

VDM® Powder 718

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VDM® Powder 718 is the powder variant of an age-hardenable nickel-chrome-iron-molybdenum alloy for use in powder based processes such as additive manufacturing, HIP or overlay welding. Hardenability is achieved by specific additions of niobium, titanium and aluminum.

VDM® Powder 718 is characterized by:

- spherical particles with low level of satellites
- high purity and reproducibility level
- low oxygen content
- small amount of porosity
- good flowability
- high apparent and tap density

Designations and standards (based on VDM® Alloy 718)

| Standard | Material designation |
|----------|---------------------------|
| EN | 2.4668 - NiCr19Fe19Nb5Mo3 |
| ISO | NiCr19Nb5Mo3 |
| UNS | N07718 |
| AFNOR | NC19FeNb |
| ASTM | F3055*, B637* |
| SAE AMS | 5662* |

Table 1 – Designations and standards, *only chemical analysis and partial heat treatments

Chemical composition

| | Ni | Cr | Fe | C | Mn | Si | Cu | Mo | Co | Nb | Al | Ti | B | P | S | N | O |
|------|----|----|------|------|------|------|-----|-----|----|------|-----|------|-------|-------|-------|------|------|
| Min. | 50 | 17 | bal. | | | | | 2.8 | | 4.75 | 0.2 | 0.65 | | | | | |
| Max. | 55 | 21 | | 0.08 | 0.35 | 0.35 | 0.3 | 3.3 | 1 | 5.5 | 0.8 | 1.15 | 0.006 | 0.015 | 0.015 | 0.02 | 0.03 |

Table 2 – Chemical composition (%) based on ASTM and SAE AMS. AMS 5662: Pb max. 0,0005%, Bi max. 0,00003%, Se max. 0,0003%

Depending on the use conditions, stricter analysis limits apply to certain alloy elements. The purpose of this limitation is to optimize the microstructure and mechanical properties with regard to the intended use. For example, alloys with carbon and niobium concentrations near the upper limit according to ASTM are best suited for high-temperature applications, while lesser carbon and niobium concentrations result in material microstructures that conform better to the requirements of corrosive use conditions.

Physical properties

| Particle size distribution µm | Flowability | | Apparent density | | Tap density |
|----------------------------------|-------------|-----------|------------------|-----------|-------------|
| | ASTM B213 | ASTM B964 | ASTM B212 | ASTM B417 | ASTM B527 |
| 15-53 | ● | ● | ● | ● | ● |
| 20-63 | ● | ● | ● | ● | ● |
| 53-150 | ● | ● | ● | ● | ● |

● the test can be performed

Table 3 – Selection of possible testing methods for different powder fractions

Standard inspection certificate contains particle size distribution and chemical analysis. Additional tests can be performed on request.

| Density | Melting range |
|----------------------------------|-----------------|
| 8.26 g/cm ³ at 20 °C | 1,257-1,342 °C |
| 0.04 lb/in ² at 68 °F | 2,2945-2,448° F |

Table 4 – Density and melting range of VDM® Alloy 718

Microstructural properties

VDM® Powder 718 is well known alloy for applications in high demanding industries such as in the aerospace, oil & gas and chemical process industries due to its unique mechanical properties and good processing characteristics, especially its workability (weldability).

VDM® Powder 718 has an austenitic microstructure, however in bulk condition different phases can occur.

VDM® Powder 718 is a complex alloy system where mechanical properties and microstructure stability at high temperatures depend on the amount and morphology of γ' -Ni₃Nb, γ' -Ni₃Al and δ -Ni₃Nb phases. The adjustment of microstructure to the relevant application needs and the necessary amount of strengthening precipitations can be achieved by applying different heat treatments.

