Material data sheet

EOS Titanium Ti64

EOS Titanium Ti64 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 Ti64 powder (EOS art.-no. 9011-0014) on the following system specifications:

- EOSINT M 270 Installation Mode *Xtended*
  with PSW 3.4 and default job Ti64_30_030_default.job
- EOSINT M 270 Dual Mode
  with PSW 3.5 and EOS Original Parameter Set Ti64_Performance 2.0

Description

Parts built in EOS Titanium Ti64 have a chemical composition corresponding to ISO 5832-3, ASTM F1472 and ASTM B348.

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 engineering applications, for example in aerospace and motor racing, and also 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

Min. wall thickness [1]	approx. 0.3 – 0.4 mm approx. 0.012 – 0.016 inch
Surface roughness, as built [2]	R_a 9 - 12 µm, R_z 40 - 80 µm R_a 0.36 – 0.47 x 10^{-3} inch R_z 1.6 – 3.2 x 10^{-3} inch
Volume rate [3]	3.75 mm^3/s (13.5 cm^3/h) 0.82 in^3/h

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

[2] 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.

[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.

Physical and chemical properties of parts

Material composition	Ti (balance) Al (5.5 – 6.75 wt.-%) V (3.5 – 4.5 wt.-%) O (< 2000 ppm) N (< 500 ppm) C (< 800 ppm) H (< 150 ppm) Fe (< 3000 ppm)
Relative density	approx. 100 %
Density	4.41 g/cm^3 0.159 lb/in^3

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Mechanical properties of parts

	As built	Heat treated [5]
Tensile strength [4]		
- in horizontal direction (XY)	1230 ± 40 MPa 178.4 ± 5.8 ksi	min. 930 MPa (134.8 ksi) typ. 1050 ± 20 MPa (152.2 ± 2.9 ksi)
- in vertical direction (Z)	1200 ± 40 MPa 174 ± 5.8 ksi	min. 930 MPa (134.8 ksi) typ. 1060 ± 20 MPa (153.7 ± 2.9 ksi)
Yield strength ($R_{p0.2}$) [4]		
- in horizontal direction (XY)	1060 ± 40 MPa 153.7 ± 5.8 ksi	min. 860 MPa (124.7 ksi) typ. 1000 ± 20 MPa (145 ± 2.9 ksi)
- in vertical direction (Z)	1070 ± 40 MPa 155.2 ± 5.8 ksi	min. 860 MPa (124.7 ksi) typ. 1000 ± 20 MPa (145 ± 2.9 ksi)
Elongation at break [4]		
- in horizontal direction (XY)	(10 ± 2) %	min. 10 % typ. (14 ± 1 %)
- in vertical direction (Z)	(11 ± 3) %	min. 10 % typ. (15 ± 1 %)
Modulus of elasticity [4]		
- in horizontal direction (XY)	110 ± 5 GPa 16.0 ± 0.7 Msi	116 ± 10 GPa 16.8 ± 1.5 Msi
- in vertical direction (Z)	110 ± 5 GPa 16.0 ± 0.7 Msi	114 ± 10 GPa 16.5 ± 1.5 Msi
Hardness [6]	typ. 320 ± 12 HV5	

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

[5] Specimens were treated at 800 °C (1470 °F) for 4 hours in argon inert atmosphere. Mechanical properties are expressed as minimum values to indicate that mechanical properties exceed the minimum requirements of material specification standards. ASTM F1472-08. By fulfilling these minimum values, also the specifications of standards ASTM B348-09 and ISO 5832-3:2000 are meet.

[6] Vickers hardness measurement (HV) according to EN ISO 6507-1 on polished surface. Note that measured hardness can vary significantly depending on how the specimen has been prepared.

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Thermal properties of parts

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

Abbreviation

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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