13 Al

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

M2 Series 5 Titanium CpTi

Parameter for GE Additive's Concept Laser M2 Series 5

Data in this material datasheet represents material built with 30 µm layer thickness and in an argon atmosphere on a Concept Laser M2 Series 5 single-laser or dual-laser machine. Values listed are typical.

Titanium

In general, Titanium and its alloys have been used extensively in many industries due to their low density, high corrosion resistance and oxidation resistance. Commercially pure titanium (CpTi), due its biocompatibility and lack of potentially harmful alloying elements, is especially useful for medical devices and non-load bearing devices such as medical implants or trauma plates. Titanium alloys are used in additive manufacturing to produce a wide range of industrial components, including blades, fasteners, rings, discs, hubs and vessels.

M2 Series 5 CpTi

The parameter for the Concept Laser M2 Series 5 are developed leveraging the performance of the previous M2 generations of CpTi parameters. The surface parameter is a 30 µm parameter that produces best surface roughness in the range of 10 µm without bead blast or shot peening. The productivity 60 µm parameter showed similar vertical roughness by about 1.6 increased productivity.
Moreover, the microstructure shows extremely low amount of porosity.
The parameter has outstanding tensile properties exceeding the limits for conventional processed CpTi according to ASTM B348 Grade 2 in the stress relieved state.

M2 Series 5 Titanium CpTi

With appropriate approval* Commercially Pure Titanium (CpTi) can be used for medical and industrial applications.

Data in this material datasheet represents material built with 30 µm and 60 µm layer thickness and in an argon atmosphere on a Concept Laser M2 Series 5 single-laser or dual-laser. Values listed are typical.

POWDER CHEMISTRY

CpTi powder chemical composition according to ASTM B348 Grade 2. For additional information on CpTi Grade 2 powder, visit AP&C.

MACHINE CONFIGURATION

- Concept Laser M2 Series 5 (single-laser or dual-laser)
- Argon Gas
- Rubber recoater blade

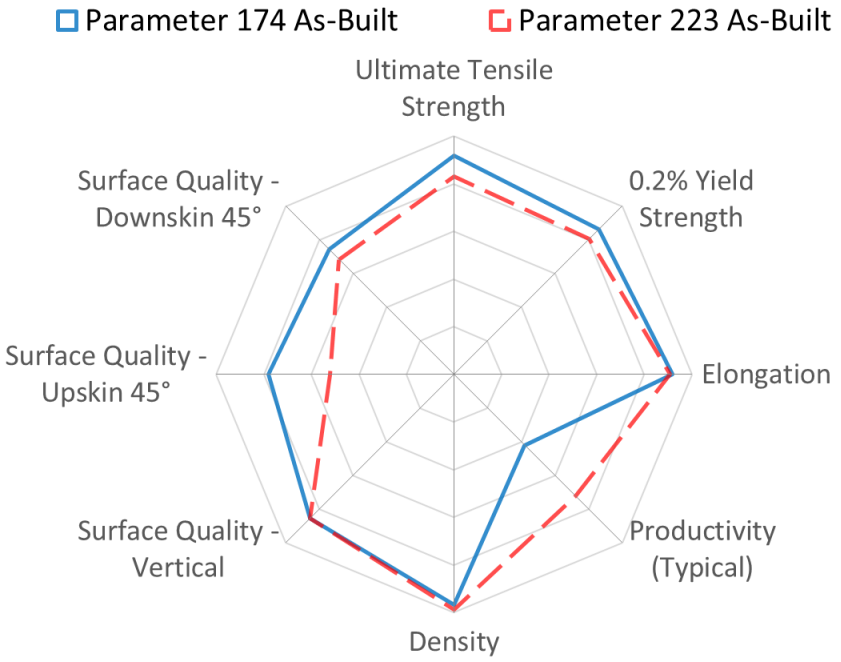
AVAILABLE PARAMETERS

- **Surface Parameter 174** 30 µm layer thickness, rubber recoater
- **Productivity Parameter 223** 60 µm layer thickness, rubber recoater

THERMAL STATES

1. As-Built
2. Stress Relief (SR)
   SR: 625°C, 1.25h hour in argon, furnace cooling

THERMAL STATE COMPARISON



Spider Plot is generated by normalizing typical material data (containing both horizontal and vertical data) against a range defined for each material family. For **CpTi**, the ranges are as follows: UTS: 0-800 MPa, 0.2%YS: 0-700 MPa, Elongation: 0-30 %, Density: 0-100 %, Productivity: 5-35 cm³/h, Surface Quality (all): 40-5 µm

TYPICAL BUILD RATE

Surface Parameter 174

	(cm³/h)
Typical build rate[1] w/coating	14.7
Theoretical melting rate[2] bulk per laser	16.6

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

PHYSICAL DATA AT ROOM TEMPERATURE

	Surface Roughness Ra – Overhang** (µm)		
	45°	60°	75°
Upskin	12	10	7
Downskin	14	10	7

	Surface Roughness Ra** (µm)
H	10
V	10

	Relative Density (%)		Hardness (HV10)		Poisson's Ratio	
Thermal State	H	V	H	V	H	V
As-Built	99.9	99.9	234	--	--	--
SR	99.9	99.9	213	--	--	--

