Material data sheet

EOS Titanium Ti64ELI

EOS Titanium Ti64ELI is a titanium alloy powder intended for processing on EOS DMLS™ machines. This document provides information and data for parts built using:

- EOS Titanium Ti64ELI powder (EOS art.-no. 9011-0017 and 9011-0040)
- EOS DMLS™ machine: EOSINT M 290 400 W
- HSS blade (2200-4073)
  - Argon atmosphere
  - IPCM extra sieving module with 63 µm mesh (9044-0032) recommended
- EOSYSTEM:
  - EOSPRINT v 1.5 or newer
  - HCS v 2.4.14 or newer
- EOS Parameter set: Ti64ELI_Performance_M291 1.10

Description

EOS Titanium Ti64ELI has a chemical composition and corresponding to ASTM F136 and ASTM F3001.

Ti64ELI is well-known light alloy, 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.

Parts built with EOS Titanium Ti64ELI powder can be machined, shot-peened and polished in as-built and heat treated states. Due to the layerwise building method, the parts have a certain anisotropy.

EOS GmbH Electro Optical Systems

Robert-Stirling-Ring 1
D-82152 Krailling / München

Telephone: +49 (0)89 / 893 36-0
Telefax: +49 (0)89 / 893 36-285
Internet: www.eos.info

Technical Data

Powder properties

The chemical composition of the powder (wt-%):

Material composition		
Element	Min	Max
Al	5.50	6.50
V	3.50	4.50
O	-	0.13
N	-	0.05
C	-	0.08
H	-	0.015
Fe	-	0.25
Y	-	0.005
Other elements, each	-	0.10
Other elements, total	-	0.40
Ti	Bal.	

Max. particle size	
> 63µm	max. 0.3 wt%

General process data

Layer thickness	30 µm
Volume rate [1]	5 mm³/s (18 cm³/h) 1.1 in³/h

[1] The volume rate is a measure of build speed during laser exposure of the skin area per laser scanner. 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.

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Physical and chemical properties of parts*

Part density [2]	Approx. 4.41 g/cm³ Approx. 0.159 lb/in³
Min. wall thickness [3]	Approx. 0.3 - 0.4 mm Approx. 0.012 - 0.016 inch
Surface roughness after shot peening [4]	Ra 5 - 9 µm; Rz 20-50 µm Ra 0.20 – 0.35 x 10-³ inch Rz 0.79– 1.96 x 10-³ inch

[2] Weighing in air and water according to ISO 3369.

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

[4] Measurement according to ISO 4287. 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.

Hardness*

Hardness as build [5]	Approx. 320 HV5

[5] Hardness measurement according to standard EN ISO 6507-1 with load 5kg (HV5)

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Tensile data at room temperature* [6, 7]

	Heat treated [8]	
	Horizontal	**Vertical**
Ultimate tensile strength, Rm	1055 MPa	1075 MPa
Yield strength, Rp0.2	945 MPa	965 MPa
Elongation at break, A	13 %	14 %
Reduction of area, Z	> 25 %	> 25 %

[6] Tensile testing according to ISO 6892-1 A14, proportional test pieces. Horizontal: diameter of the neck area 5 mm (0.2 inch), original gauge length 20 mm (0.79 inch). Vertical: diameter of the neck area 4 mm (0.16 inch), original gauge length 16 mm (0.63 inch).

[7] The numbers are average values determined from samples with horizontal and vertical orientation respectively Values are subject to variations depending on process conditions.

[8] Heat treatment procedure: Specimens were heat treated at 800 °C for 2 hours in argon inert atmosphere.

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Abbreviations

Min.	Minimum
Max.	Maximum
Approx.	Approximately
Wt.	Weight

*Part properties are provided for information purposes only and EOS makes no representation or warranty, and disclaims any liability, with respect to actual part properties achieved. Part properties are dependent on a variety of influencing factors and therefore, actual part properties achieved by the user may deviate from the information stated herein. This document does not on its own represent a sufficient basis for any part design, neither does it provide any agreement or guarantee about the specific properties of a material or part or the suitability of a material or a part for a specific application.

