

Datasheet

Ferritic stainless steel

# Osprey® 446

Osprey® 446 is a heat-resistant, ferritic stainless steel alloyed with chromium, characterized by good oxidation resistance and corrosion resistance at elevated temperatures.

UNS

S44600

AISI

446-1

EN Number

1.4749

DIN

1.4749

Powder designed for

Additive Manufacturing (AM)



## Product description

Osprey® 446 is a heat-resistant, ferritic stainless steel alloyed with chromium, suitable for use in elevated temperatures and characterized by

- Good oxidation resistance at elevated temperatures
- Good corrosion resistance at elevated temperatures
- Good mechanical properties at elevated temperatures

With its good oxidation- and corrosion resistance in combination with good mechanical properties at elevated temperatures, Osprey® 446 can be used in applications such as furnace parts, steam generators and glass moulds. The grade can be used in a temperature up to 500 °C.

This metal powder is manufactured by induction melting under Vacuum Inert Gas Atomization (VIGA), producing a powder with a spherical morphology which provides good flow characteristics and high packing density. In addition, the powder has a low oxygen content and low impurity levels, resulting in a metallurgically clean product with enhanced mechanical performance.

## Chemical composition (nominal), %

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Fe	Bal.
Cr	26.0-29.0
Mn	< 1.5
C	< 0.2
Si	< 1.0
P	< 0.040
S	< 0.015
N	0.15-0.25

## Powder characteristics and morphology

### Powder for Additive Manufacturing

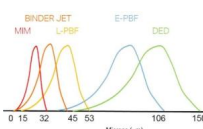
Osprey® metal powder for Additive Manufacturing is characterized by a spherical morphology and high packing density, which confer good flow properties. For powder bed processes these are essential when applying fresh powder layers to the bed to ensure uniform and consistent part build.

For blown powder processes, such as Direct Energy Deposition (DED), good flow ensures uniform build rates. Tight control of the particle size distribution also helps ensure good flowability. Low oxygen powders result in clean microstructures and low inclusion levels in the finished parts.

## Particle size distribution

### Powder for Additive Manufacturing

Osprey® metal powder for Additive Manufacturing is available in a wide range of particle size distributions that are tailored to the individual Additive Manufacturing systems. They can also be tailored to the particular requirements of the end application, both in terms of mechanical performance and surface finish.



Process technology	Size (µm)
Binder jetting	≤ 16, ≤ 22, ≤ 32, ≤ 38, ≤ 45
Laser - Powder Bed Fusion (L-PBF)	15 to 53 and 10 to 45
Electron beam - Powder Bed Fusion (E-PBF)	45 to 106
Direct Energy Deposition (DED)	53 to 150

Tailor-made particle size distributions are available on request. Contact us to discuss your specific requirements.

## Mechanical properties

The table below displays typical mechanical properties for as-built powder bed fusion – laser beam evaluated in room temperature. Material properties are given in two material conditions, as built and heat treated. The heat treatment was performed by a solution treatment at 1060 °C for 20 minutes followed by quenching in water and annealing at 870 °C for 1 h followed by air cooling.

Condition	Test temperature	Direction	Proof strength	Tensile strength	E-modulus	Elongation
			R <sub>p0.2</sub>	R <sub>m</sub>		A
			MPa	MPa	MPa <sup>1</sup>	%
L-PBF, as built	Room temp.	Horizontal	954	1089	217	19.0
L-PBF, as built	Room temp.	Vertical	840	1033	187	18.9
L-PBF, heat treated	Room temp.	Horizontal	360	616	220	26.6
L-PBF, heat treated	Room temp.	Vertical	342	554	197	30.6
L-PBF, heat treated	500°C	Horizontal	268	401	173	33.8
L-PBF, heat treated	500°C	Vertical	263	387	140	35.4

1 x10<sup>3</sup>

Condition	Test temperature	Direction	Proof strength	Tensile strength	E-modulus	Elongation
			Rp0.2	Rm		A
			ksi	ksi	ksi	%
L-PBF, as built	Room temp.	Horizontal	138	158	31.5	19.0
L-PBF, as built	Room temp.	Vertical	122	150	27.1	18.9
L-PBF, heat treated	Room temp.	Horizontal	52	89	31.9	26.6
L-PBF, heat treated	Room temp.	Vertical	50	80	28.6	30.6
L-PBF, heat treated	500°C	Horizontal	38.9	58.2	25.1	33.8
L-PBF, heat treated	500°C	Vertical	38.1	56.1	20.3	35.4

1 x103

Source: Sandvik and Uppsala University.

## Physical properties

### Wrought material data

Density: 7.7 g/cm<sup>3</sup>, 0.28 lb/in<sup>3</sup>

Thermal conductivity: 17 W/mK to 23 W/mK

Coefficient of thermal expansion: 10.0 10<sup>-6</sup> K<sup>-1</sup>

Melting point: 1290°C to 1350°C (2354°F to 2462°F)

## Creep resistance

Creep resistance has been measured and the results are as follows:

Condition	Stress	Time to rupture	Elongation at rupture
	MPa	h	%
Annealed	10	2946	48
Annealed	9	5751	43
Annealed	8	7470	44
Annealed	7.7*	10 000	N/A
Annealed	12.9*	1000	N/A

\*Extrapolated values based on the assumption that there is a linear relationship between log (stress) and log (time to rupture). Karlsson, D.et al.. Relationship between Microstructure, Mechanical Properties and Creep Behavior of a Cr-Rich Ferritic Stainless Steel Produced by Laser Powder Bed Fusion. Alloys 2022, 1, 263–276.

## Testing

All Osprey® metal powders are supplied with a certificate of analysis containing information on the chemical composition and particle size distribution. Information on other powder characteristics is available upon request.

## Packaging

A wide range of packaging options is available, from 5kgs plastic bottles to 250kg metal drums.

- 5 kg (11 lbs) Plastic bottles
- 6 kg (13 lbs) Plastic bottles
- 10 kg (22 lbs) Plastic bottles
- 20 kg (44 lbs) Metal cans
- 100 kg (220 lbs) Steel drums
- 150 kg (330 lbs) Steel drums
- 250 kg (551 lbs) Steel drums

All packaging materials are suitable for air, sea and road freight.

Contact us for more information and to discuss your packaging requirements.

