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

M2 Series 5 Nickel 625

Parameters for GE Additive’s Concept Laser M2 Series 5

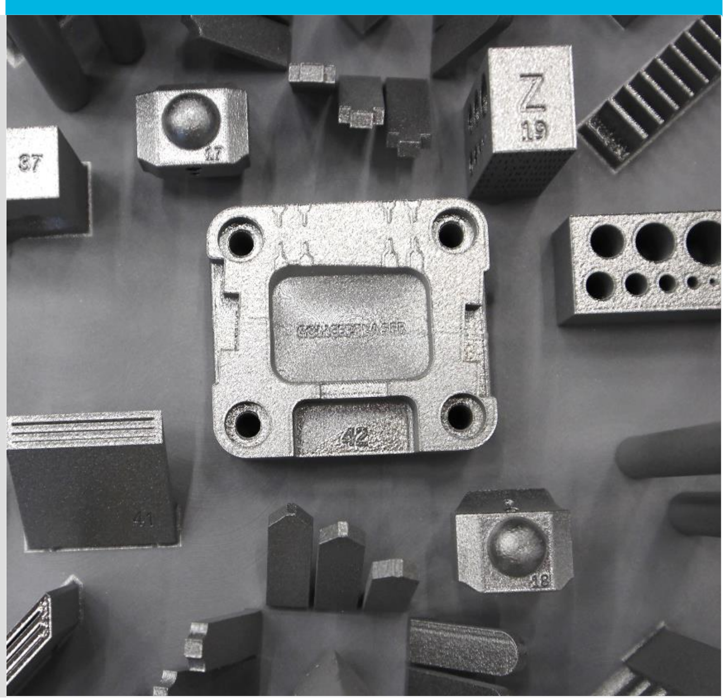
Data in this material datasheet represents material built with 30 µm and 60 µm layer thicknesses and in an argon atmosphere on a Concept Laser M2 Series 5 single-laser or dual-laser machine. Values listed are typical.

Nickel 625

Austenitic nickel-chromium superalloy Nickel 625 possesses excellent resistance to oxidation and corrosion combined with high strength over a wide temperature range from cryogenic temperatures to 982°C. The high (creep) strength is derived by solid-solution hardening of the nickel-chromium matrix, thus no age-hardening has to be applied. The alloy can be readily welded, which makes this alloy suitable for additive manufacturing. Typically, Nickel 625 is widely used in aerospace, marine engineering, chemical processing, oil and gas industry as well as power industry applications.

M2 Series 5 Nickel 625

The Nickel 625 parameters for the Concept Laser M2 Series 5 are developed leveraging the performance of the previous M2 generations. The base parameter is a 60 µm parameter that produces good surface roughness, while delivering a high productivity with dual lasers. For highest all-around surface quality, particularly within overhang downskin and upskin regions, the surface parameter has been developed. All parameters succeed the minimum tensile properties specified in ASTM F3056 and AMS 7000 for additive manufactured parts in the stress-relieved state.



M2 Series 5 Nickel 625

With corresponding approval* Nickel 625 can be used for manufacturing components for high-temperature applications.

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

POWDER CHEMISTRY

Nickel 625 powder chemical composition according to ASTM F3056 / AMS7000/ UNS N06625
For additional information on Nickel 625 powder, visit https://www.advancedpowders.com/powders/nickel/625.

