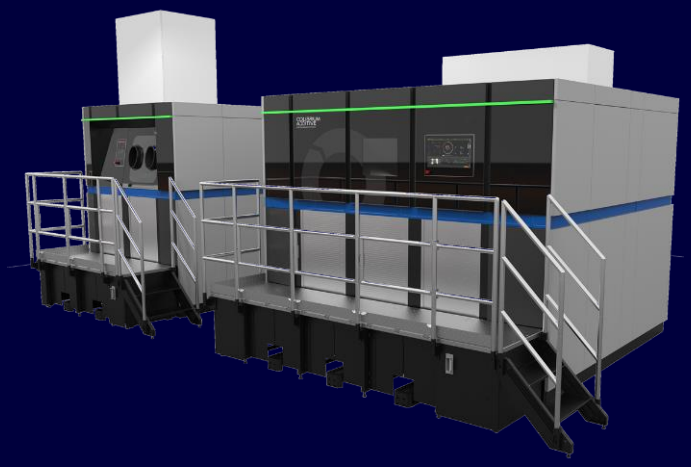
COLIBRIUM ADDITIVE
a GE Aerospace company

13 Al

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

L-PBF Ti6Al4V Grade 5

Parameter for Colibrium Additive's M Line



Titanium Ti6Al4V Grade 5

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.

M Line Ti6Al4V

The parameters for the Colibrium Additive M Line are developed based on the proven quality performance of the M2 Series 5 machines. Our balanced parameter, with a 60 µm layer thickness, delivers exceptional surface quality. For those seeking high productivity, our productivity parameter achieves 75 cm^3/h with a quad-laser system with a 120 µm layer thickness. All parameters exhibit outstanding tensile properties in a stress-relieved state and fully comply with ASTM F2924 standards.

M Line Ti6Al4V

Machine Configuration

M Line

Quad-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

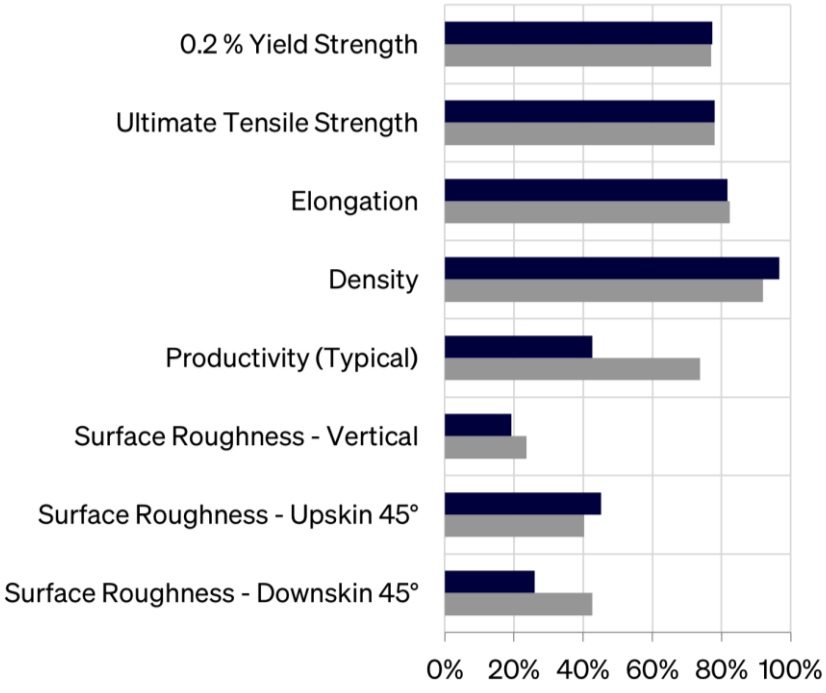
As-Built (AB)

Stress Relief (SR)