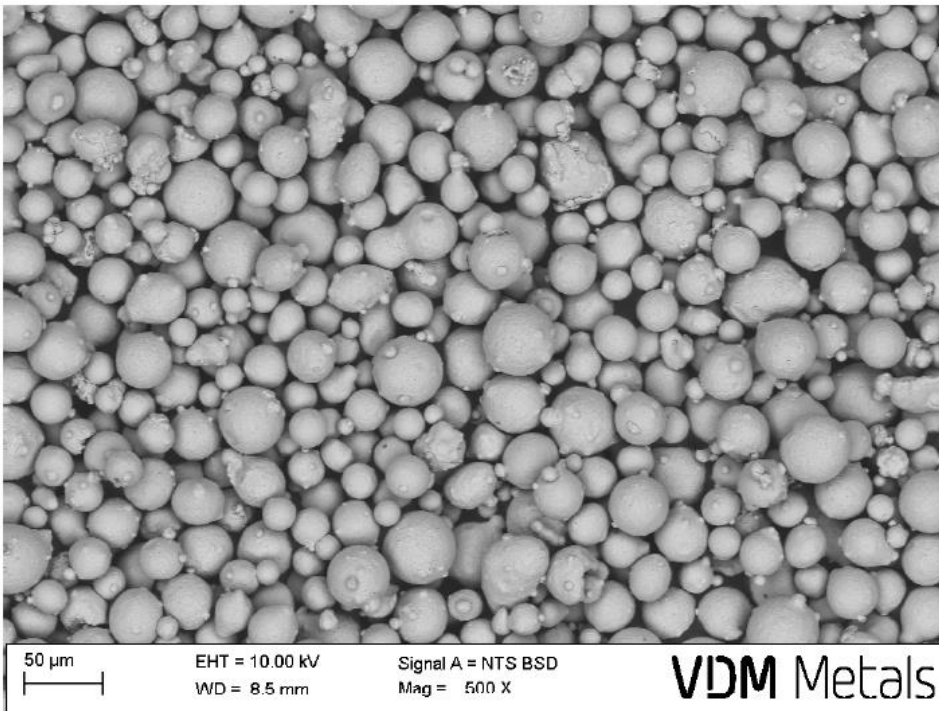


Image 1: Exemplary morphology of VDM® Powder 718. Particle size: 15-53µm

Applications

VDM® Powder 718 can be used for a wide range of processes:

- Laser based additive manufacturing
- Electron beam based additive manufacturing
- Coatings
- Direct energy deposition
- Overlay welding
- Cold and hot isostatic pressing (CIP / HIP)

VDM® Powder 718 can be used for many demanding applications. Originally, it was developed and used for static and rotating components in aircraft turbines such as housings, mounting elements and turbine disks.

The material can also be used for static and rotating components in stationary gas turbines, rocket drives and spacecraft, motor vehicle turbo chargers, high-strength screws, springs and mounting elements, and for heat-resistant tools in forgeries, extruders and separating shearers.

The variant VDM® Powder 718 CTP, which is designed specifically for the requirements of the oil and gas industry, is increasingly being used in drilling equipment and pump shafts. (For more information see data sheet no. 2001 VDM® Powder 718 CTP)

Availability

According to the requirements of the powder based processes, VDM® Powder 718 is available in a wide range of particle fractions from 15 to 250 µm. The typical powder atomization yield ranges from 0,1 to 300 µm. After atomization, the powder is sieved and air classified according to customers specifications. All production and handling operations are carried out under protective atmosphere (argon).

Standard particle fractions

| Particle size distribution | Fine particle | D10 | D50 |
|----------------------------|----------------|------------------------------|------------------------------|
| [µm] | | [µm] (tolerance +/- 5 µm) | [µm] (tolerance +/- 5 µm) |
| 15-53 | <15 µm max. 3% | 22 | 35 |
| 20-63 | <18 µm max. 3% | 25 | 40 |

Table 6 – Standard particle size distribution of different particle fractions. 53-100µm and 53-150µm are also available on request

Other powder size range distributions are available on request.

The determination of the PSD is done by laser diffraction according to ASTM B822. Sieve analysis according to ASTM B214 can also be offered on request.

Packaging

The whole production and packaging process at VDM Metals is under argon and the powder has no contact to atmosphere. The standard powder is packed in plastic bags (5kg/10kg/20kg) under argon inside of sealed plastic drums (6l). Other packaging are available on request.

Handling

Please note that powder transportation may result in segregation of particle sizes.
Do not open the container in humid environment.
After contact with air the powder has limited storability.
Humidity can influence the powder properties.

Legal notice

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Disclaimer

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