MACHINE CONFIGURATION

- Concept Laser M2 Series 5 (single-laser or dual-laser)
- Argon gas
- Rubber

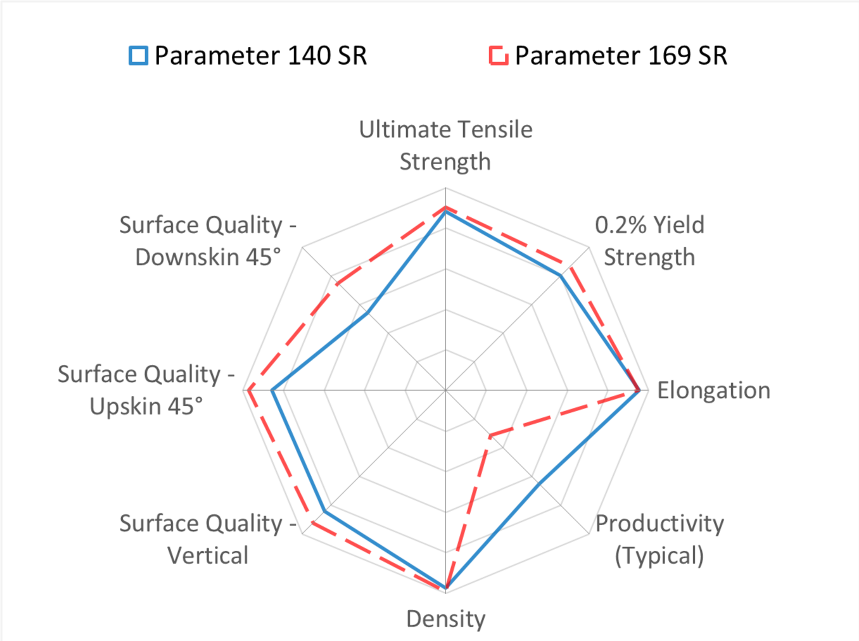
AVAILABLE PARAMETER

- **Base Parameter 140** — 60 µm layer thickness, rubber recoater
- **Surface Parameter 169** — 30 µm layer thickness, rubber recoater

THERMAL STATES

1. As-Built
2. Stress relief (SR)
   SR: 875°C, 0.5 hour in argon

PARAMETER 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 nickel-based superalloy **Nickel 625**, the ranges are as follows: UTS: 0-1050 MPa, 0.2%YS: 0-750 MPa, Elongation: 0-50 %, Density: 99-100 %, Productivity: 5-30 cm³/h, Surface Quality (all): 40-5 µm

TYPICAL BUILD RATE

	(cm³/h)
Typical build rate[1] w/coating	19.6
Theoretical melting rate[2] bulk per Laser	22.6

[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	10	8	7
Downskin	21	14	8

	Surface Roughness Ra** (µm)
H	13
V	11

	Relative Density (%)		Hardness (HV10)		Poisson's Ratio	
Thermal State	H	V	H	V	H	V
As-Built	99.9	99.9	268	--	--	--
SR	99.9	99.9	278	--	--	--

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	178	133	640	575	940	880	40.0	42.5	--	--
SR	178	153	605	590	955	895	40.0	43.5		--

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	9.4
Theoretical melting rate[2] bulk per Laser	8.6

[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	7	6	5
Downskin	14	9	6

	Surface Roughness Ra** (µm)
H	8
V	8

	Relative Density (%)		Hardness (HV10)		Poisson's Ratio	
Thermal State	H	V	H	V	H	V
As-Built	99.9	99.9	292	--	--	--
SR	99.9	99.9	295	--	--	--

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	168	138	710	625	980	890	37.0	42.5	--	--
SR	182	161	670	625	990	905	37.5	44.5	--	--

