DATA SHEET

DMLM

LASER MELTING POWDER TITANIUM ALLOY TI6AL4V (GRADE 23)[A] PROCESSED USING AM250 WITH 200 W LASER

Process specification

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

Material description

Ti6Al4V ELI-0406 alloy comprises titanium mass fraction up to 90% alloyed with aluminium up to 6.75% and vanadium up to 4.5%, along with other minor elements. Ti6Al4V grade 23 is otherwise referred to as ELI or Extra Low Interstitial with regards to the interstitial impurities oxygen, carbon, and nitrogen. It is a higher purity version of the most commonly used titanium alloy Ti6Al4V grade 5. The reduced interstitial elements in grade 23 lead to an increase in both ductility and fracture toughness.

Ti6Al4V ELI-0406 has excellent specific strength (strength to weight ratio) which makes it an ideal choice where weight saving load structures are required. It has good corrosion resistance, it is also biocompatible, so can be used for a range of surgical and dental applications.

Applications

- Medical implants
- Surgical tools
- Aerospace and defence
- Motor sport
- Jewellery and art
- Maritime applications
- High-end sports equipment

Material Properties

- High specific strength
- High corrosion resistance
- Excellent biocompatibility
- Good osseointegration
- Low thermal expansion
- Low thermal conductivity

Generic Data - wrought material

Density	4.42 g/cm^3
Thermal Conductivity at 20 °C	6 W/m·K to 8 W/m·K
Melting Range	1636 °C to 1665 °C
Coefficient of thermal expansion *(see note 1)*	8×10^{-6} K^{-1} to 9×10^{-6} K^{-1}

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Powder composition / Percent by mass

Ti	Al	V	Fe	O	Residual	C	N	H
Balance	5.5 to 6.5	3.5 to 4.5	<0.25	<0.13	<0.1 each <0.4 total	<0.08	<0.08	<0.0125

Mechanical properties of additively manufactured components

	Heat treated *(see note 2)*	**Heat treated** *(see note 3)*
Upper Tensile Strength (UTS) *(see note 4)*		
Horizontal direction (XY)	1133 MPa ±9 MPa	1077 MPa ±2 MPa
Vertical direction (Z)	1110 MPa ±13 MPa	1060 MPa ±19 MPa
Yield strenght *(see note 4)*		
Horizontal direction (XY)	1045 MPa ±7 MPa	988 MPa ±8 MPa
Vertical direction (Z)	996 MPa ±10 MPa	951 MPa ±11 MPa
Elongation at break *(see note 4)*		
Horizontal direction (XY)	8% ±4%	10% ±3%
Vertical direction (Z)	7% ±4%	8% ±4%
Modulus of elasticity *(see note 4)*		
Horizontal direction (XY)	116 GPa ±1 GPa	116 GPa ±1 GPa
Vertical direction (Z)	112 GPa ±1 GPa	114 GPa ±1 GPa
Hardness (Vickers) *(see note 5)*		
Horizontal direction (XY)	397 HV0.5 ±9 HV0.5	364 HV0.5 ±8 HV0.5
Vertical direction (Z)	399 HV0.5 ±4 HV0.5	368 HV0.5 ±9 HV0.5
Surface roughness (Ra) *(see note 6)*		
Horizontal direction (XY)	4 µm to 6 µm	
Vertical direction (Z)	4 µm to 7 µm	

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

Note 2 Annealed at 730 °C for 1 hr.

Note 3 Annealed at 850 °C ±10 °C for 1 hr.

Note 4 Tested at ambient temperature by Nadcap and UKAS accredited independent laboratory. Test ASTM E8. Machined before testing.

Note 5 Tested to ASTM E384-11. As built, after polishing.

Note 6 Tested to JIS B 0601-2001 (ISO 97). As built after bead blasting.

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