13 Al

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

M2 Series 5 Steel CR-PH

Parameter for GE Additive's Concept Laser M2 Series 5

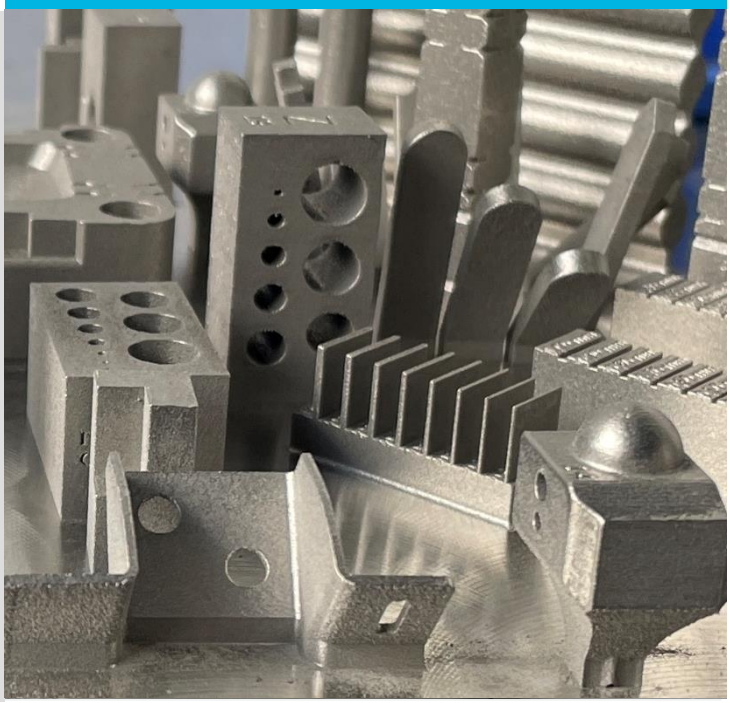
Data in this material datasheet represents material built with 30 µm layer thickness and in a nitrogen atmosphere on a Concept Laser M2 Series 5 single- or dual-laser machine. Values listed are typical.

Tool steel

CR-PH is a precipitation hardening stainless steel with outstanding corrosion and wear resistance. Due to its chemical composition the hardness can be flexible adjusted by an aging treatment and values up to 50 HRC can be reached. Next to that CR-PH shows good dimensional stability during heat treatment and favorable welding characteristics. Typical applications for CR-PH are molds for corrosive plastics, extrusion dies as well as engineering parts across various industries. Additive manufacturing offers new flexibility to design complex cooling channels and enable conformal cooling of e.g., injections molds. This can lead to significant cost savings by reduced cycle times and better part quality.

M2 Series 5 Steel CR-PH

The novel CR-PH parameter has recently been developed for M2 Series 5 machine.
The surface parameter is a 30 µm parameter that produces surface roughness less than 4 µm without bead blasting or shot peeing for vertical sidewalls. In addition, this parameter was optimized to process thin-walled structures with high feature resolution and best quality.



M2 Series 5 CR-PH Steel

With appropriate approval* CR-PH can be used within tooling industry like injection molds for corrosive plastics or molds within medical and food industry.

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

POWDER CHEMISTRY

CR-PH powder is a precipitation hardening tool steel with a chemical composition close to PH 13-8 Mo (1.4534)
For further information please contact GE Additive.

MACHINE CONFIGURATION

- Concept Laser M2 Series 5 (single- or dual-laser)
- Nitrogen gas
- Rubber recoater blade

