GE Additive

13 Al

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

M2 Series 5 Steel 17-4 PH

Parameters for Concept Laser M2 Series 5

Data in this material datasheet represents material built with a 50 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.

17-4 PH Stainless Steel

17-4 Precipitation hardenable (PH) stainless steel is used in applications for surgical or orthopedic instruments as well as chemical, oil, and aerospace industries due to high corrosion resistance and high strength and fracture toughness at moderate temperatures. Additive allows for shape freedom of complex geometries not possible with traditional manufacturing processes, where machining is very difficult to the high strength and hardness of 17-4 PH steel. Often additive parts are post-processed with blasting or polishing while traditional machining is minimized with intelligent additive design.

M2 Series 5 Steel 17-4 PH

The 17-4 PH parameters for the Concept Laser M2 Series 5 are developed leveraging the performance of the previous M2 generations. The Balanced parameters deliver good surface quality while maintaining a very good density, mechanical strength and productivity. The Balanced parameter 122 has been optimized for use of steel blade recoaters. For highest all-around surface quality, in particular within overhang downskin & upskin regions, the Surface Parameter has been developed.

M2 Series 5 Steel 17-4 PH

With corresponding approval* 17-4 PH is a widespread precipitation hardening steel which can be used for manufacturing functional components or medical instruments.

Data in this material datasheet represents material built with 25 and 50µm layer thickness and in an Argon atmosphere on a Concept Laser M2 Series 5 single laser or dual laser machine. Values listed are typical.

POWDER CHEMISTRY

Steel 17-4 PH powder chemical composition according to ASTM A564 / A564M - 13 UNS S17400 / SUS 630.

MACHINE CONFIGURATION

- Concept Laser M2 Series 5 (Single Laser or Dual Laser)
- Argon gas
- Stainless steel or rubber recoater blade

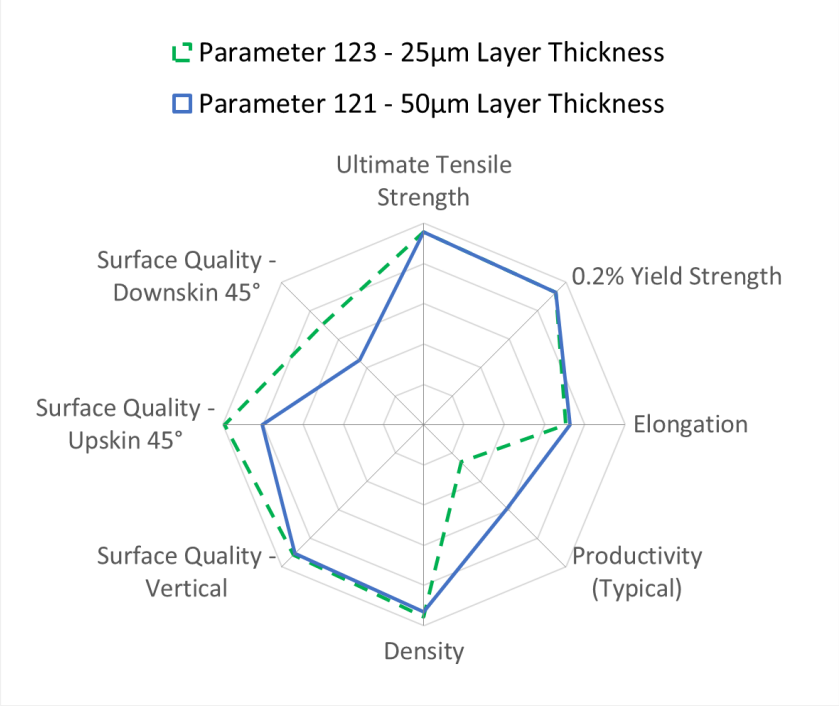
AVAILABLE PARAMETERS

- **Balanced Parameter 121** 50 µm layer thickness, rubber recoater
- **Balanced Parameter 122** 50 µm layer thickness, steel recoater
- **Surface Parameter 123** 25 µm layer thickness, rubber recoater

