Datasheet
Superalloys

Osprey® H-X

Osprey® H-X is a nickel-chromium-molybdenum-iron superalloy characterized by high-temperature strength and good resistance to oxidation.

UNS

N06002

EN Number

2.4665

Powder designed for

- Additive Manufacturing (AM)
- Metal Injection Moulding (MIM)

Product description

Osprey® H-X is a nickel-chromium-molybdenum-iron superalloy characterized by high-temperature strength and good resistance to oxidation. The alloy is typically used in aerospace, oil and gas applications. Osprey® H-X is an alloy of the same type as Hastelloy® X and Inconel® alloy HX*.

This metal powder is manufactured by either induction melting under Vacuum Inert Gas Atomization (VIGA) or melting under argon prior to Inert Gas Atomization (IGA), 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.

*Hastelloy® is a trademark owned by Haynes International Inc. Inconel® is a trademark owned by Huntington Alloys Corporation.

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Chemical composition (nominal), %

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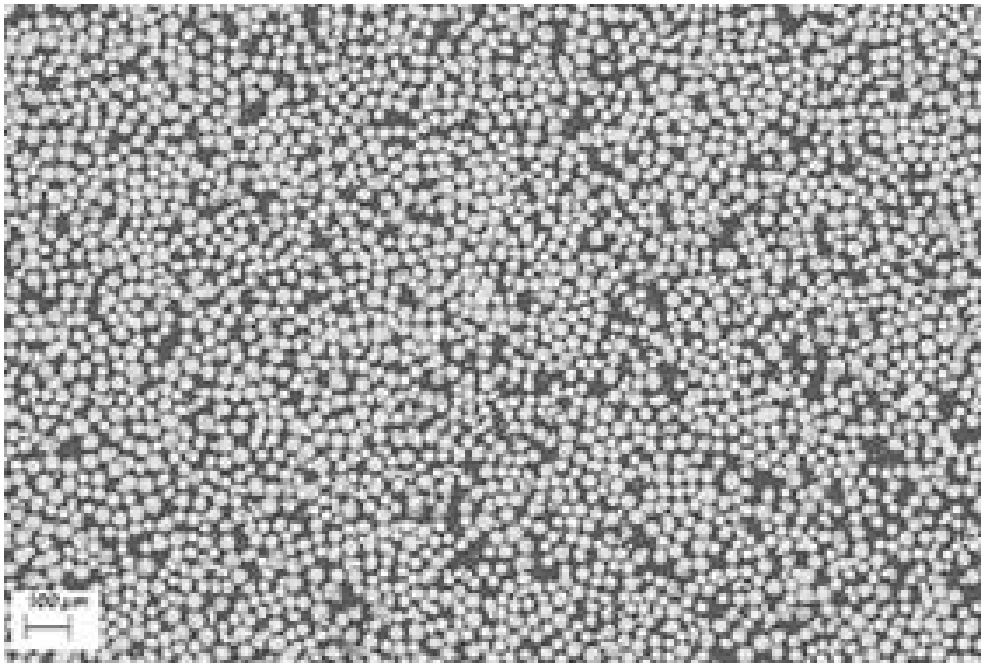
Ni	Bal.
Fe	18
C	≤0.15
Cr	21.0
Mo	9.0
Co	1.0
B	≤0.008
Mn	≤0.1
Si	≤0.1
P	≤0.015
S	≤0.015
Other	W 0.7

Powder characteristics and morphology

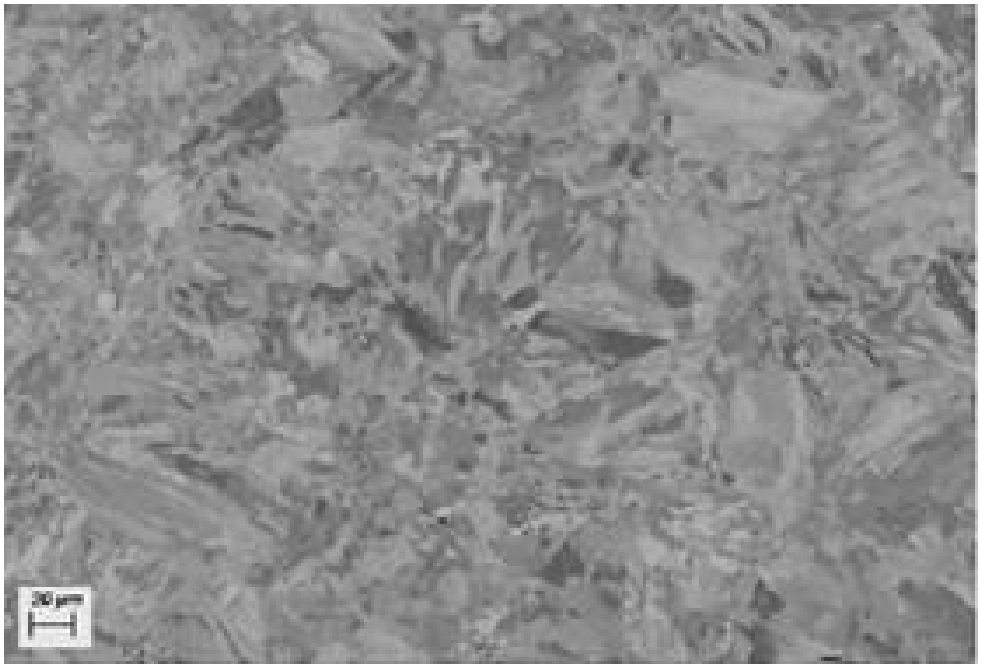
Powder for Additive Manufacturing

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.



