OSPREY® TI-6AL-4V POWDER FOR ADDITIVE MANUFACTURING

DATASHEET

GENERAL DESCRIPTION

Osprey® TI-6AL-4V Grade 5 & Grade 23 powders are manufactured to the highest international standards by Electrode Inert Gas Atomisation, using a state-of-the-art titanium powder plant that offers a high level of automation, ensuring even better reliability and consistency. Offering typically lower cost & higher capacity than plasma atomised powders. Designed for processing by Additive Manufacturing processes, including Powder Bed Fusion by Laser & Electron Beam for medical, aerospace, automotive and engineering applications that require significant weight saving while maintaining high performance. Suitable for repair and refurbishment of worn and damaged components by Direct Energy Deposition.

CHEMICAL COMPOSITION

Osprey® TI-6AL-4V Class 5*, Chemical composition (nominal), wt%

Ti	Al	V	Fe	O	C	N	H	Y	Others, each	Other, total
Balance	5.50-6.75	3.5-4.5	<0.30	<0.20	<0.08	<0.05	<0.015	<0.005	<0.10	<0.40

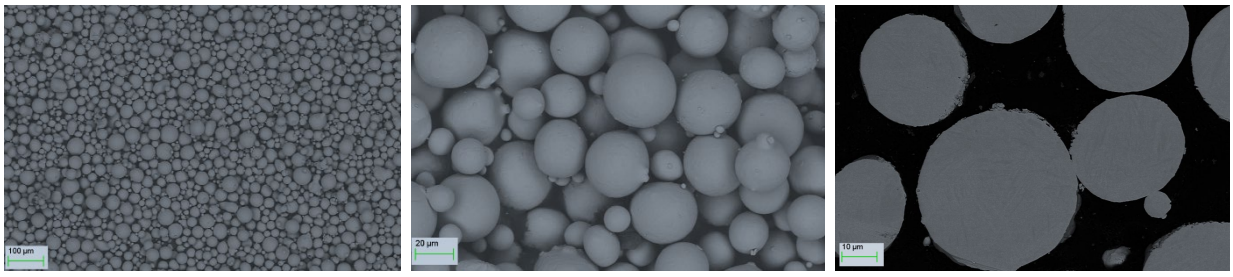
*According to ASTM F2924-14

Osprey® TI6-AL-4V Class 23**, Chemical composition (nominal), wt%

Ti	Al	V	Fe	O	C	N	H	Y	Others, each	Other, total
Balance	5.50-6.75	3.5-4.5	<0.25	<0.13	<0.08	<0.05	<0.012	<0.005	<0.10	<0.40

**According to ASTM F3001-14

POWDER MORPHOLOGY



SEM micrographs of -63 +20 µm powder with a spherical morphology (HS Circularity 0.95), smooth surface and low level of powder satellites (magnifications x100 & x250) and a section through the powder (magnification x1000), with no visible internal porosity.

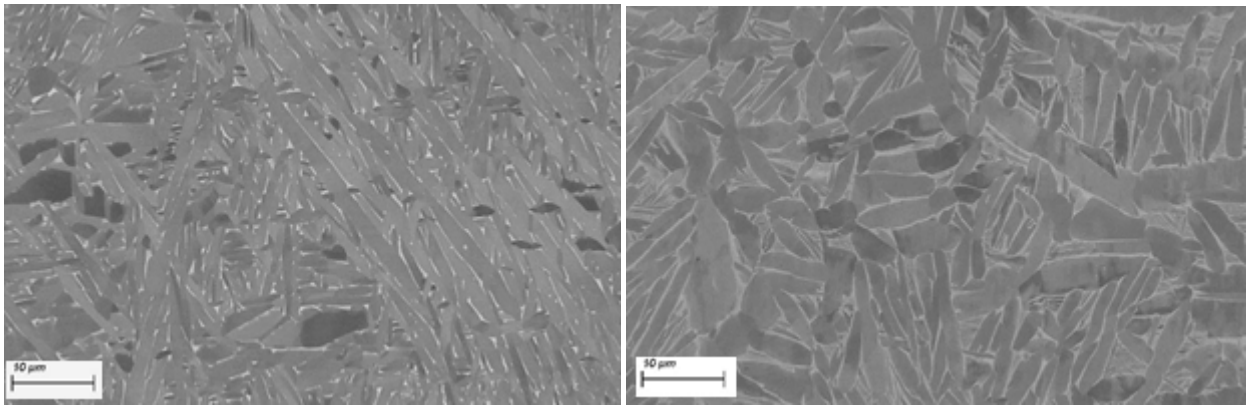
POWDER SIZE DISTRIBUTION

Available in a range of customised powder sizes suitable for different AM platforms:

- Laser beam - Powder Bed Fusion, (L-PBF)
  e.g. 63 to 20 µm
- Electron Beam - Powder Bed Fusion, (E-PFB)
  106 to 45 µm
- Direct Energy Deposition (DED)
  150 to 53 µm & 90 to 45 µm

Other powder size range distributions are available by request, including fine powder (<45 microns) for Metal Injection Moulding.

MICROSTRUCTURE



SEM micrographs of Osprey® TI-6AL-4V L-PBF material in a heat-treated condition (solution annealed at 850 °C for 2 hours in argon) on the left, featuring a fine lamellar and dense microstructure is identified which originates from the decomposition of martensitic α' as expected; showing a phase transformation that gave rise to a coarser structure consisting of a α phase matrix (grey) and an interlamellar β phase (bright). The difference in microstructure for vertical and horizontal builds is not significant. The mechanical properties of heat treated L-PBF material is provided below. The microstructure, shown on the right, for L-PBF material after Hot Isostatic Pressing (HIP), which results in a coarsening of the grain size. The mechanical properties of HIP material is similar to that of the heat treated material with an improvement in impact toughness, especially in the vertical direction (32 J).

MECHANICAL PROPERTIES

Typical mechanical properties of Osprey® TI-6AL-4V Grade 23 L-PBF material in a heat treated condition and evaluated at room temperature. Combining high levels of mechanical performance with light-weight, corrosion resistance and biocompatibility.

Metric units

Condition	Direction	Proof strength	Tensile strength	E-modulus	Elongation	Impact Toughness
		$R_{p0.2}$	R_m		A	
		MPa	MPa	GPa	%	J
Heat treated	Horizontal	957 ±7	1076 ±6	119 ±2	14 ±0.6	23 ±0.5
	Vertical	997 ±6	1094 ±4	122 ±2	15 ±0.5	22 ±0.9

Imperial units

Condition	Direction	Proof strength	Tensile strength	E-modulus	Elongation	Impact Toughness
		$R_{p0.2}$	R_m		A	
		ksi	ksi	ksi	%	J
Heat treated	Horizontal	139 ±1	156 ±1	17,260 ±290	14 ±0.6	23 ±0.5
	Vertical	145 ±1	159 ±1	17,695 ±290	15 ±0.5	22 ±0.9

Typical Vicker's Hardness levels (ASTM E92, ISO 6507-1, JIS Z2244, GB/T 4340.1), in the L-PBF heat-treated condition.

Condition	Direction	Hardness
		HV
Heat treated	Horizontal	344 ±4
	Vertical	346 ±4