THERMAL STATES

1. As-Built
2. Solution Anneal + Age (SOLN+AGE)
   SOLN: 1040°C, 1 hour, water quench; AGE: 480°C, 1 hour, water quench

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 **Precipitation Hardening Steels,** the ranges are as follows: UTS: 0-1500 MPa, 0.2%YS: 0-1400 MPa, Elongation: 0-30%, Density: 0-100%, Productivity: 5-30 cm³/hr, Surface Quality (all): 40-5 µm

TYPICAL BUILD RATE

Parameters 121 & 122

	(cm³/h)
Typical build rate[1] w/coating	17.6
Theoretical melting rate[2] bulk per Laser	18.7

[1]Measured by using standard Factory Acceptance Test layout
[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	9	6
Downskin	24	13	7

	Surface Roughness Ra** (µm)
H	15
V	9

	Relative Density (%)		Hardness (HV10)		Poisson's Ratio	
Thermal State	H	V	H	V	H	V
As-Built	99.9	99.9	308	--	--	--
SOLN+AGE	99.9	99.9	457	--	--	--

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	185	180	715	705	995	935	17.3	17.6	--	--
SOLN+AGE	195	195	1315	1325	1440	1445	10.6	9.0	--	--

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

	(cm³/h)
Typical build rate[1] w/coating	7.9
Theoretical melting rate[2] bulk per Laser	9.0

[1]Measured by using standard Factory Acceptance Test layout
[2]Calculated (layer thickness x scan velocity x hatch distance)

PHYSICAL DATA AT ROOM TEMPERATURE

	Surface Roughness Ra** - Overhang (µm)		
	45°	60°	75°
Upskin	6	5	5
Downskin	16	6	5

	Surface Roughness Ra** (µm)
H	11
V	8

	Relative Density (%)		Hardness (HV10)		Poisson's Ratio	
Thermal State	H	V	H	V	H	V
As-Built	99.9	99.9	275	--	--	--
SOLN+AGE	99.9	99.9	--	--	--	--

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	170	160	780	765	855	805	22.3	22.2	--	--
SOLN+AGE	190	190	1280	1315	1420	1450	12.6	8.2	--	--

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V: VERTICAL (Z) orientation

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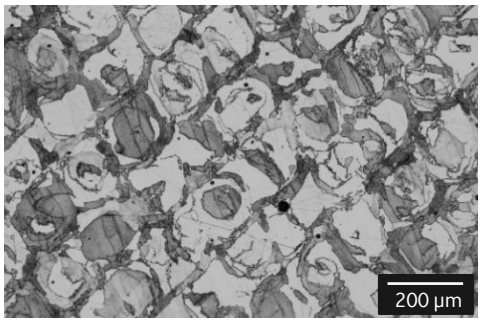
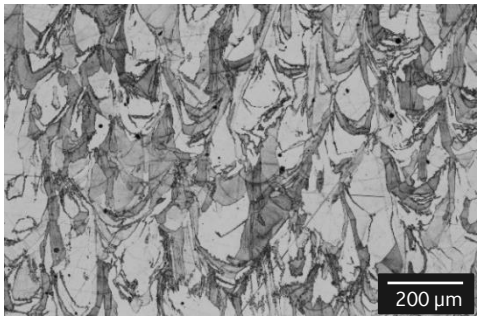
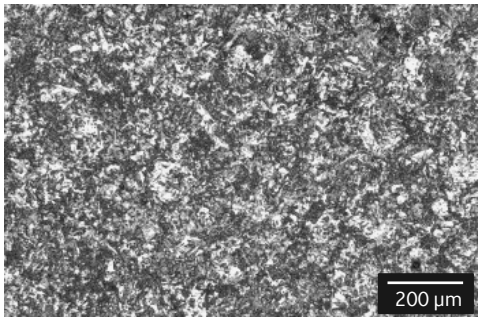
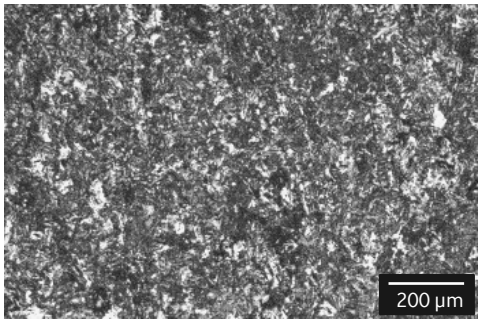
	Horizontal	Vertical
As-Built		
T7 SOLN + AGE		

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