SLM SOLUTIONS

AlSi10Mg

DIN EN1706 / EN AC-43000

MATERIAL DATA SHEET

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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. AlSi10Mg is one of the most common aluminum alloys, originally designed as hardenable casting alloy for sophisticated designs. Due to its inherent characteristics, AlSi10Mg is particularly suited for lightweight designs and highly stressed components with famous examples from aerospace engineering or the automotive industry – even facing dynamic loads.

CHEMICAL COMPOSITION

DIN EN 1706[1]													
	Al	**Si**	**Mg**	**Fe**	**Mn**	**Ti**	**Zn**	**Cu**	**Ni**	**Pb**	**Sn**	**Total each**	**Total others**
Min.	Bal.	9.00	0.20										
Max.		11.00	0.45	0.55	0.45	0.15	0.10	0.05	0.05	0.05	0.05	0.05	0.15

POWDER PROPERTIES

Particle Size[1]	20 - 63 µm
Mass Density[2]	≈ 2.67 g/cm³
Particle Shape[3]	Spherical

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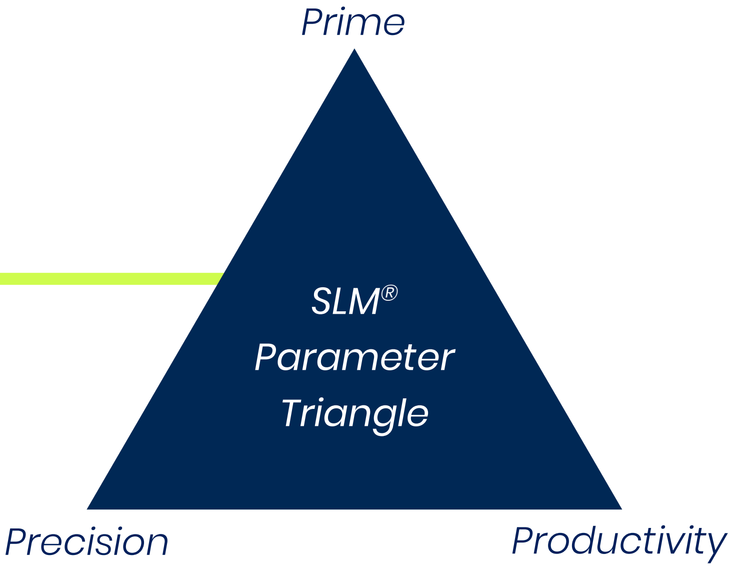
SLM® PARAMETERS

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

1. The **SLM® machine** fitting your needs,
2. The **metal powder** that defines the later purpose and functionality of a part,
3. Precisely engineered **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 in three categories to you: from high-resolution complex details (**Precision**) up to the highest build rates (**Productivity**) or right in between (**Prime**).



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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PRECISION SLM® 280

Parameter Set	AlSi10Mg_PREC_MBP3_V1 (30 µm)
Machine Compatibility	SLM® 280 2.0, SLM® 280 Production Series (400 W)
Validated Data Preparation	Materialise SLM Build Processor
Theoretical System Build Rate[4]	49 cm³/h (Twin)
Minimum Relative Density[5,10]	99.9 %

Mechanical Properties[6]

M: Mean | SD: Standard deviation

Non-heat-treated (NHT)

Machined	Tensile strength R_m [MPa]		Yield strength $R_{p0.2}$ [MPa]		Elongation at break A [%]	
	M	SD	M	SD	M	SD
Horizontal	455	5	300	10	8	1
Vertical	475	5	275	10	6	1

Heat-treated (SR)[7]

Machined	Tensile strength R_m [MPa]		Yield strength $R_{p0.2}$ [MPa]		Elongation at break A [%]	
	M	SD	M	SD	M	SD
Horizontal	280	20	170	15	20	4
Vertical	285	20	160	10	18	3

Hardness[8]

M: Mean | SD: Standard Deviation

	Vickers hardness HV5	
	M	SD
NHT	124	7
SR[7]	82	1

Surface Roughness[9]

M: Mean | SD: Standard Deviation

	Roughness average Ra [µm]		Mean roughness depth Rz [µm]	
	M	SD	M	SD
As built	8	2	55	13
Corundum	5	1	34	6
Corundum + Glass bead	4	1	26	4

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SLM SOLUTIONS

PRIME SLM® 280

Parameter Set	AlSi10Mg_PRIM_MBP3_V1 (60 µm)
Machine Compatibility	SLM® 280 2.0, SLM® 280 Production Series (400 W)
Validated Data Preparation	Materialise SLM Build Processor
Theoretical System Build Rate[4]	71.2 cm³/h (Twin)
Minimum Relative Density[5,10]	99.5 %

