F357

AMS4289

MATERIAL DATA SHEET

Nikon SLM SOLUTIONS

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MATERIAL

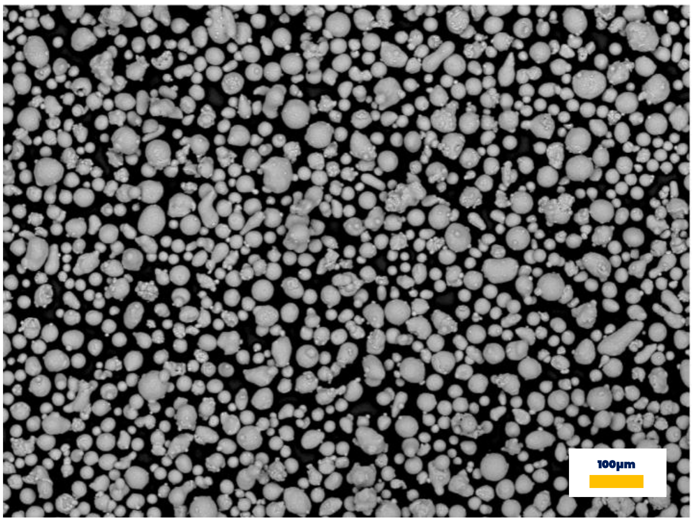
Aluminum – a lightweight and versatile material for more than 100 years now. Various processing routes (e.g. casting, rolling, forging) combined with good strength at a low mass density make aluminum an excellent choice for industrial applications. Good thermal and electrical conductivities as well as a high resistance in corrosive atmosphere complete the profile. Compared to AlSi10Mg, F357 features a reduced silicon content of around 7%, leading to increased mechanical properties, while still maintaining exceptional weldability. F357 is almost identical to the commonly known casting alloy A357, except it is completely free of the toxic element beryllium. F357 is in accordance with AlSi7Mg0.6 and already today in extended usage within aerospace or automotive applications.

CHEMICAL COMPOSITION

AMD4289[1]	Al	Si	Mg	Cu	Ti	Fe	Mn	Zn	Be	Total each	Total other
Min.	Bal.	6.5	0.40		0.04						
Max.		7.5	0.7	0.20	0.20	0.10	0.10	0.10	0.002	0.05	0.15

POWDER PROPERTIES

Particle Size[1]	20 - 63 µm
Mass Density[2]	≈ 2.67 g/cm³
Particle Shape[3,4]	Spherical, typical batch morphology displayed below



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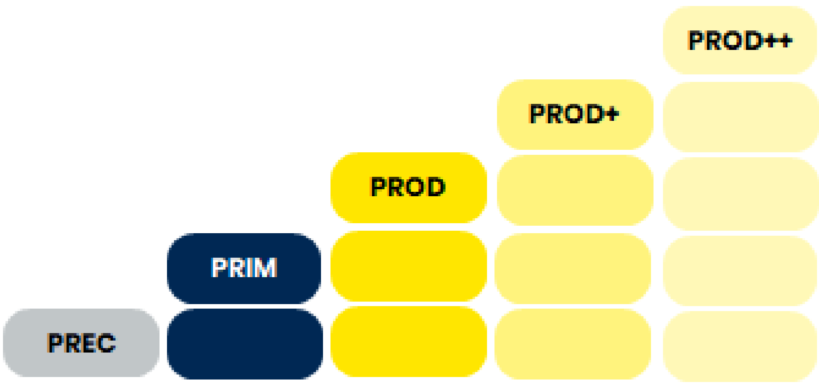
NIKON SLM® PARAMETERS

It only takes 3 tools to make you successful with metal additive manufacturing:

1. The **NIKON SLM® machine** fitting your needs,
2. The **metal powder** that defines the later purpose and functionality of a part,
3. Precisely engineered **NIKON SLM® parameters** as the missing link.

Our open parameters are the result of our vast experience in multi-laser technology and a diligent development and qualification procedure. They are key to produce fully functional parts with properties you can expect and rely on – whether you are new to AM or a large-scale production operator. We offer them to you in the following categories: **Precision (PREC)** for high-resolution complex details, **Prime (PRIM)** for balanced properties with improved productivity and **Productivity (PROD)** for the highest build rates. Pushing boundaries is in our work culture, we can also offer a new dimension of productivity on selected materials with **Productivity+ (PROD+)** and **Productivity++ (PROD++)** parameters.



MATERIAL QUALIFICATION

As one of the inventors of the selective laser melting process, we impose the most comprehensive test procedures on ourselves: hundreds of samples, multiple systems, various powder batches, numerous heat-treatments, machined vs. near-net-shape tensile specimens, several surface roughness conditions and angles, fatigue behavior, corrosion investigation, creep testing... Did we miss anything? Get in touch with us!

