Material data sheet

EOS StainlessSteel 17-4 for EOSINT M 270

A number of different materials are available for use with EOSINT M 270 systems, offering a broad range of e-Manufacturing applications. EOS StainlessSteel 17-4 is a stainless steel powder which has been optimized especially for Direct Metal Laser-Sintering (DMLS) on EOSINT M systems. Other materials are also available for EOSINT M 270 systems, and further materials are continuously being developed - please refer to the relevant material data sheets for details.

This document provides a brief description of the principle applications, and a table of technical data. For details of the system requirements please refer to the relevant information quote.

Description, application

EOS StainlessSteel 17-4 is a pre-alloyed stainless steel in fine powder form. Its composition corresponds to US classification 17-4 PH and European 1.4542 and fulfils the requirements of AMS 5643 for Mn, Mo, Ni, Si, C, Cr and Cu. This kind of steel is characterized by having very good corrosion resistance and mechanical properties, especially excellent ductility in laser processed state, and is widely used in a variety of engineering applications.

This material is ideal for many part-building applications (DirectPart) such as functional metal prototypes, small series products, individualised products or spare parts. Standard processing parameters use full melting of the entire geometry with 20 µm layer thickness, but it is also possible to use skin and core building style to increase the build speed. Using standard parameters the mechanical properties are fairly uniform in all directions. Laser-sintered parts made from EOS StainlessSteel 17-4 can be welded, machined, micro shot-peened, polished and coated if required. Unexposed powder can be reused without restriction or refreshing.

Typical applications:

- engineering applications including functional prototypes, small series products, individualised products or spare parts.
- parts requiring high corrosion resistance, sterilisability, etc.
- parts requiring particularly high toughness and ductility.

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Technical data

General process data

	EOS StainlessSteel 17-4
Minimum recommended layer thickness	20 µm 0.8 mil
Typical achievable part accuracy [1]	
- small parts [1]	± 20 – 50 µm 8 - 20 mil
- large parts [2]	± 0.2 %
Min. wall thickness [3]	0.3 - 0.4 mm 0.012 - 0.016 in
Volume rate [4]	
- standard parameters (full density)	2 – 2.5 mm^3/s 0.44 - 0.55 in^3/h
- Skin/core parameters	4 - 5 mm^3/s 0.88 - 1.1 in^3/h

[1] Based on users' experience of dimensional accuracy for typical geometries, e.g. ± 20 µm when parameters can be optimized for a certain class of parts or ± 50 µm when building a new kind of geometry for the first time.

[2] For larger parts the accuracy can be improved by post-process tempering; this is currently being optimized.

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

[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 laser-sintered parts

	EOS StainlessSteel 17-4
Material composition	steel including alloying elements Cr (15 – 17.5 wt-%) Ni (3 - 5 wt-%) Cu (3 - 5 wt-%) Mn (max. 1 wt-%) Si (max. 1 wt-%) Mo (max. 0.5 wt-%) C (max. 0.07 wt-%) Nb (0.15 – 0.45 wt-%)
Relative density with standard parameters	approx. 100 %

Mechanical properties of laser-sintered parts

	EOS StainlessSteel 17-4
Ultimate tensile strength (MPIF 10)	1050 ± 50 MPa 152 ± 7 ksi
Yield strength (Rp 0.2 %)	540 ± 50 MPa 78 ± 7 ksi
Elongation at break	25 ± 5 %
Young's modulus	170 ± 20 GPa 25 ± 3msi
Hardness [5]	
- as laser-sintered	approx. 230 HV
- after post-hardening [6]	> 40 HRC (~ 400 HV)
Surface roughness	
- after shot-peening	R_a 2.5 - 4.5 µm, R_y 15 - 40 µm R_a 0.1 - 0.2 mil, R_y 0.6 - 1.6 µm
- after polishing	R_z up to < 0.5 µm (can be very finely polished)

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[5] Vickers hardness measurement (HV) according to DIN EN ISO 6507-1. Rockwell C (HRC) hardness measurement according to DIN EN ISO 6508-1. Values in parentheses are converted in accordance with DIN 50150, which is applicable to cast steels and therefore only gives an indication for laser-sintered materials. Note that depending on the measurement method used, the measured hardness value can be dependent on the surface roughness and can be lower than the real hardness. To avoid inaccurate results, hardness should be measured on a polished surface.

[6] Post hardening treatment still to be optimised

Thermal properties of laser-sintered parts

	EOS StainlessSteel 17-4
Coefficient of thermal expansion	14 x 10^{-6} m/m°C 7.8 x 10^{-6} in/in°F
Thermal conductivity	at 20 °C: 13 W/mK at 100 °C: 14 W/mK at 200 °C: 15 W/mK at 300 °C: 16 W/mK at 68 °F: 90 BTU at 212 °F: 97 BTU at 392 °F: 104 BTU at 572 °F: 111 BTU
Maximum operating temperature	550 °C 1022 °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 horizontal 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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