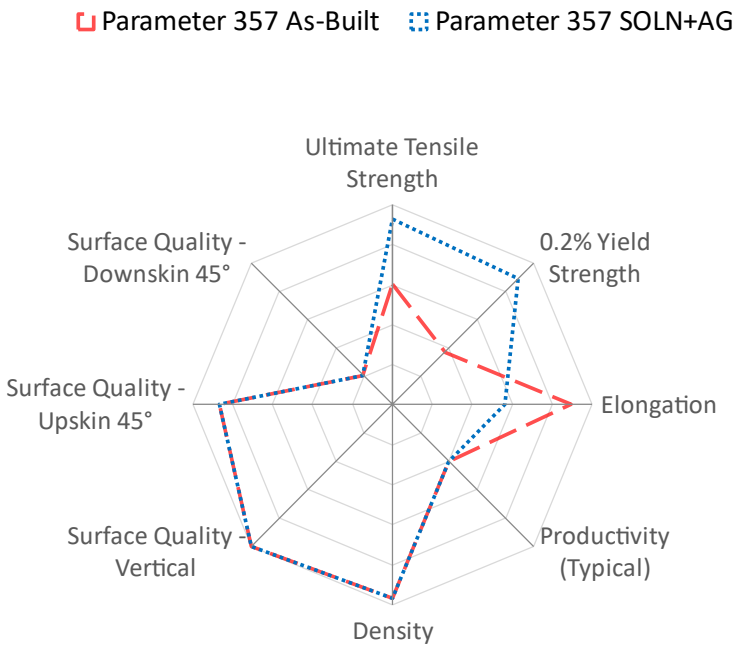
AVAILABLE PARAMETERS

- **Surface Parameter 357** — 30 µm layer thickness, rubber recoater

THERMAL STATES

1. As-Built
2. Solution Anneal + Age (SOLN+AGE)
   SOLN: 850°C, 0.5 hour in Argon, Cooling; AGE: 530 °C, 3 hours, cooled in air

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 **CR-PH**, the ranges are as follows: UTS: 0-1800 MPa, 0.2%YS: 0-1800 MPa, Elongation: 0-20 %, Density: 99-100 %, Productivity: 5-30 cm^3/h, Surface Quality (all): 40-4 µm

TYPICAL BUILD RATE

	(cm³/h)
Typical build rate[1] w/coating	12
Theoretical melting rate[2] bulk per Laser	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	9	7	5
Downskin	33	18	5

	Surface Roughness Ra** (µm)
H	6
V	4

	Relative Density (%)		Hardness		Poisson's Ratio	
Thermal State	H	V	HV10	HRC	H	V
As-Built	99.9	99.9	345	--	--	--
SOLN+AGE	99.9	99.9	512	51	--	--

TENSILE DATA

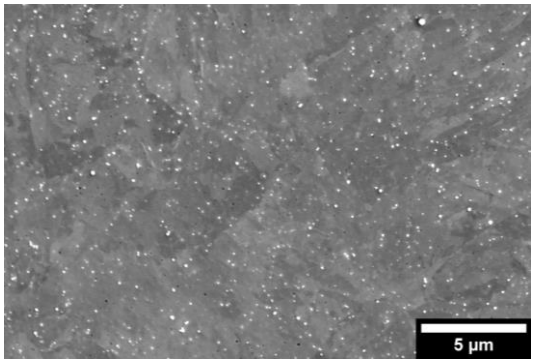
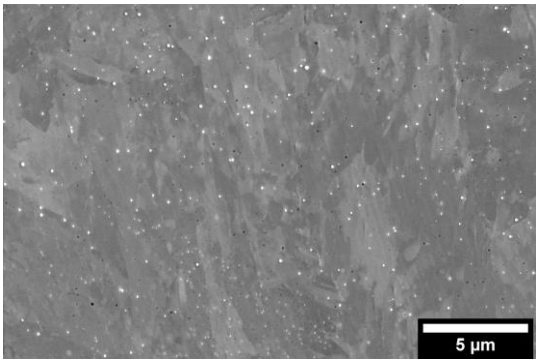
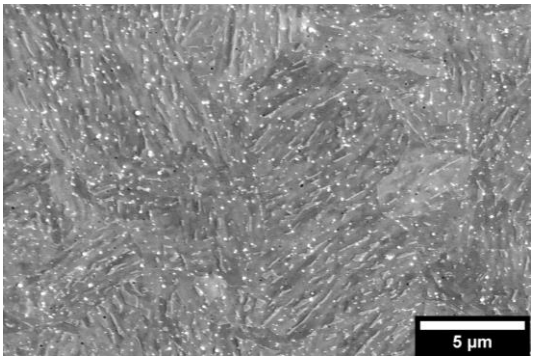
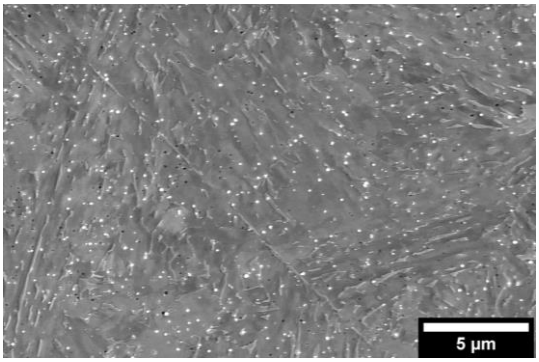
Tensile testing done in accordance with ASTM E8 and ASTM E21

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	--	--	640	700	1075	1090	15	14	64	63
SOLN+AGE	--	--	1585	1620	1650	1680	6	3	26	14

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.

	Horizontal	Vertical
As-Built		
SOLN+AGE		

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