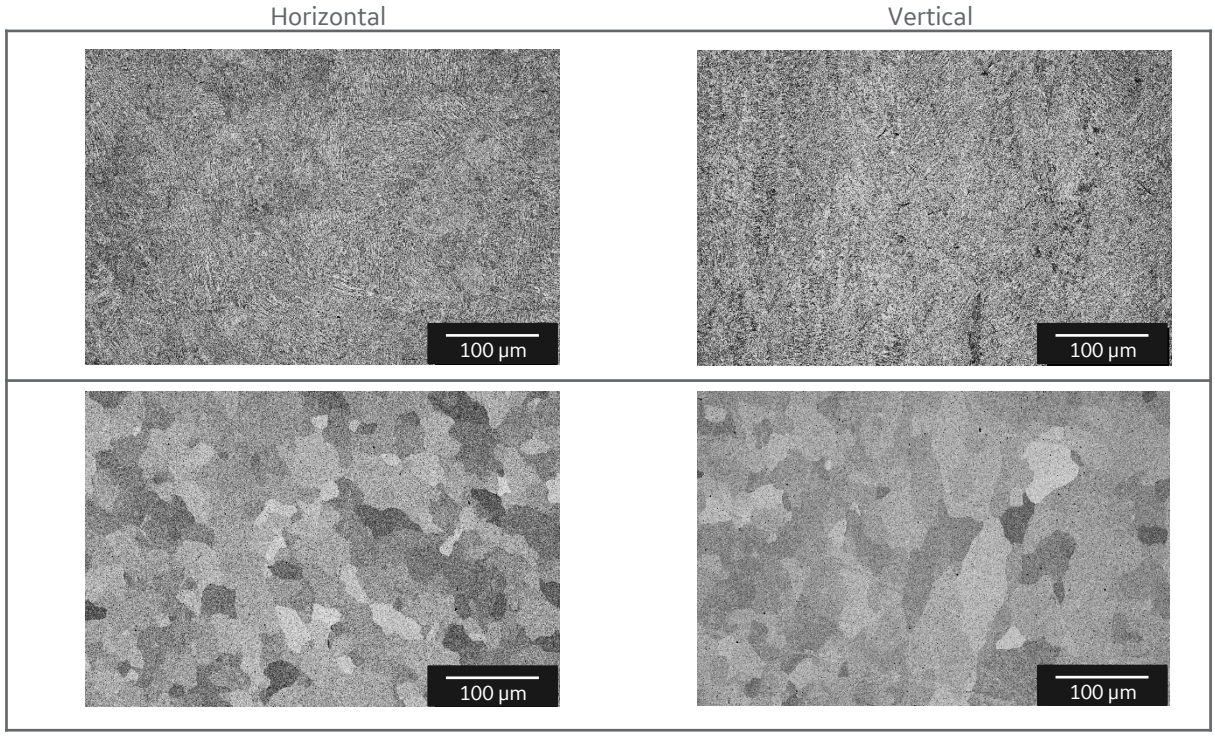
TENSILE DATA

Tensile testing done in accordance with ASTM E8 and ASTM E21

Test Temperature: RT

	Modulus of Elasticity (GPa)		0.2% Yield Strength (MPa)		Ultimate Tensile Strength (MPa)		Elongation (%)		Reduction of Area (%)	
Thermal State	H	V	H	V	H	V	H	V	H	V
As-Built	111	107	615	585	720	745	23	22	61	64
SR	108	115	475	520	595	620	25	25	53	59

SEM IMAGES



H: HORIZONTAL (XY) orientation
V: VERTICAL (Z) orientation

* All of the figures contained herein are approximate only. The figures provided are dependent on a number of factors, including but not limited to, process and machine parameters, and the approval is brand specific and/or application specific. The information provided on this material data sheet is illustrative only and cannot be relied on as binding.
** 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.

TYPICAL BUILD RATE

Productivity Parameter 223

	(cm³/h)
Typical build rate[1] w/coating	25.3
Theoretical melting rate[2] bulk per laser	25.9

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

PHYSICAL DATA AT ROOM TEMPERATURE

	Surface Roughness Ra – Overhang** (µm)		
	45°	60°	75°
Upskin	22	17	13
Downskin	16	12	9

	Surface Roughness Ra** (µm)
H	15
V	10

	Relative Density (%)		Hardness (HV10)		Poisson's Ratio	
Thermal State	H	V	H	V	H	V
As-Built	99.9	99.9	217	--	--	--
SR	99.9	99.9	211	--	--	--

TENSILE DATA

Tensile testing done in accordance with ASTM E8 and ASTM E21

Test Temperature: RT

	Modulus of Elasticity (GPa)		0.2% Yield Strength (MPa)		Ultimate Tensile Strength (MPa)		Elongation (%)		Reduction of Area (%)	
Thermal State	H	V	H	V	H	V	H	V	H	V
As-Built	114	113	560	560	665	665	22	21.5	49	58

H: HORIZONTAL (XY) orientation
V: VERTICAL (Z) orientation

* All of the figures contained herein are approximate only. The figures provided are dependent on a number of factors, including but not limited to, process and machine parameters, and the approval is brand specific and/or application specific. The information provided on this material data sheet is illustrative only and cannot be relied on as binding.
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