

In625-0402 powder for additive manufacturing

Process specification

Powder description	Nickel alloy powder
Layer thickness	30 µm and 60 µm
Laser power	200 W
Additive manufacturing system	AM250

Material description

In625-0402 alloy comprises nickel alloyed with chromium of mass fraction up to 23% and molybdenum up to 10%, along with other minor elements. The addition of niobium, acting with molybdenum, gives the alloy high strength and toughness in the annealed condition.

In625-0402 has a wide range of applications within industry and is particularly suitable for seawater applications and applications where corrosion and oxidation resistance at high temperatures is required. Similar to In718-0405 which is suitable for applications where good tensile, creep, and rupture strength is required.

Material properties

- High creep resistance
- Very high corrosion and oxidation resistance at high temperatures
- High fatigue strength in seawater
- Excellent welding characteristics
- Nonmagnetic

Applications

- Automotive
- Aerospace and defence
- Chemical process industry
- Marine engineering
- Oil and gas industry
- Nuclear
- Seawater heat exchangers

Generic data - wrought material

Density	8.44 g/cm ³
Thermal conductivity	9.2 W/mK to 10.7 W/mK
Melting range	1290 °C to 1350 °C
Coefficient of thermal expansion (see note 1)	12.8 10 ⁻⁶ K ⁻¹

Note 1 In the range of 20 °C to 200 °C.

Note 2 Annealed at 1048 °C for 1 hr followed by furnace cool.

Note 3 Tested at ambient temperature to ASTM E8. Machined prior to testing. Values based on a sample size of 6.

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

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

Composition of powder

Element	Mass (%)
Nickel	Balance
Chromium	20.00 to 23.00
Molybdenum	8.00 to 10.00
Iron	≤ 5.00
Niobium	3.15 to 4.15
Cobalt	≤ 1.00
Copper	≤ 0.50
Manganese	≤ 0.50
Silicon	≤ 0.50
Aluminium	≤ 0.40
Titanium	≤ 0.40
Carbon	≤ 0.10
Tantalum	≤ 0.05
Nitrogen	≤ 0.02
Oxygen	≤ 0.02
Phosphorus	≤ 0.015
Sulphur	≤ 0.015

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

Mechanical properties of additively manufactured components built using 30 µm layer thickness

	As built		Heat treated (see note 2)	
	Mean	Standard deviation ($\pm 1\sigma$)	Mean	Standard deviation ($\pm 1\sigma$)
Ultimate Tensile strength (UTS) (See note 3)				
Horizontal direction (XY)	1055 MPa	3 MPa	1020 MPa	1 MPa
Vertical direction (Z)	964 MPa	2 MPa	955 MPa	2 MPa
Yield strength (see note 3)				
Horizontal direction (XY)	767 MPa	9 MPa	633 MPa	1 MPa
Vertical direction (Z)	676 MPa	7 MPa	598 MPa	2 MPa
Elongation at break (see note 3)				
Horizontal direction (XY)	34%	1%	39%	1%
Vertical direction (Z)	42%	1%	43%	1%
Modulus of elasticity (see note 3)				
Horizontal direction (XY)	205 GPa	10 GPa	206 GPa	3 GPa
Vertical direction (Z)	186 GPa	11 GPa	200 GPa	2 GPa
Hardness (Vickers) (See note 4)				
Horizontal direction (XY)	331 HV0.5	8 HV0.5	251 HV0.5	13 HV0.5
Vertical direction (Z)	332 HV0.5	8 HV0.5	254 HV0.5	16 HV0.5
Surface roughness (R_a) (See note 5)				
Horizontal direction (XY)	2 µm to 3 µm			
Vertical direction (Z)	6 µm to 7 µm			

Density of additively manufactured In625 is typically 99.8%, measured optically on a 10 mm × 10 mm × 10 mm sample at 75x magnification.

Mechanical properties of additively manufactured components built using 60 µm layer thickness

	As built		Heat treated (see note 2)	
Ultimate Tensile strength (UTS) (See note 3)	Mean	Standard deviation ($\pm 1\sigma$)	Mean	Standard deviation ($\pm 1\sigma$)
Horizontal direction (XY)	922 MPa	9 MPa	1005 MPa	6 MPa
Vertical direction (Z)	770 MPa	56 MPa	985 MPa	10 MPa
Yield strength (see note 3)				
Horizontal direction (XY)	667 MPa	11 MPa	600 MPa	4 MPa
Vertical direction (Z)	536 MPa	34 MPa	583 MPa	2 MPa
Elongation at break (see note 3)				
Horizontal direction (XY)	18%	2%	31%	2 %
Vertical direction (Z)	11%	4%	32%	4 %
Modulus of elasticity (see note 3)				
Horizontal direction (XY)	175 GPa	16 GPa	208 GPa	4 GPa
Vertical direction (Z)	176 GPa	9 GPa	209 GPa	6 GPa
Hardness (Vickers) (See note 4)				
Horizontal direction (XY)	302 HV0.5	13 HV0.5	279 HV0.5	7 HV0.5
Vertical direction (Z)	308 HV0.5	6 HV0.5	290 HV0.5	8 HV0.5
Surface roughness (R_a) (See note 5)				
Horizontal direction (XY)	1.5 µm to 2 µm			
Vertical direction (Z)	6 µm to 7 µm			

Density of additively manufactured In625 is typically 99.8%, measured optically on a 10 mm x 10 mm x 10 mm sample at 75x magnification.

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