

Introduction

PowderRange metal Additive Manufacturing powders from Carpenter Additive are developed with the needs of the busy AM facility in mind.

- ▶ Easy ordering
- ▶ Standard specifications
- ▶ 24-hour shipment
- ▶ Sold in easy-to-handle multiples of 2.5 kgs
- ▶ Easy repeat orders to optimize inventory management

This leaves you free to concentrate on the design and build of your AM parts, confident that PowderRange metal AM powders from Carpenter Additive will add reliability and consistency to your AM built parts.

Characteristics

PowderRange Ti6-4 (Titanium-6% Aluminum-4%, Vanadium, Ti-6Al-4V) High Performance Titanium is a high-performance alloy characterised by having excellent mechanical properties with a low specific weight and good corrosion resistance. Carpenter Additive offers two versions of the alloy as standard, equivalent to ASTM Grade 5 and Grade 23. Grade 23 has lower specified oxygen, carbon and nitrogen limits, and is considered the higher purity version. Grade 23 displays increased ductility and fracture toughness over Grade 5 as a result of the reduction in interstitials, as well as demonstrating excellent biocompatibility.

One of the favored manufacturing methods for titanium alloy Ti-6Al-4V powder is plasma atomization, resulting in superior sphericity, low internal porosity and low residual elements such as oxygen but introduces the risk of high-density inclusions that are inherent to the plasma atomization process. However certain gas atomization techniques, such as EIGA, can also achieve comparable residual element levels with acceptable morphology, and are atomized in a ceramic- and tungsten-free process which reduces the risk of high-density inclusions.

Applications

PowderRange Ti6-4 High Performance Titanium Grade 23 has a range of applications in several industries including aerospace, medical and automotive. Specific examples of Ti6-4 alloys include medical implants, surgical tools and gas turbine engine components.

Chemical composition

| Element | | Minimum wt% | Maximum wt% |
|---------|----------|-------------|-------------|
| Al | Aluminum | 5.50 | 6.50 |
| C | Carbon | | 0.08 |
| H | Hydrogen | | 0.012 |
| Fe | Iron | | 0.25 |
| N | Nitrogen | | 0.05 |
| O | Oxygen | | 0.13 |
| Ti | Titanium | Balance | |
| V | Vanadium | 3.50 | 4.50 |

Particle size distribution – CT PowderRange Ti64 F

| Size | Value | Method |
|--------|--------------|------------------------|
| -15 µm | 5 Volume % | Laser Size Diffraction |
| +45 µm | 7 Weight % | Sieve Analysis |
| D10 | 18-24 µm | Laser Size Diffraction |
| D50 | 32.5-34.4 µm | Laser Size Diffraction |

Mechanical properties (indicative only)

| Property | | As built |
|--------------------------------------|-------------------------------|-------------------------------------|
| Tensile Strength [1] | Horizontal Direction (XY) | 1130 - 1250 MPa 163.9- 181.3 ksi |
| | Vertical Direction (Z) | 1100 - 1250 MPa 159.5- 181.3 ksi |
| Yield Strength [1] | Horizontal Direction (XY) | 1050 - 1150 MPa 152.3- 166.8 ksi |
| | Vertical Direction (Z) | 1000 - 1125 MPa 145- 163.2 ksi |
| Young's Modulus [1] | Horizontal Direction (XY) | 105 - 115 GPa 15.2- 16.7 Msi |
| | Vertical Direction (Z) | 110 - 115 GPa 16- 16.7 Msi |
| Elongation [1] | Horizontal Direction (XY) | 5 - 10 % |
| | Vertical Direction (Z) | 5 - 10 % |
| Hardness [2] | Horizontal Direction (XY) | 385 - 405 HV0.5 |
| | Vertical Direction (Z) | 395 - 405 HV0.5 |
| Coefficient of Thermal Expansion [3] | 8 – 9 × 10 ⁻⁶ m/mK | |
| Thermal Conductivity [3] | 6 - 8 W/mK | |

1. As built. Mechanical testing in accordance with ISO 6892

2. As built. Hardness test in accordance with ASTM E384-11

3. In the range of 20°C (68°F) to 100°C (212°F)

Range of mechanical properties encompasses expected values across multiple machine platforms

Similar materials

| Company | Alternative Title |
|---------------------|---------------------------------|
| LPW | Ti6-4 High Performance Titanium |
| UNS | R56400/R56407 |
| Other Generic Names | ASTM B348 |
| 3D Systems | Ti Gr.23 |
| Concept Laser | CL 41 TI ELI |
| EOS | Ti64ELI |
| Realizer | N/A |
| Renishaw | Ti6Al4V ELI-0406 |
| SLM Solutions | TiAl6V4 |
| TRUMPF | TitaniumT:64 ELI-A LMF |

Ordering information

PowderRange Ti64 F is available from stock and dispatched within 24 hours of receipt of order. Our PowderRange metal AM powders are sold in multiples of 2.5 kgs giving you the flexibility to order just the volume you need to maintain efficient material stock levels.

All our PowderRange materials are supplied with a full metal powder certification to Carpenter Additive's standard material specification, reporting size distribution, flow, chemistry and morphology.

| Code | Description | Unit volumes |
|-----------------------|------------------------------------------------------------------------------------------------------------|--------------|
| CT PowderRange Ti64 F | Flexible material developed to be suitable for a wide range of powder bed fusion machines and applications | 2.5 kgs |

Further information

To make an enquiry, please contact powderrange@carpenteradditive.com. Alternatively, for EU/Row, call +44 (0)1928 240 530 and for USA call +1-412-788-2856. You can visit us at www.carpenteradditive.com.