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SLM® 280 PRECISION

Parameter Set	F357_SLM280_PREC_MBP3_V1.0 (30 µm)
Machine Compatibility	SLM® 280 2.0, SLM® 280 Production System (400W)
Validated Data Preparation	Materialise SLM Build Processor
Theoretical System Build Rate[5]	45 cm³/h (Twin)
Minimum Relative Density[6,7]	99.9 %

MECHANICAL PROPERTIES[8]

M: Mean | MIN: Minimum (95 % population coverage / 95 % confidence level)[7]

Non-heat-treated

	Tensile strength R_m [MPa]		Yield strength $R_{p0.2}$ [MPa]		Elongation at break A [%]	
Machined	M	MIN	M	MIN	M	MIN
Horizontal	420	415	290	285	11	9
Vertical	430	425	265	260	8	5
Near-Net-Shape	M		M		M	
Vertical	410	400	260	250	7	5

HARDNESS[9]

M: Mean | MIN: Minimum (95 % population coverage / 95 % confidence level)[7]

	Vickers hardness HV10	
	M	MIN
As built	110	85

SURFACE ROUGHNESS[10]

M: Mean | MIN: Minimum (95 % population coverage / 95 % confidence level)[7]

	Roughness average Ra [µm]		Mean roughness depth Rz [µm]	
	M	MIN	M	MIN
As built	6	10	77	245
Corundum + Glass bead	5	10	31	67

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SLM® 280 PRIME

Parameter Set	F357_SLM280_PRIM_MBP3_V1 (60 µm)
Machine Compatibility	SLM® 280 2.0, SLM® 280 Production System (400W)
Validated Data Preparation	Materialise SLM Build Processor
Theoretical System Build Rate[5]	54 cm³/h (Twin)
Minimum Relative Density[6,7]	99.7 %

MECHANICAL PROPERTIES[8]

M: Mean | MIN: Minimum (95 % population coverage / 95 % confidence level)[7]

Non-heat-treated

	Tensile strength R_m [MPa]		Yield strength $R_{p0.2}$ [MPa]		Elongation at break A [%]	
Machined	**M**	**MIN**	**M**	**MIN**	**M**	**MIN**
Horizontal	415	400	280	270	8	5
Vertical	420	385	260	255	5	2
Near-Net-Shape	**M**		**M**		**M**	
Vertical	385	345	250	235	4	1

HARDNESS[9]

M: Mean | MIN: Minimum (95 % population coverage / 95 % confidence level)[7]

	Vickers hardness HV10	
	M	**MIN**
As built	120	115

SURFACE ROUGHNESS[10]

M: Mean | MAX: Maximum (95 % population coverage / 95 % confidence level)[7]

	Roughness average Ra [µm]		Mean roughness depth Rz [µm]	
	M	**MAX**	**M**	**MAX**
As built	15	21	92	124

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SLM® 280 PRODUCTIVITY

Parameter Set	F357_SLM280_PROD_MBP3_V1.0 (90 µm)
Machine Compatibility	SLM® 280 2.0, SLM® 280 Production System (700 W)
Validated Data Preparation	Materialise SLM Build Processor
Theoretical System Build Rate[5]	145 cm³/h (Twin)
Minimum Relative Density[6,7]	99.4 %

MECHANICAL PROPERTIES[8]

M: Mean | MIN: Minimum (95 % population coverage / 95 % confidence level)[7]

Non-heat-treated

	Tensile strength R_m [MPa]		Yield strength $R_{p0.2}$ [MPa]		Elongation at break A [%]	
Machined	M	MIN	M	MIN	M	MIN
Horizontal	385	380	245	235	7	5
Vertical	395	385	240	230	5	2
Near-Net-Shape	M		M		M	
Vertical	335	295	235	225	2	1

HARDNESS[9]

M: Mean | MIN: Minimum (95 % population coverage / 95 % confidence level)[7]

	Vickers hardness HV10	
	M	MIN
As built	110	105

SURFACE ROUGHNESS[10]

M: Mean | MAX: Maximum (95 % population coverage / 95 % confidence level)[7]

	Roughness average Ra [µm]		Mean roughness depth Rz [µm]	
	M	MAX	M	MAX
As built	20	25	125	161

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NXG PRECISION

Parameter Set	F357_NXG600_PREC_MBP3_V1 (30 µm)
Machine Compatibility	NXG XII 600 (1000 W)
Validated Data Preparation	Materialise SLM Build Processor
Theoretical System Build Rate[5]	270 cm³/h (12 Laser)
Minimum Relative Density[6,7]	99.9 %

MECHANICAL PROPERTIES[8]

M: Mean | MIN: Minimum (95 % population coverage / 95 % confidence level)[7]

Non-heat-treated

	Tensile strength R_m [MPa]		Yield strength $R_{p0.2}$ [MPa]		Elongation at break A [%]	
Machined	M	MIN	M	MIN	M	MIN
Vertical	425	420	275	270	8	5
Near-Net-Shape	M		M		M	
Vertical	405	400	265	260	7	4

