COLIBRIUM ADDITIVE
a GE Aerospace company

13 Al | 22 Ti | 24 Cr | 26 Fe | 27 Co | 28 Ni | 29 Cu

L-PBF Ti6Al4V Grade 5

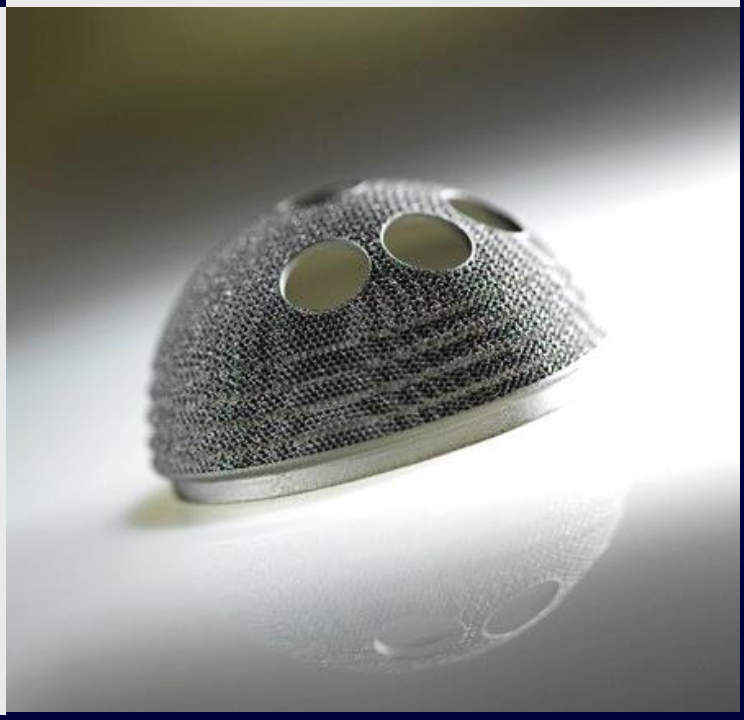
Parameters for Colibrium Additive's M2 Series 5

Titanium Ti6Al4V

Ti6Al4V Grade 5, renowned for its exceptional strength-to-weight ratio, is ideal for additive manufacturing. Its superior corrosion resistance ensures longevity and reliability in demanding environments. This alloy is widely used in the aerospace industry for critical components and in high-performance motorsports for lightweight, robust parts. Its versatile properties make Ti6Al4V a preferred choice across these advanced industries.

M2 Series 5 Ti6Al4V

The parameters for the Colibrium Additive M2 Series 5 are tailored to meet various demands. The balanced parameter, with a 60 µm layer thickness, ensures excellent surface quality, while the productivity parameter, featuring a 120 µm layer thickness, achieves exceptional productivity rates of up to 61 cm^3/h with our dual-laser system. All parameters exhibit outstanding tensile properties in a stress-relieved state and comply with ASTM F2924 standards.



M2 Series 5 Ti6Al4V

Machine Configuration

M2 Series 5

Single- or dual-laser architecture

Argon gas

Platform heating: 200°C

Powder Chemistry

Ti6Al4V Grade 5 powder chemical composition according to ASTM F2924

Particle size: 20-63 µm

For more information, visit: AP&C

Thermal States

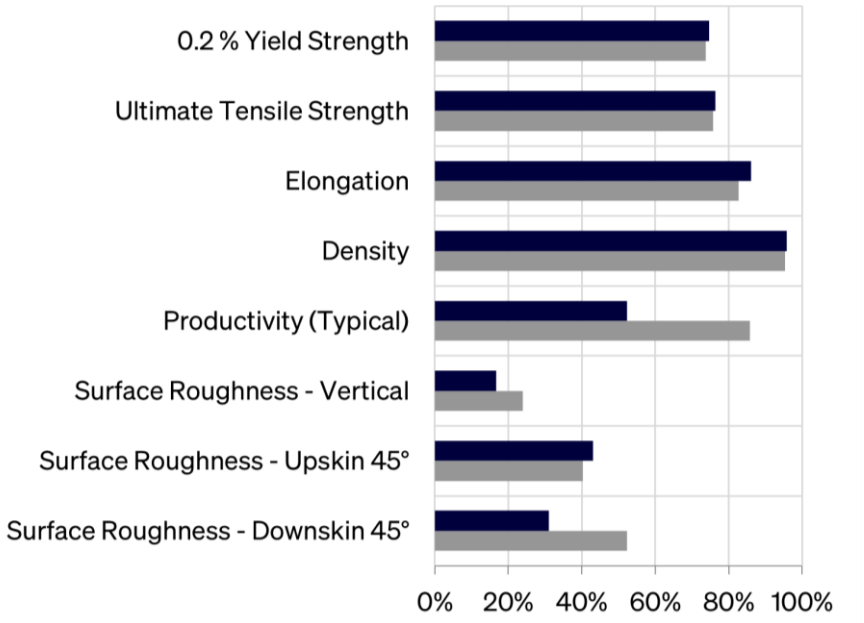
As-Built

Stress Relief (SR)

900°C for 1 hour in argon; furnace cooling

Parameter Availability and Thermal State Comparison

- Balanced Parameter 414 SR
  400 W, 60 µm layer thickness, rubber recoater
- Productivity Parameter 415 SR
  400 W, 120 µm layer thickness, rubber or steel recoater



Bar plot is generated by normalizing typical material data (containing both horizontal and vertical data) against a range defined for each material family. For titanium-based alloys, the ranges are as follows: 0.2%YS: 0-1250 MPa UTS: 0-1350 MPa, Elongation: 0-20%, Density: 99-100%, Productivity: 5-70 cm³/h, Surface Quality (all): 5-40 µm. 0% in the bar plot indicates the lower range value, 100% indicates the upper range value.

