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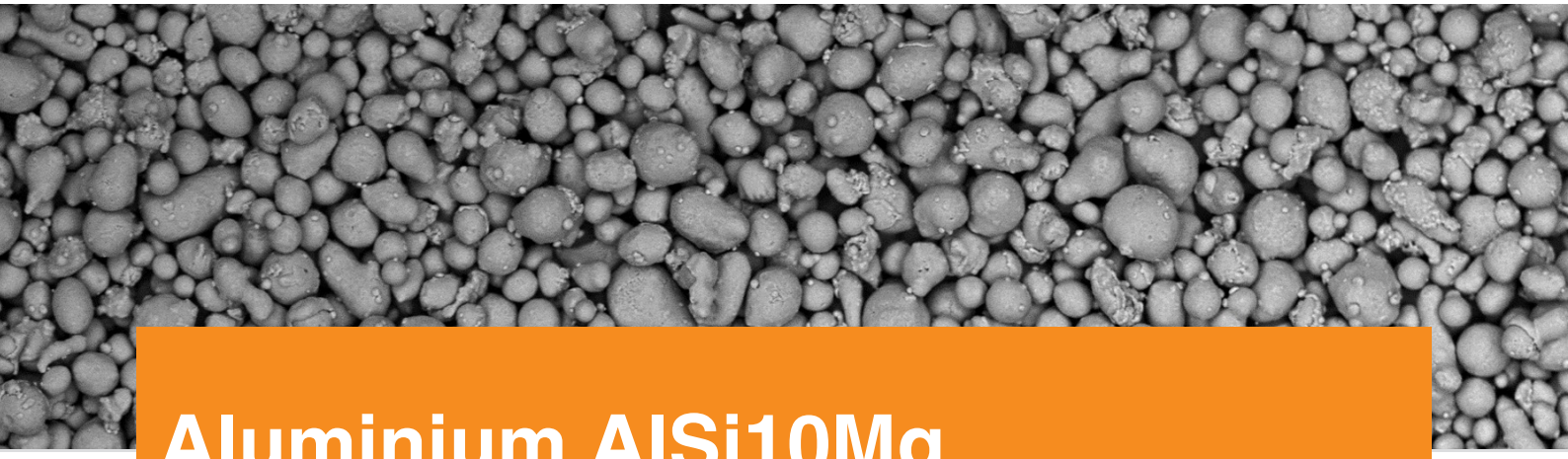

Aluminium AlSi10Mg

Parameter set options

Layer thickness	Optimised for	Page number
30 µm	Single laser per part	3
60 µm	Single laser per part	4
60 µm	Multiple lasers per part	5

To download the latest material files, visit **www.renishaw.com/softwarelicensing.**

Material description

AlSi10Mg-0403 alloy comprises aluminium alloyed with silicon of mass fraction up to 10%, small quantities of magnesium and iron, along with other minor elements. The presence of silicon makes the alloy both harder and stronger than pure aluminium due to the formation of Mg_2Si precipitate.

Due to the natural formation of an oxide layer on the surface of the aluminium alloy, the material has high corrosion resistance which can be further improved by chemically anodising.

Material properties

- Low density (ideal for lightweight components)
- High specific strength (strength to mass ratio)
- High thermal conductivity
- Very high electrical conductivity
- Responds well to post process finishing

Applications

- Automotive
- Aerospace and defence
- Electronics cooling
- Consumer goods

Generic material data

Typical wrought material properties

Material property	Wrought material value
Density	2.7 g/cm^3
Thermal conductivity	130 W/mK to 190 W/mK
Melting temperature	570 °C to 590 °C
Coefficient of thermal expansion [1]	20×10^{-6} K^{-1} to 21×10^{-6} K^{-1}

[1] In the range of 0 °C to 100 °C.

Recommended composition of powder

Element	Mass (%)
Aluminium	Balance
Silicon	9.00 to 11.00
Magnesium	0.25 to 0.45
Iron	≤ 0.25
Nitrogen	≤ 0.20
Oxygen	≤ 0.20
Titanium	≤ 0.15
Zinc	≤ 0.10
Manganese	≤ 0.10
Nickel	≤ 0.05
Copper	≤ 0.05
Lead	≤ 0.02
Tin	≤ 0.02
Residual elements	≤ 0.05 each, ≤ 0.05 total

Recommended powder size distribution: 20 µm to 63 µm.

The values shown in this table are representative of a general composition powder. Renishaw powders are supplied to a tighter specification to minimise batch-to-batch variations. Results quoted in this data sheet are from samples produced using Renishaw's tighter-specification powder. To purchase powder from Renishaw, visit the online store at **www.renishaw.com/shop.**

Please contact Renishaw for further information about specifications or if you require support in qualifying non-Renishaw powders.

Parameter set summary

Layer thickness	Optimised for	Laser mode	Gas flow rate	Build rate	
30 µm	Single laser per part	Modulated	180 m^3/h	One laser: 17.5 cm^3/h	Four lasers: 70 cm^3/h

Material files: AlSi10Mg_500QS_A30_M_##_# (meander scan strategy)
AlSi10Mg_500QS_A30_S_##_# (stripe scan strategy)

Properties of additively manufactured components

NOTE: This parameter set is optimised for bulk density. The material properties in this table are indicative only. Further modification of the material file may be required to suit your application.

