

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.

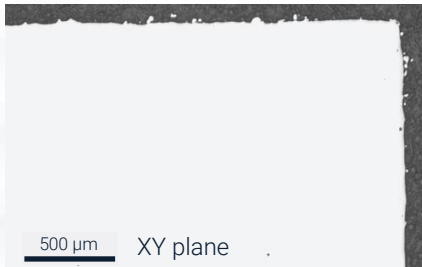
The alloy has excellent creep strength – similar to alloy 939 and alloy 738 – while having superior resistance to cracking during manufacture and heat treatment, enabling complex part design.



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

Height: 291 mm
Width: 147 mm

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



ABD[®]-900AM shows high as-printed part density of >99.9% and no cracking when printed with standard alloy 718 parameters.

Key Material Properties

Mechanical ^{1,2} (900°C)	Yield strength/ MPa	574 Z, 568 XY
	Ultimate tensile strength/ MPa	582 Z, 593 XY
	Elongation at failure/ %	13 Z, 7 XY
	Area reduction at failure/ %	12Z,7XY
Thermophysical ³ (25-1200°C)	Thermal Conductivity/ W(m°C) ⁻¹	11.0 – 30.1
	CTE (Linear)/ x10 ⁻⁶ °C ⁻¹	11.4 – 19.2
Physical ⁴	Density/ g cm ⁻³	8.395
	Melting range ² / °C	1305 – 1380

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

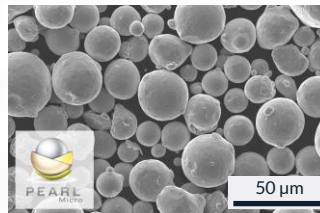
Powder Properties

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

Test	Value	Standard
Carney flow/ s 50g ⁻¹	2 - 3	ASTM B964
Hall flow/ s 50g ⁻¹	12 - 14	ASTM B213
Apparent density/ g cm ⁻³	4.3 - 4.5	ASTM B212
Tapped density/ g cm ⁻³	5.1 - 5.4	ASTM B527

Also available in:

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



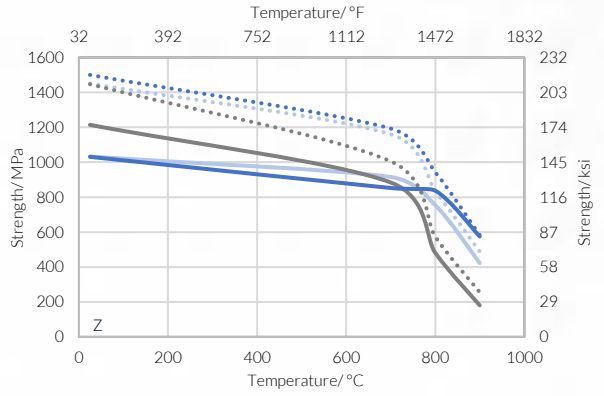
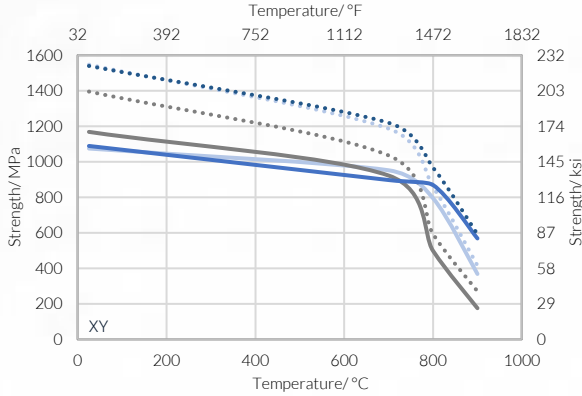
ABD[®]-900AM is available in batch sizes suitable for R&T and full production from our powder partner Aubert & Duval

Typical powder morphology

ABD[®]-900AM

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Yield Strength & Ultimate Tensile Strength

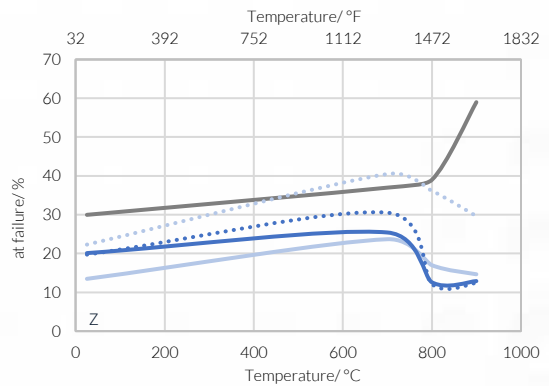
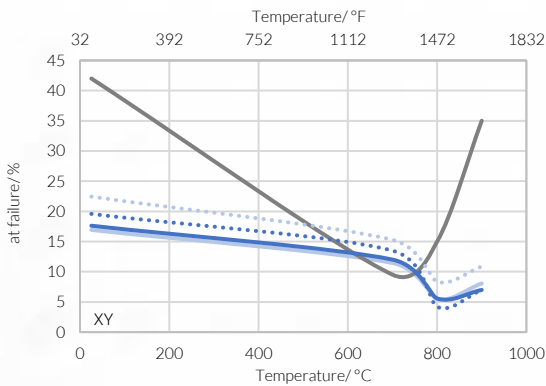


