parts are not ideal in temperature range 427°C - 816°C where precipitation of chromium carbides occurs. Due to layer-wise building method, the parts have a certain anisotropy which could be seen from mechanical properties.

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Technical data

General process data

	EOS StainlessSteel 316L
Typical achievable part accuracy [1]	
- small parts	approx. ±20-50 µm (±0.0008 – 0.002 inch)
- large parts	approx. ± 0.2 %
Min. wall thickness [2]	approx. 0.3 - 0.4 mm (0.012 – 0.016 inch)
Layer thickness	20 µm (0,8 x 10^{-3} inch)
Surface roughness [3]	
- as-manufactured	R_a 13 ±5 µm; R_z 80 ±20 µm R_a 0.5 ±0.2 x 10^{-3} inch; R_z 3.1 ±0.8 x 10^{-3} inch
- after shot-peening	R_a 5 ±2 µm; R_z 30 ±10µm R_a 0.2 ±0.08 x 10^{-3} inch; R_z 1.2 ±0.4 x 10^{-3} inch
- after polishing	R_z up to < 1 µm Rz up to < 0.04 x 10^{-3} inch (can be very finely polished)
Volume rate [4]	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. 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 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 contour and Up-/DownSkin parameters.

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Physical and chemical properties of parts

	EOS StainlessSteel 316L		
Material composition	Element	Min	Max
	Fe	balance	
	Cr	17.00	19.00
	Ni	13.00	15.00
	Mo	2.25	3.00
	C		0.030
	Mn		2.00
	Cu		0.50
	P		0.025
	S		0.010
	Si		0.75
	N		0.10
Relative density with standard parameters	approx. 100 %		
Density with standard parameters	min. 7.9 g/cm³ min. 0.285 lb/in³		

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Mechanical properties of parts (at room temperature)

	As built
Ultimate tensile strength [5]	
- in horizontal direction (XY)	640 ± 50 MPa
- in vertical direction (Z)	540 ± 55 MPa
Yield strength, Rp0.2% [5]	
- in horizontal direction (XY)	530 ± 60 MPa
- in vertical direction (Z)	470 ± 90 MPa
Young's modulus [5]	
- in horizontal direction (XY)	typ. 185 GPa
- in vertical direction (Z)	typ. 180 GPa
Elongation at break [5]	
- in horizontal direction (XY)	40 ± 15 %
- in vertical direction (Z)	50 ± 20 %
Hardness [6]	typ. 85 HRB

[5] Machining and testing of the test bars according to ISO 6892 / ASTM E8M, propotional test pieces, diameter of the neck area 5 mm (0.2 inch), gauge length 4D = 20.0mm (0.79 inch), stress rate 10MPa/s, strain speed in plastic region 0.375 1/min.

[6] Rockwell hardness (HRB) measurement according to EN ISO 6508-1 on polished surface.

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Abbreviations

typ.	typical
min.	minimum
approx.	approximately
wt	weight

The quoted values refer to the use of these materials with EOSINT M 280 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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