Balanced Parameter 414 - 400 W / 60 µm

Typical Build Rate

	(cm^3/h)
Typical build rate with coating[1]	39.0
Theoretical melting rate bulk per laser[2]	40.4

[1] Using standard Factory Acceptance Test layout and 2 lasers
[2] Calculated (layer thickness × scan velocity × hatch distance)

Tensile Performance at Room Temperature

Thermal State	Modulus of Elasticity (GPa)		0.2% Yield Strength (MPa)		Ultimate Tensile Strength (MPa)	
	H	V	H	V	H	V
As-Built	113	114	1145	1170	1275	1300
SR	117	119	930	935	1030	1025

Thermal State	Elongation (%)		Area Reduction (%)	
	H	V	H	V
As-Built	9.0	7.0	28	34
SR	16.5	17.5	43	47

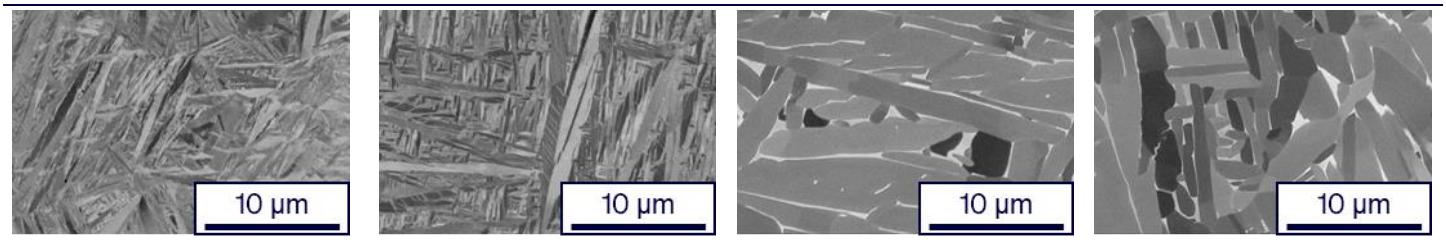
	Overhang Surface Roughness, Ra (µm)		
	45°	60°	75°
Upskin	21	16	13
Downskin	16	12	8

Surface Roughness, Ra (µm)	
H	21
V	11

Thermal State	Relative Density (%)		Hardness (HV10)
	H	V	H
As-Built	99.9	99.9	355
SR	99.9	99.9	335

Microstructure

As-Built		SR	
H	V	H	V



Scanning electron microscope images in As-Built and Stress Relief (SR) condition as defined previously.

Productivity Parameter 415 - 400 W / 120 µm

Typical Build Rate

	(cm^3/h)
Typical build rate with coating[1]	60.8
Theoretical melting rate bulk per laser[2]	56.2

[1] Using standard Factory Acceptance Test layout and 2 lasers
[2] Calculated (layer thickness × scan velocity × hatch distance)

Tensile Performance at Room Temperature

Thermal State	Modulus of Elasticity (GPa)		0.2% Yield Strength (MPa)		Ultimate Tensile Strength (MPa)	
	H	V	H	V	H	V
As-Built	113	112	1100	1145	1215	1260
SR	116	117	915	920	1020	1020

Thermal State	Elongation (%)		Area Reduction (%)	
	H	V	H	V
As-Built	10.5	6.5	35	34
SR	16.0	16.5	44	44

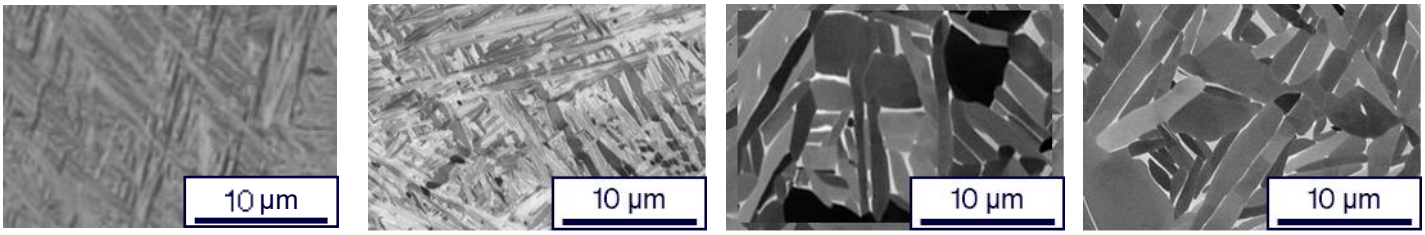
	Overhang Surface Roughness, Ra (µm)		
	45°	60°	75°
Upskin	20	16	15
Downskin	24	15	13

Surface Roughness, Ra (µm)	
H	15
V	14

Thermal State	Relative Density (%)		Hardness (HV10)
	H	V	H
As-Built	99.9	99.9	357
SR	99.9	99.9	332

Microstructure

As-Built		SR	
H	V	H	V



Scanning electron microscope images in As-Built and Stress Relief (SR) condition as defined previously.

Data Sheet Nomenclature and Notation

H: Horizontal, perpendicular to build direction.
V: Vertical, parallel to build direction.
Other angles are measured from horizontal.

Roughness measurements have been performed according to DIN EN ISO 4287 and DIN EN ISO 4288. In general analysis of the surface quality is strongly dependent on the methodology used and therefore deviations might be observed depending on methodology used. Vertical and horizontal sidewalls have been characterized using a tactile system, overhangs using an optical system.

Tensile evaluations were performed according to ASTM E8 or E21, depending on test temperature.