

Datasheet  
Low-alloy steel

# Osprey® 4340

Osprey® 4340 is a medium-carbon, low-alloy steel alloyed with nickel, chromium and molybdenum, and is suitable for heat treatment by quench and tempering to achieve high hardness and toughness.

UNS  
G43400

ASTM, AISI  
4340

Powder designed for  
Additive Manufacturing (AM)  
Metal Injection Moulding (MIM)



## Product description

Osprey® 4340 is a medium-carbon, low-alloy steel alloyed with nickel, chromium and molybdenum suitable for heat treatment by quench and tempering to achieve high hardness and toughness. The alloy is characterized by

Extremely good corrosion resistance in widely varying acidic and chloride containing environments  
High strength  
Excellent fabrication properties

Osprey® 4340 can be heat treated to different material conditions using tempering. It is suitable for the use in structural parts in aerospace and automotive, as well as for defense applications and general purposes.

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 | 0.7-0.9   |
| Ni | 1.65-2.00 |
| Mo | 0.2-0.3   |
| Si | 0.15-0.35 |
| Mn | 0.6-0.8   |
| S  | <0.040>   |
| 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)**

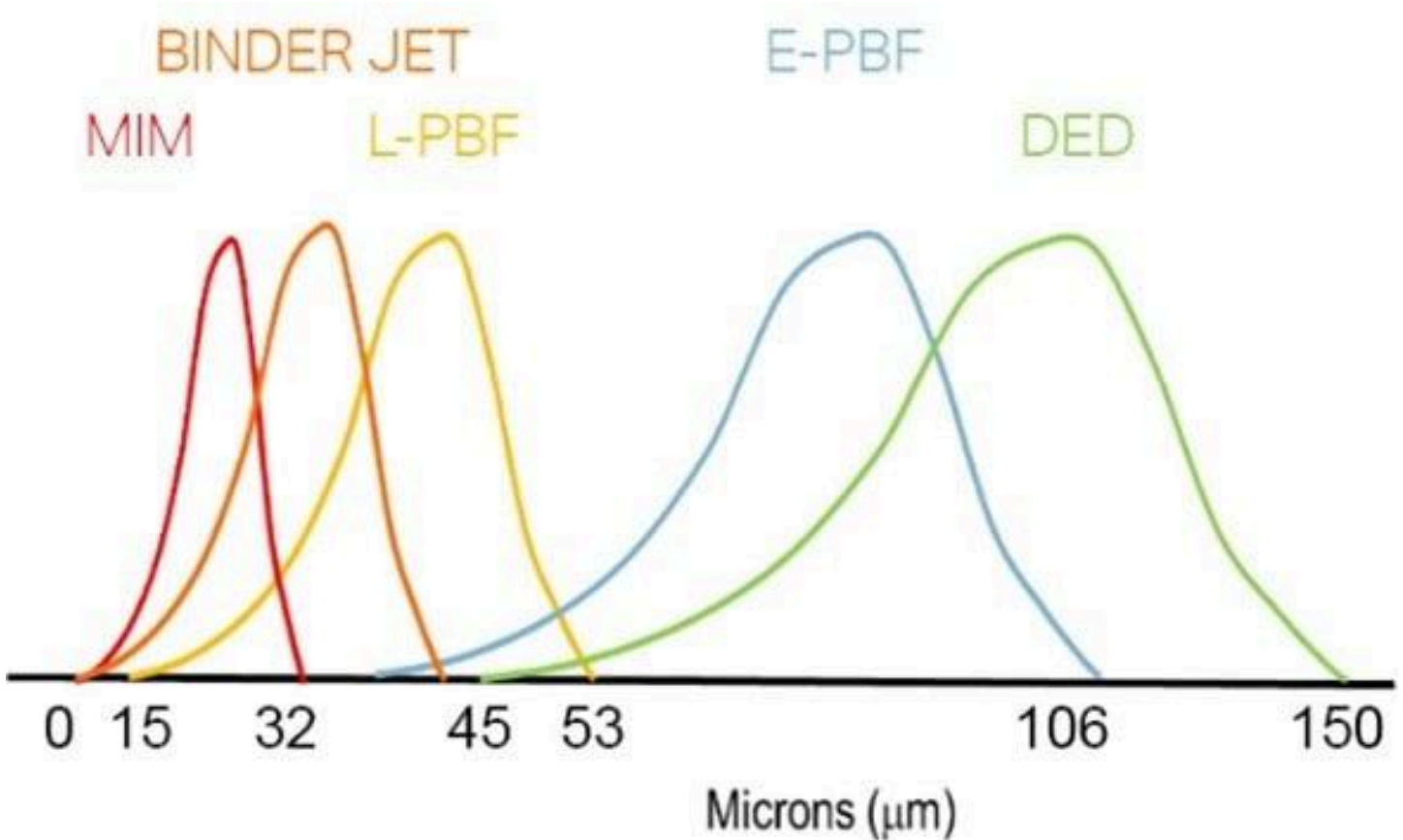
Osprey® MIM powder has a spherical morphology, resulting in high packing density. This enables the manufacture of feedstocks with high powder loading, which not only minimizes binder costs but also reduces part shrinkage during debinding and sintering. Spherical powder also has excellent flow characteristics, 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 |
|-----------------|------------|----------------|------------------|-----------|------------|
|                 |            | Rp0.2          | Rm               |           | A          |
|                 |            | MPa            | MPa              | MPa1      | %          |
| L-PBF, as built | Horizontal | 1330           | 1510             | 218       | 14.3       |
| L-PBF, as built | Vertical   | 1230           | 1510             | 209       | 14.1       |

1 x103

| Condition       | Direction  | Proof strength | Tensile strength | E-modulus | Elongation |
|-----------------|------------|----------------|------------------|-----------|------------|
|                 |            | Rp0.2          | Rm               |           | A          |
|                 |            | ksi            | ksi              | ksi1      | %          |
| L-PBF, as built | Horizontal | 193            | 219              | 31.6      | 14.3       |
| L-PBF, as built | Vertical   | 178            | 219              | 30.3      | 14.1       |

Source: Chalmers University of Technology

| Condition       | Direction  | Impact toughness |
|-----------------|------------|------------------|
|                 |            | Charpy V         |
|                 |            | J                |
| L-PBF, as built | Horizontal | 71               |
| L-PBF, as built | Vertical   | 61               |

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Source: Sandvik and Chalmers University of Technology

## Physical properties

### Wrought material data

Density: 7.85 g/cm<sup>3</sup>, 0.28 lb/in<sup>3</sup>

Thermal conductivity: 44.5 W/mK

Coefficient of thermal expansion: 12.3 10<sup>-6</sup> K<sup>-1</sup>

Melting point: 1427 °C (2600 °F)

## 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.