- ABD[®]-900AM – YS – full heat treatment
- ABD[®]-900AM – YS – recrystallisation anneal and full heat treatment
- Alloy 718 – YS – standard full heat treatment

- ABD[®]-900AM – UTS – full heat treatment
- ABD[®]-900AM – UTS – recrystallisation anneal and full heat treatment
- Alloy 718 – UTS – standard full heat treatment

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



- ABD[®]-900AM – Elongation – full heat treatment
- ABD[®]-900AM – Elongation – recrystallisation anneal & full heat treatment
- Alloy 718 – Elongation – standard full heat treatment

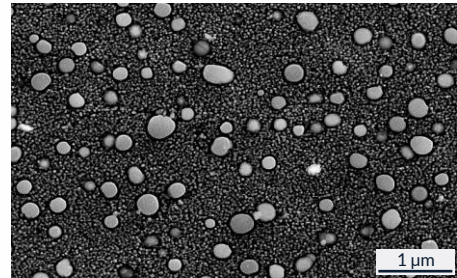
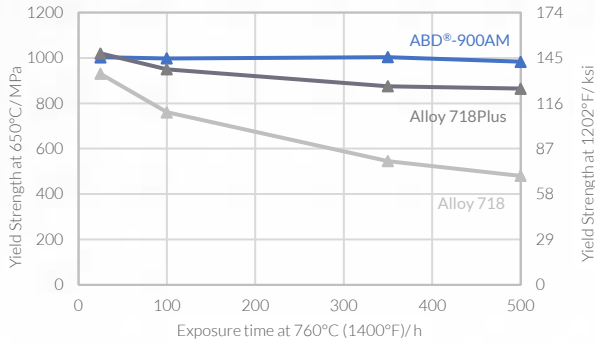
- ABD[®]-900AM – Area Reduction – full heat treatment
- ABD[®]-900AM – Area Reduction – recrystallisation anneal and full heat treatment

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. Elongation and Area Reduction were measured after failure as per the standards.

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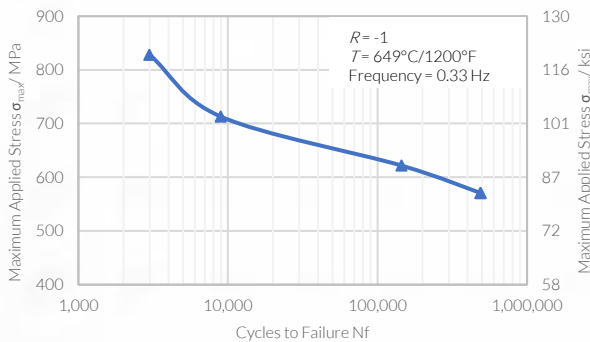
Long Term Stability



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"

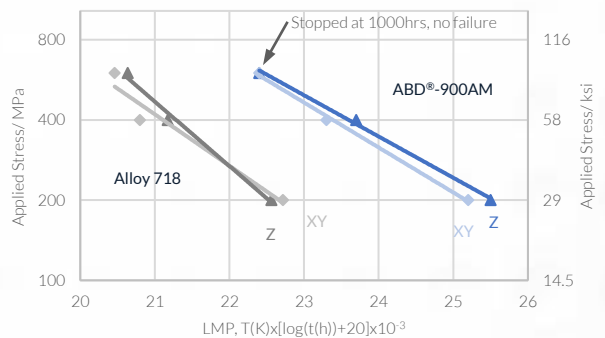
SEM image of fully heat-treated ABD[®]-900AM after electro-chemical etching in 10% phosphoric acid showing the bi-modal γ-phase distribution: 50 and 200 nm

Fatigue Properties

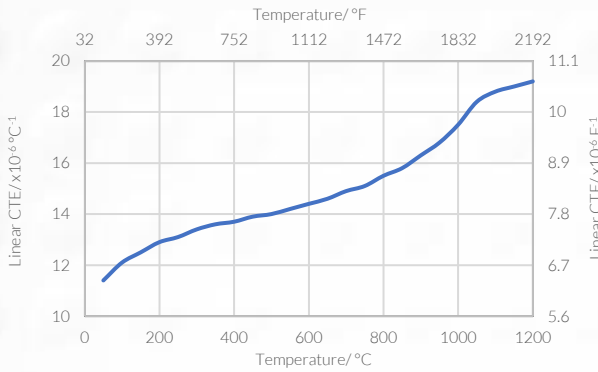


Fatigue properties of additively manufactured ABD[®]-900AM after full heat treatment cycle. Tested in accordance to ASTM E606.

