Datasheet
Low-alloy steel

Osprey® 4140

Osprey® 4140 is a low-alloy steel alloyed with chromium, molybdenum and manganese, and suitable for heat treatment by quench and tempering to achieve high hardness.

UNS

G41400

ASTM, AISI

4140

Powder designed for

Additive Manufacturing (AM)
Metal Injection Moulding (MIM)

Product description

Osprey® 4140 is a low-alloy steel alloyed with chromium, molybdenum and manganese, and is suitable for heat treatment by quench and tempering to achieve high hardness. The alloy is characterized by

Good balance of strength, toughness and wear resistance
Good impact toughness
Excellent fabrication properties

Osprey® 4140 can be heat treated to different material conditions using tempering and is suitable for use in general engineering exposed to heavy strain (shafts, gear, bolts), oil-patch applications, and in heat-treated condition it can be used for wear-resistant applications.

This metal powder is manufactured by 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.

Chemical composition (nominal), %

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Fe	Bal.
C	0.38-0.43
Cr	0.8-1.1
Ni	
Mo	0.15-0.25
Si	0.15-0.35
Mn	0.75-1.00
S	0.04
P	0.035

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.

Powder for Metal Injection Moulding (MIM)

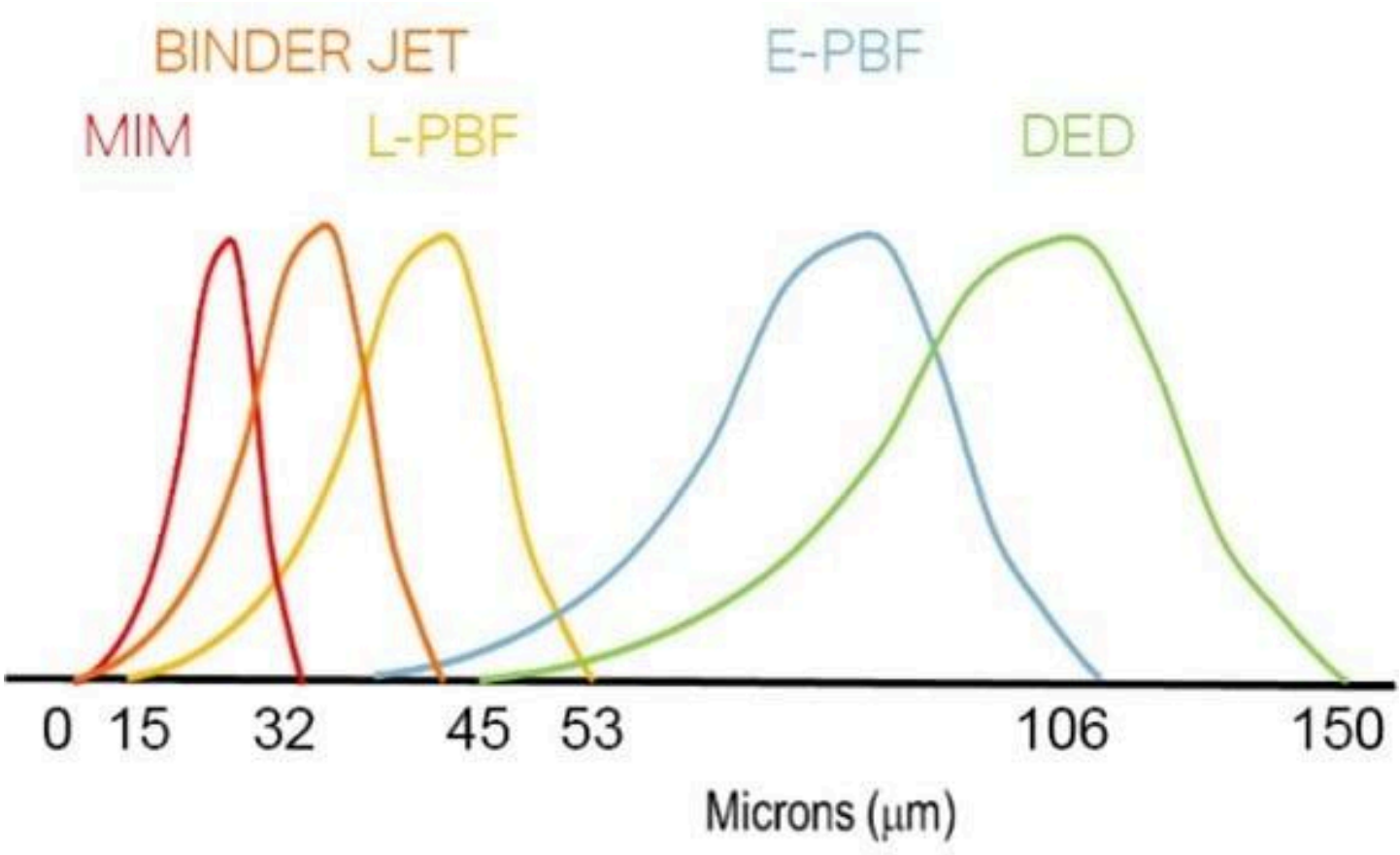
Osprey® MIM powder has a spherical morphology, resulting in high packing density. This enables the manufacture of feedstocks with high powder loading, which not only minimizes binder costs but also reduces part shrinkage during debinding and sintering. Spherical powder also has excellent flow characteristics,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



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

The table below displays typical mechanical properties for as-built powder bed fusion – laser beam evaluated in room temperature.

Condition	Direction	Proof strength	Tensile strength	E-modulus	Elongation	Impact toughness
		$R_{p0.2}$	R_m		A	Charpy V
		MPa	MPa	MPa1	%	J
L-PBF, as built	Horizontal	1300	1420	225	13.9	100
L-PBF, as built	Vertical	1240	1400	218	14.2	92

1 x103

Condition	Direction	Proof strength	Tensile strength	E-modulus	Elongation	Impact toughness
		$R_{p0.2}$	R_m		A	Charpy V
		ksi	ksi	ksi1	%	ft-lb
L-PBF, as built	Horizontal	189	206	32.6	13.9	74

L-PBF, as built	Vertical	180	203	31.6	14.2	68

1 x103

Source: Sandvik and Chalmers University of Technology

Physical properties

Wrought material data
Density: 7.85 g/cm3, 0.28 lb/in3
Thermal conductivity: 42.6 W/mK
Coefficient of thermal expansion: 12.2 10-6 K-1
Melting point: 1416 °C (2580 °F)

Heat treatment

Osprey® 4140 can be heat treated to different material conditions using tempering. The alloy can be tempered between 200 °C and 600 °C to a desired hardness.

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.

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