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AlSi10Mg-0403 powder for additive manufacturing

Process specification

Powder description	Aluminium alloy powder
Layer thickness	25 µm
Laser power	200 W
Additive manufacturing system	AM250

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 (good for light weight 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 data - wrought material

Density	2.68 g/cm³
Thermal conductivity	130 W/mK to 190 W/mK
Melting range	570 °C to 590 °C
Coefficient of thermal expansion (see note 1)	20 $10^{-6}K^{-1}$ to 21 $10^{-6}K^{-1}$

Note 1 In the range of 0 °C to 100 °C.

Note 2 Stress relieved at 300 °C ±10 °C for 2 hrs, air cooled.

Note 3 Tested at ambient temperature by Nadcap and UKAS accredited independent laboratory. Test ASTM E8. Machined prior to testing.

Note 4 Tested to ASTM E384-11, after polishing.

Note 5 Tested to JIS B 0601-2001 (ISO 97). As built after bead blasting.

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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

Mechanical properties of additively manufactured components

	As Built	**Stress relieved** (See note 2)
Ultimate tensile strength (UTS) (See note 3)		
Horizontal direction (XY)	400 MPa ±13 MPa	361 MPa ±4 MPa
Vertical direction (Z)	366 MPa ±30 MPa	394 MPa ±4 MPa
Yield strength (see note 3)		
Horizontal direction (XY)	266 MPa ±2 MPa	236 MPa ±3 MPa
Vertical direction (Z)	220 MPa ±11 MPa	215 MPa ±6 MPa
Elongation at break (see note 3)		
Horizontal direction (XY)	4% ±1%	5% ±1%
Vertical (Z)	3% ±1%	5% ±2%
Modulus of elasticity (see note 3)		
Horizontal direction (XY)	64 GPa ±16 GPa	78 GPa ±6 GPa
Vertical direction (Z)	69 GPa ±9 GPa	85 GPa ±7 GPa
Hardness (Vickers) (see note 4)		
Horizontal direction (XY)	83 HV0.5 ±2 HV0.5	116 HV0.5 ±3 HV0.5
Vertical direction (Z)	113 HV0.5 ±3 HV0.5	112 HV0.5 ±2 HV0.5
Surface roughness (R_a) (See note 5)		
Horizontal direction (XY)	5 µm to 7 µm	
Vertical direction (Z)	7 µm to 9 µm	

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