900°C for 1 hour in argon; furnace cooling

Parameter Availability and Thermal State Comparison

- Balanced Parameter 399 SR
  400 W, 60 µm layer thickness, rubber recoater
- Productivity Parameter 412 SR
  400 W, 120 µm layer thickness, rubber 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: 0-1350 MPa UTS: 0-1250 MPa, Elongation: 0-20%, Density: 99-100%, Productivity: 5- 100 cm^3/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 399 - 400 W / 60 µm

Typical Build Rate

	(cm^3/h)
Typical build rate with coating[1]	45.5
Theoretical melting rate bulk per laser[2]	34.0

[1] Using standard Factory Acceptance Test layout and 4 lasers
[2] Calculated (layer thickness × scan velocity × hatch distance)

Tensile Performance at Room Temperature

Thermal State	Sample Size	YM (GPa)	0.2% YS (MPa)	UTS (MPa)	Elongation (%)	Area Reduction (%)
As-Built H - SL	12	110	1170	1330	8.0	20
As-Built H - ST	12	110	1170	1325	6.5	20
As-Built V	63	112	1215	1345	9.0	20
SR H - SL	12	113	955	1050	15.5	39
SR H - ST	12	115	950	1050	15.5	40
SR V	36	119	975	1050	16.5	43

Physical Properties at Room Temperature

	Overhang Surface Roughness, Ra (µm)		
	45°	60°	75°
Upskin	21	17	13
Downskin	15	11	8

Surface Roughness, Ra (µm)	
H	---
V	12

Thermal State	Relative Density (%)	
	H	H
As-Built	99.9	99.9
SR	99.9	99.9

Productivity Parameter 412 - 400 W / 120 µm

Typical Build Rate

	(cm^3/h)
Typical build rate with coating[1]	75.0
Theoretical melting rate bulk per laser[2]	55.3

[1] Using standard Factory Acceptance Test layout and 4 lasers

[2] Calculated (layer thickness × scan velocity × hatch distance)

Tensile Performance at Room Temperature

Thermal State	Sample Size	YM (GPa)	0.2% YS (MPa)	UTS (MPa)	Elongation (%)	Area Reduction (%)
As-Built H - SL	12	110	1170	1315	8.0	25
As-Built H - ST	12	111	1170	1315	7.0	22
As-Built V	63	113	1200	1325	9.0	28
SR H - SL	12	115	955	1050	16.0	41
SR H - ST	12	115	955	1050	16.0	40
SR V	36	118	965	1055	16.5	41

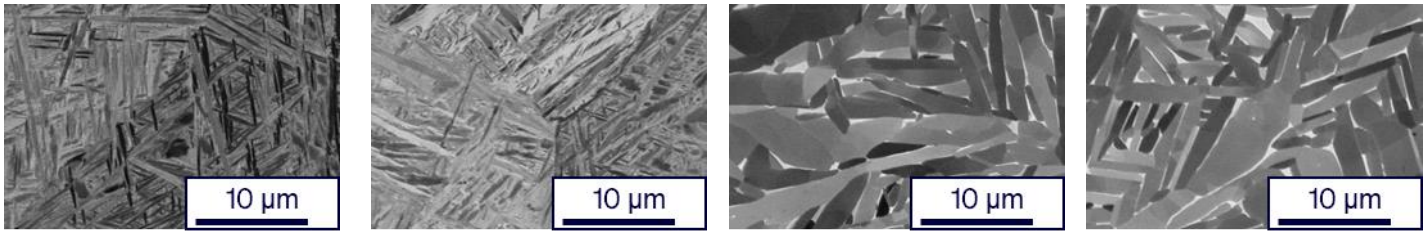
	Overhang Surface Roughness, Ra (µm)		
	45°	60°	75°
Upskin	20	16	14
Downskin	20	13	10

Surface Roughness, Ra (µm)	
H	16
V	14

Thermal State	Relative Density (%)		Hardness (HV10)
	H	H	H
As-Built	99.9	99.9	364
SR	99.9	99.9	343

Microstructure

As-Built		SR	
H	V	H	V



Scanning electron microscope images in As-Built and Stress Relief 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.

SL: Single Laser, parts build by one optical system.
ST: Stitched, parts build by multiple optical systems.

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.