Material Data Sheet

Al-Alloy AlSi10Mg[1]

General

AlSi10Mg is a hardenable aluminum-based alloy with a density of circa 2.67 g/cm^3. It is applicable for thin-walled components and parts with complex geometries. AlSi10Mg is highly suitable for processing and characterized by a good resistance in corrosive atmospheres as well as a high electrical conductivity. The combination of achievable high strengths while maintaining dynamic load capacity enable it to be used for highly stressed parts. With this profile of properties, AlSi10Mg is currently the most common aluminum-based alloy. Components made of AlSi10Mg are ideal to use in areas such as aerospace engineering and the automotive industry.

Material Structure

SLM® processed aluminum-based alloy components exhibit a homogeneous, nearly non-porous texture, with mechanical characteristic values in the range of material specifications. Through subsequent processing such as heat treatment, the components' properties can be adapted to meet specific requirements. Due to high solidi cation rates, a typical heat treatment of aluminum alloys (T6) is not necessary for SLM® parts. Therefore, only a stress relief heat treatment at 300 °C for 2 h is recommended after the SLM® process.

Chemical composition [Mass fraction in %][2]

Al	Si	Fe	Cu	Mn	Mg	Zn	Ti	Ni	Pb	Sn	Other total
Balance	9.00 – 11.00	0.55	0.05	0.45	0.20 – 0.45	0.10	0.15	0.05	0.05	0.05	0.15

Powder properties

Particle size[2]	20 – 63 µm	Particle shape[3]	Spherical
Mass density[4]	≈ 2.67 g/cm^3	Thermal conductivity[5]	130 – 150 W/(m·K)

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30 µm / 400 W[6]		As-built	Heat-treated[14]
Build-up rate[9]	[cm³/h]	24.5 cm³/h	
Component density[10]	[%]	≥ 99.5 %	

Tensile test[11]				M	SD	M	SD
Tensile strength	R_m	[MPa]	H	454	5	276	16
			V	474	5	280	14
Offset yield strength	$R_{p0,2}$	[MPa]	H	297	7	166	12
			V	271	7	158	7
Elongation at break	A	[%]	H	8	1	19	3
			V	6	1	17	2
Reduction of area	Z	[%]	H	9	1	36	4
			V	7	2	31	3
Young's modulus	E	[GPa]	H	73	4	62	16
			V	74	2	66	7

Hardness test[12]		M	SD	M	SD
Vickers hardness	HV5	124	7	82	1

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

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60 µm / 400 W[7]			As-built	Heat-treated[14]
Build-up rate[9]	[cm³/h]		35.6 cm³/h	
Component density[10]	[%]		≥ 99.0 %	

Tensile test[11]			M	SD	M	SD
Tensile strength	R_m [MPa]	H	443	6	264	5
		V	432	28	273	5
Offset yield strength	$R_{p0,2}$ [MPa]	H	277	7	151	8
		V	259	5	154	6
Elongation at break	A [%]	H	8	1	19	3
		V	5	1	14	3
Reduction of area	Z [%]	H	7	2	30	5
		V	4	1	19	6
Young's modulus	E [GPa]	H	72	5	57	14
		V	71	3	58	14

Hardness test[12]		M	SD	M	SD
Vickers hardness	HV5	127	4	80	1

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

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60 µm / 700 W[8]		As-built	Heat-treated[14]
Build-up rate[9]	[cm³/h]	67.9 cm³/h	
Component density[10]	[%]	≥ 99.0 %	

Tensile test[11]				M	SD	M	SD
Tensile strength	R_m	[MPa]	H	421	4	261	12
			V	424	10	270	11
Offset yield strength	$R_{p0,2}$	[MPa]	H	251	6	141	13
			V	235	5	142	10
Elongation at break	A	[%]	H	8	1	16	3
			V	6	1	13	2
Reduction of area	Z	[%]	H	7	1	20	3
			V	6	1	17	3
Young's modulus	E	[GPa]	H	72	5	59	14
			V	72	3	57	8

Hardness test[12]		M	SD	M	SD
Vickers hardness	HV5	123	7	76	1

Roughness measurement[13]			As-built		Corundum blasted		Glass-bead blasted	
			M	SD	M	SD	M	SD
Roughness average	Ra	[µm]	16	4	9	3	7	1
Mean roughness depth	Rz	[µm]	96	22	52	18	41	7

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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.

[1] Material according to DIN EN 1706:2013, EN AC-43000, EN AC-AlSi10Mg(a).

[2] With respect to powder material.

[3] According to DIN EN ISO 3252:2001.

[4] Material density varies by ± 0,01 g/cm^3 within the range of possible chemical composition variations.

[5] Literature value for conventionally manufactured material at 20 °C.

[6] Material data file: AlSi10Mg_SLM_MBP3.0_30_CE2_400W_Stripes_V1.2

[7] Material data file: AlSi10Mg_SLM_MBP3.0_60_CE2_400W_Stripes_V1.3

[8] Material data file: AlSi10Mg_SLM_MBP3.0_60_CE2_700W_Stripes_V1.3

[9] Theoretical build-up rate for each laser = layer thickness x scan speed x track distance

[10] Optical density determination at test specimens by light microscopy.

[11] Tensile test according to DIN EN ISO 6892-1:2017 B (DIN 50125:2016 – D6x30); testing machine: ZwickRoell ProLine; load range: 100 kN; testing speed: 0,008 1/s; testing temperature: room temperature. Test samples were turned before tensile test.

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

[13] Roughness measurement according to DIN EN ISO 4288:1998; λc = 2,5 mm. Glass-bead blasting is an additional post-processing step after corundum blasting.

[14] Heat treatment: 2 h at 300 °C, air quenching.

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