Material data sheet

EOS Titanium Ti64ELI

EOS Titanium Ti64ELI is a titanium alloy powder which has been optimized especially for processing on EOSINT M systems.

This document provides information and data for parts built using EOS Titanium Ti64ELI powder (EOS art.-no. 9011-0017) on the following system specifications:

- EOSINT M 280 400W with PSW 3.6 and Parameter Set Ti64ELI_Performance 1.0
- EOSINT M 290 400W with EOSPRINT 1.0 and Parameter Set Ti64ELI_Performance 1.0

Description

Parts built in EOS Titanium Ti64 have a chemical composition and mechanical properties corresponding to ASTM F136.

This well-known light alloy is characterized by having excellent mechanical properties and corrosion resistance combined with low specific weight and biocompatibility.

This material is ideal for many high-performance applications, for example for the production of biomedical implants (note: subject to fulfilment of statutory validation requirements where appropriate).

Due to the layerwise building method, the parts have a certain anisotropy, which can be reduced or removed by appropriate heat treatment - see Technical Data for examples.

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Technical data

General process and geometric data

Typical achievable part accuracy [1], [7]	± 50 µm
Min. wall thickness [2], [7]	approx. 0.3 – 0.4 mm approx. 0.012 – 0.016 inch
Surface roughness [3], [7]	
as built	R_a 3–20 µm, R_z 16–126 µm R_a 0.120.79 x 10^{-3} inch, R_z 0.634.96 x 10^{-3} inch
peened	R_a 4–9 µm, R_z 22–56 µm R_a 0.160.35 x 10^{-3} inch, R_z 0.872.20 x 10^{-3} inch
Volume rate [4]	5 mm^3/s (18 cm^3/h) 1.1 in^3/h

[1] Based on users' experience of dimensional accuracy for typical geometries. 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	Ti (balance) Al (5.5 – 6.75 wt.-%) V (3.5 – 4.5 wt.-%) O < 0,2 wt.-% N < 0,05 wt.-% C < 0,08 wt.-% H < 0,015 wt.-% Fe < 0,3 wt.-%
Relative density	approx. 100 %
Density	4.41 g/cm³ 0.159 lb/in³

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Mechanical properties of parts [7]

	As built	Heat treated [6]
Tensile strength [5]		
- in horizontal direction (XY)	1260 ± 40 MPa 183 ± 6 ksi	min. 860 MPa (124.7 ksi) 1075 ± 30 MPa (156 ±4 ksi)
- in vertical direction (Z)	1250 ± 50 MPa 181 ± 7 ksi	min. 860 MPa (124.7 ksi) 1080 ± 30 MPa (157 ± 4 ksi)
Yield strength ($R_{p0.2}$) [5]		
- in horizontal direction (XY)	1125 ± 65 MPa 163 ± 9 ksi	min. 795 MPa (115.3 ksi) typ. 1000 ± 40 MPa (145 ± 6 ksi)
- in vertical direction (Z)	1130 ± 75 MPa 164 ± 11 ksi	min. 795 MPa (115.3 ksi) 1005 ± 40 MPa (146 ± 6 ksi)
Elongation at break [5]		
- in horizontal direction (XY)	(7 ± 3) %	min. 10 % (13 ± 3 %)
- in vertical direction (Z)	(9 ± 3) %	min. 10 % (15 ± 4 %)
Modulus of elasticity [5]		
- in horizontal direction (XY)	108 ± 20 GPa 16 ± 2.9.0 Msi	111 ± 20 GPa 16 ± 2.9 Msi
- in vertical direction (Z)	112 ± 13 GPa 16 ± 1.9 Msi	typ. 115 ± 20 GPa typ. ± 2.9 Msi

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

[6] Specimens were treated at 800 °C (1470 °F) for 2hours in argon inert atmosphere. The minimum values refer standards ASTM F136-08$^{\varepsilon 1}$.

[7] Hint: these properties were determined on an EOSINT M 280 400W. Test parts from machine type EOS M 290 400W correspond with these data.

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Thermal properties of parts

Maximum long-term operating temperature	approx. 350 °C approx. 660 °F

Abbreviations

typ.	typical
min.	minimum
wt.	weight
approx.	approximately

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 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.

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