Mechanical Properties[6]

M: Mean | SD: Standard deviation

Non-heat-treated (NHT)

	Tensile strength R_m [MPa]		Yield strength $R_{p0.2}$ [MPa]		Elongation at break A [%]	
Machined	M	SD	M	SD	M	SD
Horizontal	445	10	280	10	8	2
Vertical	435	30	260	10	5	2

Heat-treated (SR)[7]

	Tensile strength R_m [MPa]		Yield strength $R_{p0.2}$ [MPa]		Elongation at break A [%]	
Machined	M	SD	M	SD	M	SD
Horizontal	270	10	155	10	20	5
Vertical	275	10	155	10	15	5

Hardness[8]

M: Mean | SD: Standard Deviation

	Vickers hardness HV5	
	M	SD
NHT	130	10
SR[7]	85	5

Surface Roughness[9]

M: Mean | SD: Standard Deviation

	Roughness average Ra [µm]		Mean roughness depth Rz [µm]	
	M	SD	M	SD
As built	13	2	80	13
Corundum	8	1	49	7
Corundum + Glass bead	5	1	30	4

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SLM SOLUTIONS

PRODUCTIVITY SLM® 280

Parameter Set	AlSi10Mg_PROD_MBP3_V1 (60 µm)
Machine Compatibility	SLM® 280 2.0, SLM® 280 Production Series (700 W)
Validated Data Preparation	Materialise SLM Build Processor
Theoretical System Build Rate[4]	135.8 cm^3/h (Twin)
Minimum Relative Density[5,10]	99.4 %

Mechanical Properties[6]

M: Mean | SD: Standard deviation

Non-heat-treated (NHT)

	Tensile strength R_m [MPa]		Yield strength $R_{p0.2}$ [MPa]		Elongation at break A [%]	
Machined	M	SD	M	SD	M	SD
Horizontal	425	5	255	10	8	2
Vertical	425	10	240	10	6	2

Heat-treated (SR)[7]

	Tensile strength R_m [MPa]		Yield strength $R_{p0.2}$ [MPa]		Elongation at break A [%]	
Machined	M	SD	M	SD	M	SD
Horizontal	265	15	145	15	16	3
Vertical	270	15	145	15	13	3

Hardness[8]

M: Mean | SD: Standard Deviation

	Vickers hardness HV10	
	M	SD
NHT	125	10
SR[7]	80	5

Surface Roughness[9]

M: Mean | SD: Standard Deviation

	Roughness average Ra [µm]		Mean roughness depth Rz [µm]	
	M	SD	M	SD
As built	16	4	96	22
Corundum	9	3	52	18
Corundum + Glass bead	7	1	41	7

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SLM SOLUTIONS

PRECISION SLM® 500

Parameter Set	AlSi10Mg_SLM500_PREC_MBP3_V1 (30 µm)
Machine Compatibility	SLM® 500 1.3 (400 W)
Validated Data Preparation	Materialise SLM Build Processor
Theoretical System Build Rate[4]	98 cm³/h (Quad)
Minimum Relative Density[5,10]	99.8 %

Mechanical Properties[6]

M: Mean | MIN: Minimum (95 % population coverage / 95 % confidence level)[10]

Non-heat-treated (NHT)

	Tensile strength R_m [MPa]		Yield strength $R_{p0.2}$ [MPa]		Elongation at break A [%]	
Machined	M	MIN	M	MIN	M	MIN
Horizontal	450	435	300	290	8	6
Vertical	470	445	280	270	5	3
Near-Net-Shape	M	MIN	M	MIN	M	MIN
Vertical	425	380	265	245	3	0

Hardness[8]

M: Mean | MIN: Minimum (95 % PC / 95 % CL)[10]

	Vickers hardness HV5	
	M	MIN
NHT	127	120

Surface Roughness[9]

M: Mean | MAX: Maximum (95 % PC / 95 % CL)[10]

	Roughness average Ra [µm]		Mean roughness depth Rz [µm]	
	M	MAX	M	MAX
As built	12	25	80	152

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SLM SOLUTIONS

PRIME SLM® 500

Parameter Set	AlSi10Mg_SLM500_PRIM_MBP3_V1 (60 µm)
Machine Compatibility	SLM® 500 1.3 (700 W)
Validated Data Preparation	Materialise SLM Build Processor
Theoretical System Build Rate[4]	272 cm³/h (Quad)
Minimum Relative Density[5,10]	99.4 %

Mechanical Properties[6]

M: Mean | MIN: Minimum (95 % population coverage / 95 % confidence level)[10]

