MATERIAL OVERVIEW

- An age-hardenable nickel-based superalloy designed specifically for use as feedstock in powder bed fusion. Stellar ABD®-900AM is optimized for high creep and tensile strength, and corrosion/oxidation resistance, with a working temperature range up to 900°C in its age-hardened state.
- The new alloy has excellent creep strength – similar to alloy 939 and Ni 738 – while having superior resistance to cracking during manufacture and heat treatment.

Designed to be free of solidification, liquidation and strain-age cracks, Stellar ABD®-900AM is 40% γ’ phase and showcases exceptional printability for such a high temperature strengthened alloy. It is suitable for complex components within the Aerospace, Power, Automotive and Space industries.

KEY PROPERTIES

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yield strength (MPa)</td>
<td>z 574</td>
</tr>
<tr>
<td></td>
<td>xy 568</td>
</tr>
<tr>
<td>Ultimate tensile strength (MPa)</td>
<td>z 582</td>
</tr>
<tr>
<td></td>
<td>xy 593</td>
</tr>
<tr>
<td>Elongation at failure %</td>
<td>z 13</td>
</tr>
<tr>
<td></td>
<td>xy 7</td>
</tr>
<tr>
<td>Area reduction at failure %</td>
<td>z 12</td>
</tr>
<tr>
<td></td>
<td>xy 7</td>
</tr>
</tbody>
</table>

- Mechanical

(900°C)

Thermo-
physical

(25-1200°C)

Physical

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<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>

- All measurements are for the fully heat treated alloy printed with a layer thickness of 30 μm.
- ¹strain rate of 10⁻⁴ s⁻¹, ²after recrystallisation anneal and full heat treatment, ³after full heat treatment, ⁴as-printed

PRINTABILITY

Stellar ABD®-900AM shows high part density and no cracking when printed with standard Ni 718 parameters.

POWDER CHARACTERISTICS

- Particle size distributions:
  - Laser Beam Melting (powder bed): 15-53 μm
  - Electron Beam Melting (powder bed): 45-106 μm
  - Directed energy deposition (LMD): 45-106 μm
- Custom size distributions available on request

Stellar ABD®-900AM is well suited for gas atomisation

Stellar ABD®-900AM is available in batch sizes suitable for R&T and full production.

Contact: powder@eramet.com
www.aubertduval.com
TENSILE PROPERTIES

Strength/ MPa vs Temperature / °C

- Stellar ABD®-900AM Recrystallised, annealed and full heat treatment
- Ni718 Standard full heat treatment

Tensile properties of additively manufactured ABD®-900AM and Ni718, 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 Rp₀.₂% stress, Ultimate Tensile Strength (UTS) is stress at maximum force.

TENSILE DUCTILITY & REDUCTION OF AREA

At failure (%) vs Temperature / °C

- Stellar ABD®-900AM Recrystallised, annealed and full heat treatment
- Ni718 Standard full heat treatment

Tensile properties of additively manufactured Stellar ABD®-900AM and Ni718, 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. 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 Alloy 718 and Alloy 718Plus taken from "Advanced Materials and Processes, December 2006"

FATIGUE PROPERTIES

Low cycle 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. Ni718 is additively manufactured and fully heat treated.

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**THERMOPHYSICAL PROPERTIES**

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

Mass gain of Stellar ABD®-900AM and other alloys during the course of cyclic oxidation in laboratory air over 200 hrs.²

Thermal conductivity (λ) of Stellar ABD®-900AM is calculated according to ASTM standards from measured values of density (ρ), specific heat capacity (Cp), and thermal diffusivity (α): λ = ρCpα.¹

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

¹Stellar ABD®-900AM after full heat treatment, ²Stellar ABD®-900AM in an as-printed condition

**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 / 3 hrs

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

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