HARDNESS[9]

M: Mean | MIN: Minimum (95 % population coverage / 95 % confidence level)[7]

	Vickers hardness HV10	
	M	MIN
As built	119	117

SURFACE ROUGHNESS[10]

M: Mean | MAX: Maximum (95 % population coverage / 95 % confidence level)[7]

	Roughness average Ra [µm]		Mean roughness depth Rz [µm]	
	M	MAX	M	MAX
As built	5	8	29	43

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NXG PRIME

Parameter Set	F357_NXG600_PRIM_MBP3_V1 (60 µm)
Machine Compatibility	NXG XII 600 (1000 W)
Validated Data Preparation	Materialise SLM Build Processor
Theoretical System Build Rate[5]	672 cm³/h (12 Lasers)
Minimum Relative Density[6,7]	99.7 %

MECHANICAL PROPERTIES[8]

M: Mean | MIN: Minimum (95 % population coverage / 95 % confidence level)[7]

Non-heat-treated

	Tensile strength R_m [MPa]		Yield strength $R_{p0.2}$ [MPa]		Elongation at break A [%]	
Machined	M	MIN	M	MIN	M	MIN
Vertical	400	390	255	245	5	3
Near-Net-Shape	M		M		M	
Vertical	365	355	245	240	3	2

HARDNESS[9]

M: Mean | MIN: Minimum (95 % population coverage / 95 % confidence level)[7]

	Vickers hardness HV10	
	M	MIN
As built	113	107

SURFACE ROUGHNESS[10]

M: Mean | MAX: Maximum (95 % population coverage / 95 % confidence level)[7]

	Roughness average Ra [µm]		Mean roughness depth Rz [µm]	
	M	MAX	M	MAX
As built	12	15	65	83

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DISCLAIMER

The properties and mechanical characteristics apply to powder that is tested and sold by Nikon SLM Solutions, and that has been processed on Nikon SLM Solutions machines using the original Nikon SLM Solutions parameters in compliance with the applicable operating instructions (including installation conditions and maintenance). The part properties are determined based on specified procedures. More details about the procedures used by Nikon SLM Solutions are available upon request.

The specifications correspond to the most recent knowledge and experience available to us at the time of publication and do not form a sufficient basis for component design on their own. Certain properties of products or parts or the suitability of products or parts for specific applications are not guaranteed. The manufacturer of the products or parts is responsible for the qualified verification of the properties and their suitability for specific applications. The manufacturer of the products or parts is responsible for protecting any third-party proprietary rights as well as existing laws and regulations.

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NOTES

[1] With respect to powder material. Compositions stated as mass or weight percent.

[2] Material density varies within the range of possible chemical composition variations.

[3] According to DIN EN ISO 3252:2023.

[4] Secondary Electron Image of a typical powder batch

[5] Theoretical system build rate = layer thickness x scan speed x hatch distance x number of lasers. The value represents a com-parable indicator but remains a theoretical value after all. It does expressively not reflect true build rates, which are influenced by part geometry, ratio between hatch and contour areas, area of exposure, recoating times, and more.

[6] Optical density determination at test specimens by light microscopy according to internal specification. Relative density may vary depending on part geometry, orientation, volume, and other process factors. Population coverage: 99 %, confidence level: 99 %.

[7] Minimum or maximum values are set by using tolerance interval method, which is a statistical approach based on the input of population coverage (PC) and confidence level (CL). Tolerance intervals ensure that a certain percentage of samples within a batch will be above the minimum value or below the maximum value with a certain probability, e.g. the probability that 95% of all samples will be above the minimum value or below the maximum value (within a defined batch and tested according to mentioned specifications) is 95%.

[8] Tensile testing was performed in accordance to DIN EN ISO 6892-1:2020 B and conducted at room temperature. Samples are either machined before testing or tested in near-net-shape without any surface finishing (geometry according to DIN 50125:2016-D6x30). Values include overlap samples, i.e. multiple lasers work simultaneously on one specimen. All data is derived from standardized SLM Solutions qualification jobs. Samples are built out of both virgin powder as well as used powder.

[9] Hardness testing according to DIN EN ISO 6507-1:2024. Measurement direction “2” according to VDI 3405 2.1. Values include overlap samples, i.e. multiple lasers work simultaneously on one specimen. All data is derived from standardized SLM Solutions qualification jobs. Samples are built out of both virgin powder as well as used powder.

[10] Roughness measurement on vertical walls according to DIN EN ISO 21920-3:2022; $\lambda c = 2.5$ mm. Glass bead blasting is an additional post-processing step after corundum blasting. Values include overlap samples, i.e. multiple lasers work simultaneously on one specimen. All data is derived from standardized Nikon SLM Solutions qualification jobs. Samples are built out of both virgin powder as well as used powder.