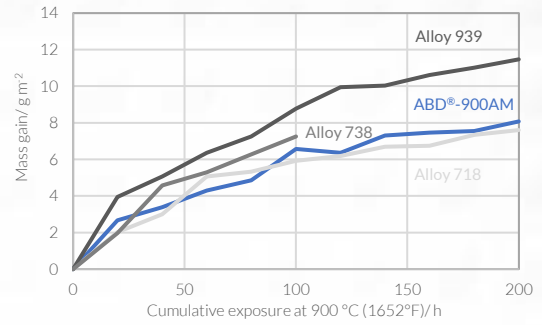
Stress Rupture Properties



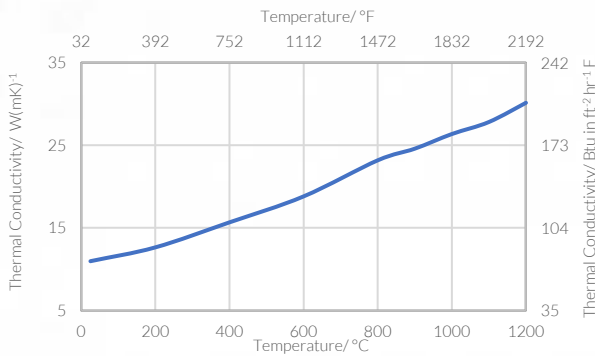
Stress rupture properties of additively manufactured ABD[®]-900AM after recrystallisation anneal and full heat treatment cycle. Tested in accordance to ASTM E139. Larson-Miller Parameter evaluated with Temperature (T) in Kelvin and Time (t) in hours. Alloy 718 is additively manufactured and fully heat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



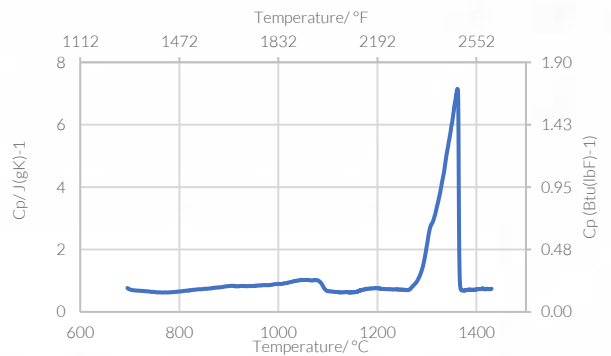
Linear coefficient of thermal expansion measured according to ASTM E228. Average of heating and cooling curves. ¹



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 ASTM standards from measured values of density (ρ), specific heat capacity (C_p), and thermal diffusivity (a): $\lambda = \rho C_p a$. ¹



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

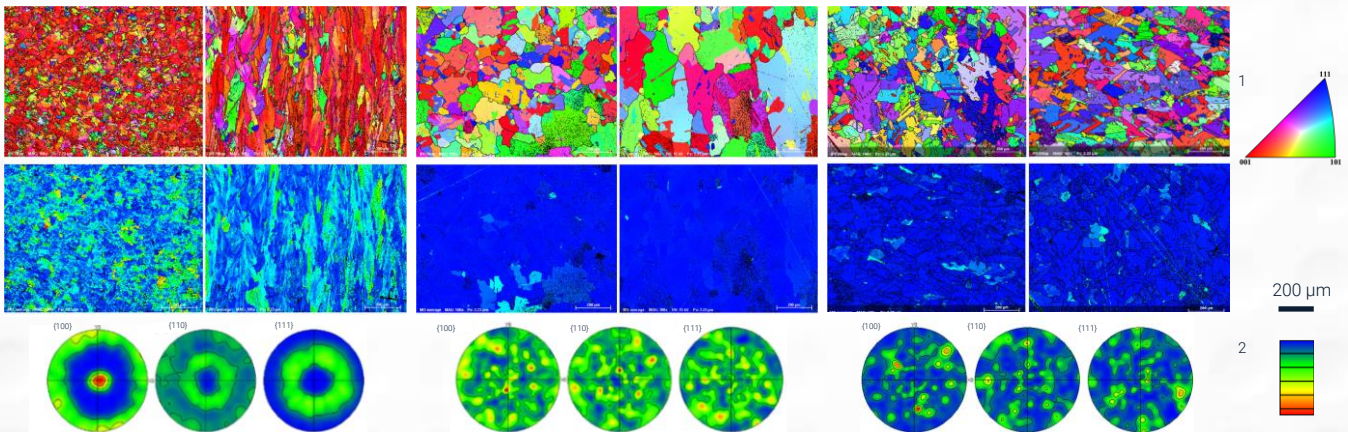
¹ABD®-900AM after full heat treatment, ²ABD®-900AM in an as-printed condition

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 / 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