Titanium Ti64 ELI

This document provides information and data for parts built using an optimized Titanium Ti64ELI powder.

Description

Parts built in 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.

Technical data

General process and geometrical data

Typical achievable part accuracy [1]	± 50 µm
Smallest wall thickness [2]	approx. 0.3 – 0.4 mm approx. 0.012 – 0.016 inch
Surface roughness [3]	
- as built	Ra 3 – 20 µm, Rz 16 – 126 µm Ra 0.120.79 x 10^{-3} inch, Rz 0.634.96 x 10^{-3} inch
- peened	Ra 4 – 9 µm, Rz 22 – 56 µm Ra 0.160.35 x 10^{-3} inch, Rz 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.
[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.

Physical and chemical properties of the parts

Material composition	Ti (balance) Al (5.5 – 6.75 wt.-%) V (3.5 – 4.5 wt.-%) O < 0,13 wt.-% N < 0,05 wt.-% C < 0,08 wt.-% H < 0,012 wt.-% Fe < 0,25 wt.-%
Relative density	approx. 100 %
Density	4.41 g/cm^3 0.159 lb/in^3

Mechanical properties of the parts		
	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 (Rp 0.2 %) [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 F136-08ε1.

Thermal properties of parts	
Maximum long-term operating temperature	approx. 350 °C approx. 660 °F

Notes

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. Measurements of the same properties using different test methods (e.g. specimen geometries) can give different results.
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.