SEM micrographs of Osprey® H-X -53 +15 µm powder with a spherical morphology.



SEM micrographs of Osprey® H-X, a section through the printed Laser - Powder Bed Fusion (L-PBF) material, which notably shows the absence of cracks.

Powder for Metal Injection Moulding (MIM)

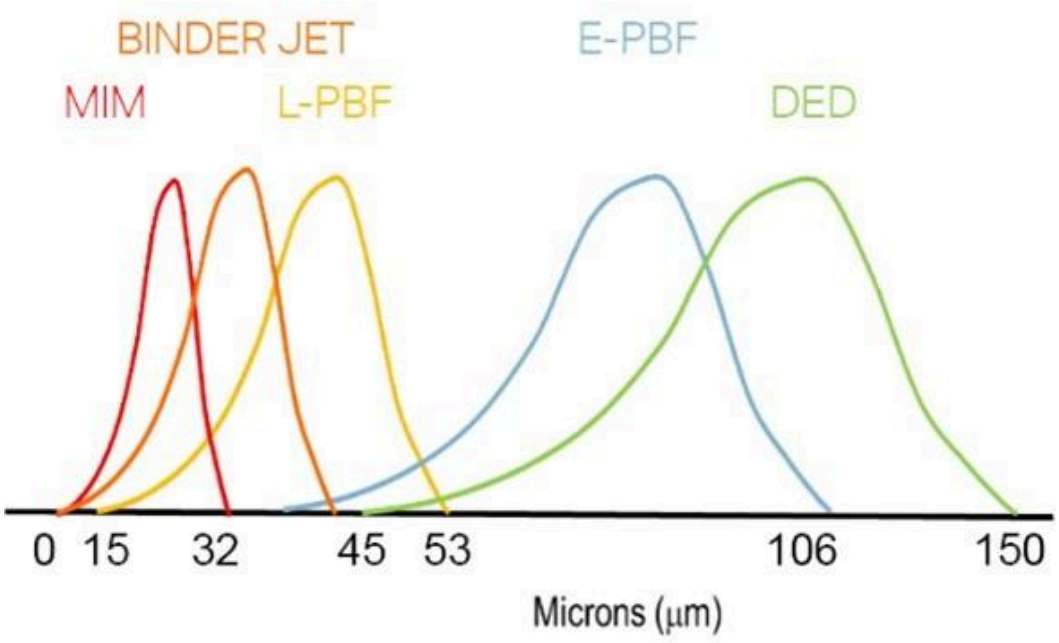
Osprey® MIM powder has a spherical morphology, resulting in high packing density. This enables the manufacture of feedstocks with high powder loading, which not only minimizes binder costs but also reduces part shrinkage during debinding and sintering. Spherical powder also has excellent flow characteristics, resulting in reduced tool wear and consistent mould filling.

Osprey® MIM powder's low oxygen content allows better control of carbon and consistency during sintering. Low oxygen levels, together with high packing density, also facilitate faster sintering.

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.



Typical particle size distributions for Additive Manufacturing.

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

Powder for Metal Injection Moulding (MIM)

Osprey® metal powder for Metal Injection Moulding (MIM) is available in a wide range of particle size distributions, from under 5 µm up to 38 µm. The table shows our standard particle size distributions for MIM powders.

Size (µm)	D10 (µm)	D50 (µm)	D90 (µm)
≤ 38	5.5	13.0	31.0
≤ 32	5.0	12.0	29.0

80% ≤ 22	4.5	11.5	27.0
90% ≤ 22	4.0	10.5	22.0
90% ≤ 16	3.5	8.0	16.0

*Particle size measurements performed using a Malvern laser particle size analyzer, typical D10, D50 and D90 provided.

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

Mechanical properties

Typical mechanical properties of material produced by Laser - Powder Bed Fusion (L-PBF) in as-built and heat-treated conditions (solution annealing 1,177°C/2,150°F for 15 minutes, followed by water quench) evaluated at room temperature and at high temperature (815°C/1,500°F).

Condition	Direction	Yield strength (Rp0.2), MPa	Tensile strength (Rm), MPa	E-modulus, GPa	Elongation (A), %	Impact toughness, J
As built	Horizontal	627	820	194	31	105
As built	Vertical	522	684	171	41	156
Heat treated	Horizontal	444	770	227	40	156
Heat treated	Vertical	390	637	194	52	194
As built (tested at 815 °C)	Vertical	212	292	110	21	-

Condition	Direction	Yield strength (Rp0.2), ksi	Tensile strength (Rm), ksi	E-modulus, ksi	Elongation (A), %	Impact toughness, Ft.lbs
As built	Horizontal	91	119	28,137	31	77
As built	Vertical	76	99	24,802	41	115
Heat treated	Horizontal	64	112	32,924	40	115
Heat treated	Vertical	57	92	28,137	52	143
As built (tested at 1,500 °F)	Vertical	31	42	15,954	21	-

Hardness

Typical Vickers Hardness levels (ASTM E92, ISO 6507-1, JIS Z2244, GB/T 4340.1) as well as HRC values of Osprey® H-X material in the Laser - Powder Bed Fusion (L-PBF) in as-built and heat-treated conditions.

Condition	HV	HRC
As built	245	23
Heat treated	208	16

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.