This powder has not been developed, tested or certified as a medical device according to Directive 93/42/EEC (MDD) or Regulation (EU) 2017/745 (MDR) and is not intended to be used as a medical device, in particular for the purposes specified in Art. 2 No. 1 MDR. Insofar as you intend to use the powder as raw material for the manufacture of pharmaceutical products or medical devices (e.g. as raw material which as a material must meet the requirements of Annex 1, Chapter II MDR), the responsibility and liability for all analyses, tests, evaluations, procedures, risk assessments, conformity assessments, approval and certification procedures as well as for all other official and regulatory measures required for this purpose shall lie solely with you both with regard to the pharmaceutical product and/or medical device manufactured by you and with regard to the properties, suitability, testing, evaluation, risk assessment, other requirements for use of the powder as raw material.
This also applies to applications with food contact. In this respect, the limitations of liability pursuant to our General Terms and Conditions and the system sales or material contracts shall apply.

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EOS Titanium Ti64 ELI

EOS Titanium Ti64ELI is a titanium alloy powder intended for processing on EOS DMLS™ machines.This document provides information and data for parts built using EOS Titanium Ti64ELI powder (EOS art.-no. 9011-0040) on the following system setup:

- EOS DMLS™ system: EOS M400 SF
  - HSS recoating blade
  - Argon atmosphere
  - IPCM M extra sieving module with 63µm mesh recommended
- EOSPRINT v.1.5/HCS v.2.4 or newer
- EOS Parameter set Ti64ELI_030_FlexM400_100

Description

Parts built in EOS Titanium Ti64ELI have a chemical composition corresponding to ASTM F136 and ASTM F3001.

Ti64ELI is well-known light alloy, 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.

Parts built with EOS Titanium Ti64ELI powder can be machined, shot-peened and polished in as-built and heat treated states. Due to the layerwise building method, the parts have a certain anisotropy.

Quality Assurance

The quality of the EOS Titanium Ti64 powder lots is ensured by the Quality Assurance procedures. The procedures include sampling (ASTM B215), PSD analysis (ISO 13320), chemical analyses (ASTM E2371, ASTM E1409, ASTM E1941, ASTM E1447), and mechanical testing (ISO 6892-1).

The results of the quality assurance tests are given in the lot specific Mill Test Certificates (MTC) according to EN 10204 type 3.1.

Electro Optical Systems Finland Oy
Lemminkäisenkatu 36
FIN-20520 Turku
Telephone: +358 23358119
Telefax: +358 20 7659141

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Robert-Stirling-Ring 1
D-82152 Krailling / München
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Technical Data

Powder properties

Material composition [wt.%]	Element	Min	Max
	Al	5.50	6.50
	V	3.50	4.50
	O	-	0.13
	N	-	0.05
	C	-	0.08
	H	-	0.012
	Fe	-	0.25
	Y	-	0.005
	Other elements, each	-	0.10
	Other elements, total	-	0.40
	Ti		bal.

Particle size	
d50 [1]	39 ± 3 µm

[1] Particle size distribution analysis according to ISO 13320

General process data

Layer thickness	30 µm
Volume rate [2]	5 mm³/s (18 cm³/h)

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[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 properties of parts*

Part density [3]	4.4 g/cm3
Surface roughness after shot peening [4]	Approx. R_a 5-10 µm; R_z 15-30 µm
Hardness as built [5]	typ. 340 HV5

[3] Weighing in air and water according to ISO 3369.

[4] 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.

[5] Hardness measurement according to standard EN ISO 6507-1 with load 5kgf (HV5)

Tensile data at room temeprature* [6,7]

	As built	Heat treated [8]
Ultimate tensile strength	typ. 1270 MPa	typ. 1040 MPa
Yield strength, Rp0.2%	typ. 1100 MPa	typ. 930 MPa
Elongation at break A	typ. 8,7 %	typ. 14,0 %

[6] The numbers are average values and are determined from samples with horizontal and vertical orientation.

[7] Tensile testing according to ISO 6892-1 A14, proportional test pieces, diameter of the neck area 5 mm (0.2 inch), original gauge length 20 mm (0,79 inch).

[8] Heat treatment procedure: 2 hours at 800°C in Argon atmosphere.

Abbreviations

min. minimum

max. maximum

wt. weight

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