	As built		Stress relieved [1]	
	Mean	Standard deviation	Mean	Standard deviation
Bulk density [2]	≥ 99.8%	-	≥99.8%	-
Ultimate tensile strength [3]				
Vertical direction (Z)	428 MPa	11 MPa	315 MPa	3 MPa
Yield strength [3]				
Vertical direction (Z)	262 MPa	5 MPa	212 MPa	3 MPa
Elongation after fracture [3]				
Vertical direction (Z)	4%	1%	14%	2%
Modulus of elasticity [3]				
Vertical direction (Z)	69 GPa	4 GPa	73 GPa	7 GPa
Hardness (Vickers) [4]				
Horizontal direction (XY)	124 HV0.5	4 HV0.5	-	-
Vertical direction (Z)	119 HV0.5	5 HV0.5	-	-

Mechanical test samples were created using four lasers, one laser per sample and with no downstream processing. Meander scan strategy was used for vertical samples and stripe scan strategy for horizontal samples. The mechanical property data were obtained from tests performed in Renishaw's laboratories and they indicate the mechanical properties that can be achieved. The data is not intended as a guaranteed minimum specification.

1 Stress relieving method used for testing: Under argon at 15 L/min flow rate, heat at 3 °C/min to 275 °C ±10 °C, then hold temperature for 2 hours. Air cool to room temperature.

2 Measured optically on a 10 mm × 10 mm × 10 mm sample at 75× magnification.

3 Tested at ambient temperature to ASTM E8. Machined prior to testing. Values based on 16 samples.

4 Tested to ASTM E384-11 after polishing.

Parameter set summary

Layer thickness	Optimised for	Laser mode	Gas flow rate	Build rate	
60 µm	Single laser per part	Continuous wave	180 m^3/h	One laser: 48.6 cm^3/h	Four lasers: 194.4 cm^3/h

Material files: AlSi10Mg_500QS_B60_M_##_# (meander scan strategy)
AlSi10Mg_500QS_B60_S_##_# (stripe scan strategy)

Properties of additively manufactured components

NOTE: This parameter set is optimised for bulk density. The material properties in this table are indicative only. Further modification of the material file may be required to suit your application.

	As built		Stress relieved [1]	
	Mean	Standard deviation	Mean	Standard deviation
Bulk density [2]	≥ 99.8 %	-	≥99.8%	-
Ultimate tensile strength [3]				
Vertical direction (Z)	430 MPa	13 MPa	294 MPa	2 MPa
Yield strength [3]				
Vertical direction (Z)	264 MPa	4 MPa	179 MPa	3 MPa
Elongation after fracture [3]				
Vertical direction (Z)	5%	1%	12%	3%
Modulus of elasticity [3]				
Vertical direction (Z)	69 GPa	5 GPa	75 GPa	7 GPa
Hardness (Vickers) [4]				
Horizontal direction (XY)	122 HV0.5	7 HV0.5	90 HV0.5	1 HV0.5
Vertical direction (Z)	119 HV0.5	7 HV0.5	85 HV0.5	3 HV0.5
Surface roughness (Ra) [5]				
Vertical direction (Z)	11 Ra	1 Ra	-	-

Mechanical test samples were created using four lasers, one laser per sample and with no downstream processing. Meander scan strategy was used for vertical samples and stripe scan strategy for horizontal samples. The mechanical property data were obtained from tests performed in Renishaw's laboratories and they indicate the mechanical properties that can be achieved. The data is not intended as a guaranteed minimum specification.

1 Stress relieving method used for testing: Under argon at 15 L/min flow rate, heat at 3 °C/min to 275 °C ±10 °C, then hold temperature for 2 hours. Air cool to room temperature.

2 Measured optically on a 10 mm × 10 mm × 10 mm sample at 75× magnification.

3 Tested at ambient temperature to ASTM E8. Machined prior to testing. Values based on 16 samples.

4 Tested to ASTM E384-11 after polishing.

5 Tested on as-built vertical surfaces using laser interferometry. Tested to JIS B 0601-2001 (ISO 97).

Parameter set summary

Layer thickness	Optimised for	Laser mode	Gas flow rate	Build rate
60 µm	Multiple lasers per part	Continuous wave	180 m^3/h	Four lasers: 194.4 cm^3/h

Material files: AlSi10Mg_500QS_C60_S_##_# (stripe scan strategy)

Properties of additively manufactured components

NOTE: This parameter set is optimised for bulk density. The material properties in this table are indicative only. Further modification of the material file may be required to suit your application.

	As built		Stress relieved [1]	
	Mean	Standard deviation	Mean	Standard deviation
Bulk density [2]	≥ 99.8%	-	≥99.8%	-
Ultimate tensile strength [3]				
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Horizontal direction (XY)	122 HV0.5	7 HV0.5	90 HV0.5	1 HV0.5
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Surface roughness (Ra) [5]				
Vertical direction (Z)	11 Ra	1 Ra	-	-

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