**ABD®-900AM**

Nickel-based superalloy for additive manufacturing

### Material Overview

ABD®-900AM is an age-hardenable nickel-based superalloy designed specifically for use as feedstock in powder bed fusion. It is optimised for environmental resistance and high-temperature tensile strength, with a working temperature range up to 900°C (1652°F) in its age-hardened state. Compared to alloy 718, ABD®-900AM not only offers a higher operating temperature but also significant long-term stability.

The alloy has excellent creep strength – similar to alloy 939 and alloy 738 – while having superior resistance to cracking during manufacture and heat treatment, enabling complex part design.

ABD®-900AM is suitable for complex components within the Aerospace, Power, Automotive and Space industries (e.g. combustion chamber, left)

Designed to be free of solidification, liquidation, and strain-age cracks, ABD®-900AM showcases exceptional printability for a 40% γ’-phase strengthened alloy.

### Key Material Properties

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yield strength/ MPa</td>
<td>574 Z, 568 XY</td>
</tr>
<tr>
<td>Ultimate tensile strength/ MPa</td>
<td>582 Z, 593 XY</td>
</tr>
<tr>
<td>Elongation at failure/ %</td>
<td>13 Z, 7 XY</td>
</tr>
<tr>
<td>Area reduction at failure/ %</td>
<td>122.7X</td>
</tr>
<tr>
<td>Thermal Conductivity/ W(m°C)⁻¹</td>
<td>11.0 – 30.1</td>
</tr>
<tr>
<td>CTE (Linear)/ x10⁻⁶°C⁻¹</td>
<td>11.4 – 19.2</td>
</tr>
<tr>
<td>Density/ g cm⁻³</td>
<td>8.395</td>
</tr>
<tr>
<td>Melting range/ °C</td>
<td>1305 – 1380</td>
</tr>
</tbody>
</table>

### Powder Properties

ABD®-900AM powder is available for laser beam melting in a nominal 15-53 μm size range with the following properties:

<table>
<thead>
<tr>
<th>Test</th>
<th>Value</th>
<th>Standard</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carney flow/ s 50g⁻¹</td>
<td>2 - 3</td>
<td>ASTM B964</td>
</tr>
<tr>
<td>Hall flow/ s 50g⁻¹</td>
<td>12 - 14</td>
<td>ASTM B213</td>
</tr>
<tr>
<td>Apparent density/ g cm⁻³</td>
<td>4.3 - 4.5</td>
<td>ASTM B212</td>
</tr>
<tr>
<td>Tapped density/ g cm⁻³</td>
<td>5.1 - 5.4</td>
<td>ASTM B527</td>
</tr>
</tbody>
</table>

Also available in:

- 45-106 μm (EBM/DED)
- Custom size distributions available on request

ABD®-900AM is available in batch sizes suitable for R&T and full production from our powder partner Aubert & Duval

**Typical powder morphology**

ABD®-900AM shows high as-printed part density of >99.9% and no cracking when printed with standard alloy 718 parameters.
Yield Strength & Ultimate Tensile Strength

Tensile properties of additively manufactured ABD®-900AM and Alloy 718, evaluated at a strain rate of $10^{-3}$ s$^{-1}$, all other test conditions in accordance to ASTM E8/E8M-16a/E21. No HIP applied. Yield Strength (YS) shown is $R_{p0.2}\%$ stress, Ultimate Tensile Strength (UTS) is stress at maximum force.

Tensile Ductility & Reduction Of Area

Tensile properties of additively manufactured ABD®-900AM and Alloy 718, evaluated at a strain rate of $10^{-3}$ s$^{-1}$, all other test conditions in accordance to ASTM E8/EBM-16a/E21. No HIP applied. Elongation and Area Reduction were measured after failure as per the standards.
**Long Term Stability**

Tensile properties of additively manufactured ABD®-900AM after full heat treatment cycle followed by long term heat exposure. Yield strength evaluated at 650°C with a strain rate of $10^{-4}$ s$^{-1}$. Data for cast Alloy 718 and Alloy 718Plus taken from "Advanced Materials and Processes, December 2006"

**Fatigue Properties**

Fatigue properties of additively manufactured ABD®-900AM after full heat treatment cycle. Tested in accordance to ASTM E606.

**Stress Rupture Properties**

Stress rupture properties of additively manufactured ABD®-900AM after recrystallisation anneal and full heat treatment cycle. Tested in accordance to ASTM E139. Larson-Miller Parameter evaluated with Temperature (T) in Kelvin and Time (t) in hours. Alloy 718 is additively manufactured and fully heat treated.
Thermophysical Properties

**Linear coefficient of thermal expansion** measured according to ASTM E228. Average of heating and cooling curves. ¹

**Mass gain of ABD®-900AM and other alloys during the course of cyclic oxidation in laboratory air over 200 hrs.** ¹

**Thermal conductivity (λ) of ABD®-900AM is calculated using AST standards from measured values of density (ρ), specific heat capacity (C_p), and thermal diffusivity (a): λ = ρ C_p a.** ¹

**Specific heat (C_p) of ABD®-900AM, measured according to ASTM E1269.** ²

**Microstructure & Heat Treatment**

**Full heat treatment:** 1060°C / 2hrs + 850°C / 4 hrs + 760°C / 16 hrs  
**Recrystallisation anneal:** 1240°C / 2hrs, followed by full heat treatment  
**HIP parameter:** 1160°C / 100 MPa / 3hrs

Typical EBSD maps and grain structures of ABD®-900AM after the corresponding heat treatments.

¹Crystallographic misalignment scale, ²Scale for pole figures, blue-red = increasing grain density in given direction

This data is for information only. ABD® is a registered trademark of Alloyed.