EOS StainlessSteel 316L

EOS StainlessSteel 316L is a corrosion resistant iron based alloy which has been optimized for processing on EOS DMLS 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:

- EOS DMLS system M290
  - HSS blade (2200-4073)
  - Grid nozzle (2200-5501)
  - IPCM sieving module with 63µm mesh size (9044-0032) recommended
  - Argon atmosphere
- Software: EOSYSTEM 2.5 or newer
- EOS Parameter set: 316L 40µm FlexLine
  (Default Job: 316L_040_FlexM291_100)

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

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.

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Due to layer-wise building method, the parts have a certain anisotropy which could be seen from mechanical properties.

Technical Data

Powder properties

Material composition	Element	Min. [wt.-%]	Max [wt.-%]
	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
Max. particle size			
Particles ≥ 53µm [1]	≤ 5.5 wt.-%		

[1] Sieve analysis according to ASTM B214.

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General process data

Layer thickness	40 µm
Volume rate [2]	3.7 mm³/s (13.3 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]	7.9 g/ cm³
Surface roughness after shot peening [4]	R_a 4 µm; R_z 20 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
Ultimate tensile strength, R_m	590 MPa	n.a.
Yield strength, $R_{p0.2}$	500 MPa	n.a
Elongation at break, A	46.7 %	n.a

[5] The numbers are average values and are determined from samples with horizontal and vertical orientation.
[6] Tensile testing according to ISO 6892 / ASTM E8M, proportional test pieces, diameter of the neck area 5mm (0.2 inch), gauge length 4D = 20.0mm (0.79 inch), stress rate 10MPa/s, strain speed in plastic region 0.375 1/min.

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Abbreviations

min.	minimum
max.	maximum
wt.	weight

Legal notes

The quoted values refer to the use of this material with above specified EOS DMLS system, EOSYSTEM software version, parameter set and operation in compliance with parameter sheet and operating instructions. All measured values are average numbers. Part properties are measured with specified measurement methods using defined test geometries and procedures. Further details of the test procedures used by EOS are available on request. Any deviation from these standard settings may affect the measured properties.

The data correspond to EOS knowledge and experience at the time of publication and they are subject to change without notice as part of EOS' continuous development and improvement processes.

EOS does not warrant any properties or fitness for a specific purpose, unless explicitly agreed upon. This also applies regarding any rights of protection as well as laws and regulations.

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