Material Data Sheet

Ti6Al4V Gr23

Titanium Alloy

This well-known light alloy is characterised by having excellent mechanical properties and corrosion resistance combined with low specific weight and biocompatibility. Ideal for many high-performance engineering applications, for example in aerospace and motorsport, and also for the production of biomedical implants.

Typical Mechanical Properties (Heat Treated)

Ultimate tensile strength	1230 MPa (1020 MPa)
Yield strength	1080 MPa (900 MPa)
Elongation at break	10% (19%)

Highlights

- Excellent mechanical properties and strength to weight ratio
- Excellent corrosion resistance
- Applications in aerospace, automotive, marine, biomedical

Process Parameter

Quality — **Balanced** — Productivity

- Layer thickness: 60µm
- Density >99.8%
- ASTM standard mechanical properties
- Good productivity
- Minimum controlled features 0.5mm

Process Readiness Level (PRL)

R&D				Foundation		Production		
1	2	3	4	5	6	7	8	9

Additive Industries

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Powder Chemistry[2,3]										
Composition	Ti	V	Al	O	N	H	Fe	C	(Others Total)	(Others Each)
Min (wt%)	Bal	3.5	5.5	0	0	0	0	0	0	0
Max (wt%)	Bal	4.5	6.5	0.13	0.03	0.0125	0.25	0.03	0.4	0.1

Process details		
Layer thickness	60	[µm]
Build rate[8] (per laser)	32.9	[cm^3/hr]
Optical density [4]	≥ 99.8	[%]
Volumetric density [11]	≥ 4.41	[g/cm^3]

Mechanical properties [5]	Orientation	As-built (Mean)	As-Built Standard Dev.	Heat-treat (Mean)	As-Built Standard Dev.	Units
Ultimate tensile strength	Horizontal	1230	15	1020	10	[MPa]
	Vertical	1200	15	1000	10	[MPa]
Yield strength	Horizontal	1070	15	920	20	[MPa]
	Vertical	1080	15	900	20	[MPa]
Elongation at break	Horizontal	8	2	17	2	[%]
	Vertical	10	2	19	2	[%]
Youngs modulus	Horizontal	115	5	115	5	[GPa]
	Vertical	115	5	115	5	[GPa]
Vickers Hardness [6]		350	10	330	10	[HV10]

Surface Roughness [7]	Mean	Standard Deviation	Units
Vertical Surface Roughness (Ra)	9	1	[µm]
Vertical Surface Roughness (Rz)	54	10	[µm]
45° Surface Roughness (Ra)	18	5	[µm]
45° Surface Roughness (Rz)	93	25	[µm]

Notes

1. This data is only valid for Additive Industries released powder, machine and parameter sets. The material is processed under Nitrogen shielding atmosphere. The properties of the parts are measured on test coupons according to industry standards where available. These data are valid only under the tested conditions and correspond to our state of the art at the time of publication. They do not warrant any guarantee for printed parts, the producer or purchaser of these parts is responsible for checking the ultimate properties of the printed material. The listed data are subject to change without notice. We strive to continuously develop and improve the machine's performance and therefore the properties of the printed materials.
2. Powder Chemistry as per Additive Industries specification O2333 Rev. 2.0 compliant with ASTM F2924
3. Additive Industries consolidated material is in compliance with ASTM B348
4. Density measured by Optical Measurement Method as per internal process. This is the minimum guaranteed value that is achieved under standard processing conditions, manufactured using Additive Industries' qualification jobs.
5. Tensile test samples were produced as round blanks. These were machined to size and tested in accordance with ASTM E8m at a NADCAP approved supplier.
6. Hardness measured in accordance with DIN EN ISO6507-1:2018 as per internal process. Hardness values measured in XY and XZ planes from components manufactured using Additive Industries' qualification jobs.
7. Surface Roughness measured in as-printed condition in accordance with internal process. Roughness measurement conducted on specimens with varying unsupported manufacturing angle.
8. Build Rate stated is a typical value per laser. It is calculated using the formula: Layer Thickness x Laser Scan Speed x Hatch Distance.
9. Parameter released: TI64_60_BAL_MF1A64_3.0.
10. Heat Treatment : 850 °C for 4 hours in a vacuum environment.
11. Volumetric density measured according to ASTM B962. This is a minimum volumetric density measurement achieved on samples manufactured using Additive Industries' qualification jobs.

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