Non-heat-treated (NHT)

	Tensile strength R_m [MPa]		Yield strength $R_{p0.2}$ [MPa]		Elongation at break A [%]	
Machined	M	MIN	M	MIN	M	MIN
Horizontal	430	405	275	250	6	3
Vertical	425	385	255	245	4	1
Near-Net-Shape	M	MIN	M	MIN	M	MIN
Vertical	375	340	245	225	3	0

Hardness[8]

M: Mean | MIN: Minimum (95 % PC / 95 % CL)[10]

	Vickers hardness HV5	
	M	MIN
NHT	120	114

Surface Roughness[9]

M: Mean | MAX: Maximum (95 % PC / 95 % CL)[10]

	Roughness average Ra [µm]		Mean roughness depth Rz [µm]	
	M	MAX	M	MAX
As built	20	23	118	139

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AlSi10Mg

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SLM SOLUTIONS

PRODUCTIVITY SLM® 500

Parameter Set	AlSi10Mg_SLM500_PROD_MBP3_V1 (90 µm)
Machine Compatibility	SLM® 500 1.3 (700 W)
Validated Data Preparation	Materialise SLM Build Processor
Theoretical System Build Rate[4]	345 cm³/h (Quad)
Minimum Relative Density[5,10]	99.0 %

Mechanical Properties[6]

M: Mean | MIN: Minimum (95 % population coverage / 95 % confidence level)[10]

Non-heat-treated (NHT)

	Tensile strength R_m [MPa]		Yield strength $R_{p0.2}$ [MPa]		Elongation at break A [%]	
Machined	M	MIN	M	MIN	M	MIN
Horizontal	405	380	250	225	6	3
Vertical	400	365	235	225	4	2
Near-Net-Shape	M	MIN	M	MIN	M	MIN
Vertical	345	315	230	210	2	1

Hardness[8]

M: Mean | MIN: Minimum (95 % PC / 95 % CL)[10]

	Vickers hardness HV5	
	M	MIN
NHT	114	106

Surface Roughness[9]

M: Mean | MAX: Maximum (95 % PC / 95 % CL)[10]

	Roughness average Ra [µm]		Mean roughness depth Rz [µm]	
	M	MAX	M	MAX
As built	15	24	92	141

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SLM SOLUTIONS

PRIME NXG XII 600

Parameter Set	AlSi10Mg_NXG600_PRIM_MBP3_V1 (60 µm)
Machine Compatibility	NXG XII 600
Validated Data Preparation	Materialise SLM Build Processor
Theoretical System Build Rate[4]	720 cm³/h
Minimum Relative Density[5,10]	99.6 %

Mechanical Properties[6]

M: Mean | MIN: Minimum (95 % population coverage / 95 % confidence level)[10]

Non-heat-treated (NHT)

	Tensile strength R_m [MPa]		Yield strength $R_{p0.2}$ [MPa]		Elongation at break A [%]	
Machined	M	MIN	M	MIN	M	MIN
Horizontal	425	400	275	265	6	3
Vertical	430	410	250	240	4	2
Near-Net-Shape	M	MIN	M	MIN	M	MIN
Vertical	385	360	245	230	3	1

Hardness[8]

M: Mean | MIN: Minimum (95 % PC / 95 % CL)[10]

	Vickers hardness HV5	
	M	MIN
NHT	115	110

Surface Roughness[9]

M: Mean | MAX: Maximum (95 % PC / 95 % CL)[10]

	Roughness average Ra [µm]		Mean roughness depth Rz [µm]	
	M	MAX	M	MAX
As built	13	16	77	95

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DISCLAIMER

The properties and mechanical characteristics apply to powder that is tested and sold by SLM Solutions, and that has been processed on SLM Solutions machines using the original 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 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.

MDS_AlSi10Mg_2023_05.1_EN

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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 3252:2001.

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

[5] 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: 95 %, confidence level: 95 %.

[6] Tensile testing was performed in accordance to DIN EN ISO 6892-1:2017 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. Population coverage: 95 %, confidence level: 95 %.

[7] Heat treatment: Stress relieving at 300 °C for 2 h, followed by air-cooling.

[8] Hardness testing according to DIN EN ISO 6507-1:2018. 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.

[9] Roughness measurement on vertical walls according to DIN EN ISO 4288:1998; λc = 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 SLM Solutions qualification jobs. Samples are built out of both virgin powder as well as used powder.

[10] Minimum 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 with a certain probability, e.g. the probability that 95 % of all samples will be above the stated minimum value (within a defined batch and tested according to mentioned specifications) is 95 %.