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

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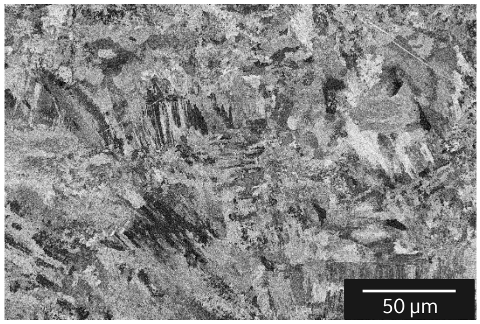
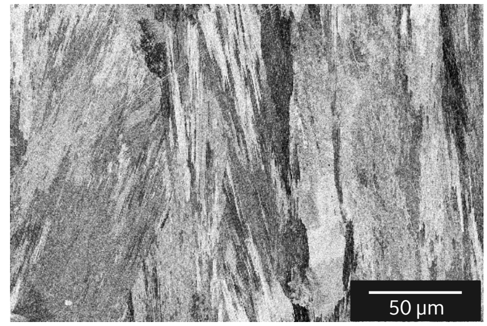
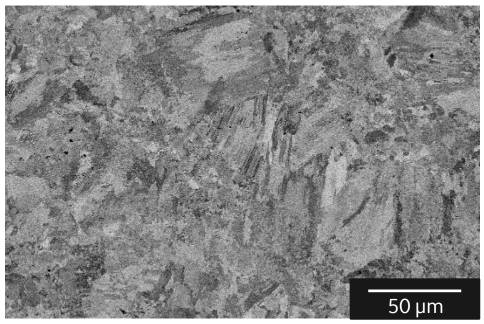
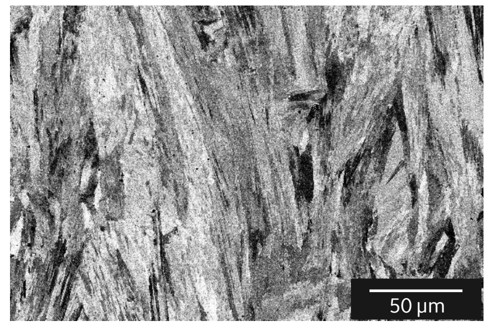
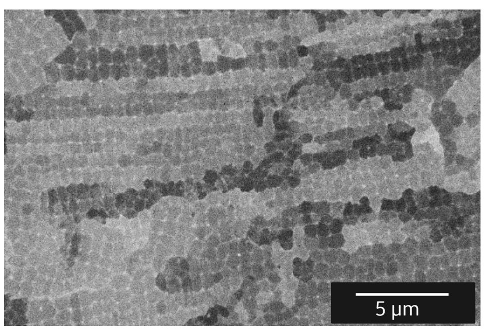
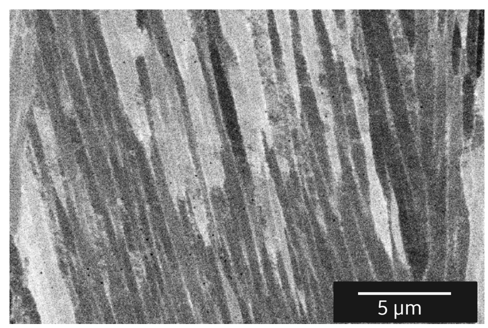
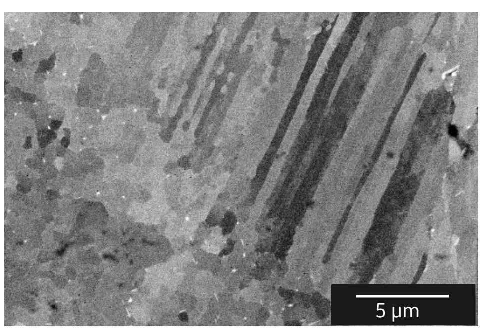
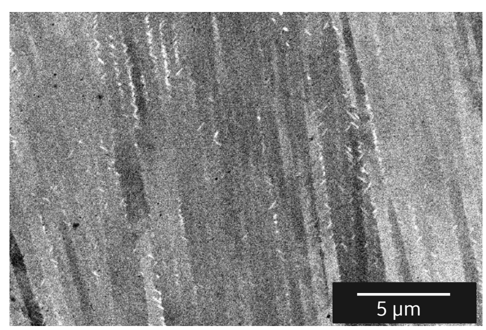
** Roughness measurements have been performed according to DIN EN ISO 4287 and DIN EN ISO 4288. In general analysis of the surface quality is strongly dependent on the methodology used and therefore deviations might be observed depending on methodology used. Vertical and horizontal sidewalls have been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

SEM IMAGES (low magnification)

	Horizontal	Vertical
As-Built		
SR		

SEM IMAGES (high magnification)

	Horizontal	Vertical
As-Built		
SR		

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V: VERTICAL (Z) orientation