

Pearl[®] Micro ABD[®]-900AM

Powder for Additive Manufacturing



MATERIAL OVERVIEW

- An age-hardenable nickel-based superalloy designed specifically for use as feedstock in powder bed fusion. ABD[®]-900AM is optimised 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, 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

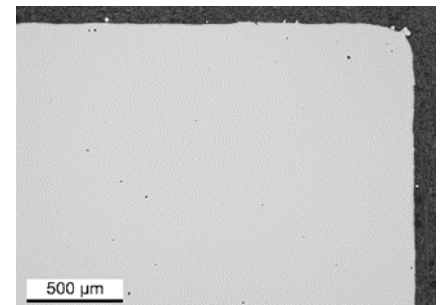
Mechanical ^{1,2} (900°C)	Yield strength (MPa)	z 574 xy 568
	Ultimate tensile strength (MPa)	z 582 xy 593
	Elongation at failure %	z 13 xy 7
	Area reduction at failure %	z 12 xy 7
Thermo-physical ³ (25-1200°C)	Thermal conductivity (W(m°C) ⁻¹)	11.0 - 30.1
	CTE (Linear)/ x10 ⁻⁶ °C ⁻¹	11.4 - 19.2
Physical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

All measurements are for the fully heat treated alloy printed with a layer thickness of 30 μ m.

¹strain rate of 10⁻³s⁻¹, ²after recrystallisation anneal and full heat treatment, ³after full heat treatment, ⁴as-printed

PRINTABILITY

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



POWDER CHARACTERISTICS

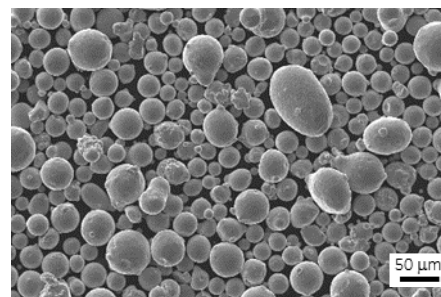
Particle size distributions:

Laser Beam Melting (powder bed): 15-53 μ m

Electron Beam Melting (powder bed): 45-106 μ m

Directed energy deposition (LMD): 45-106 μ m

Custom size distributions available on request



ABD[®]-900AM is well suited for gas atomisation

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

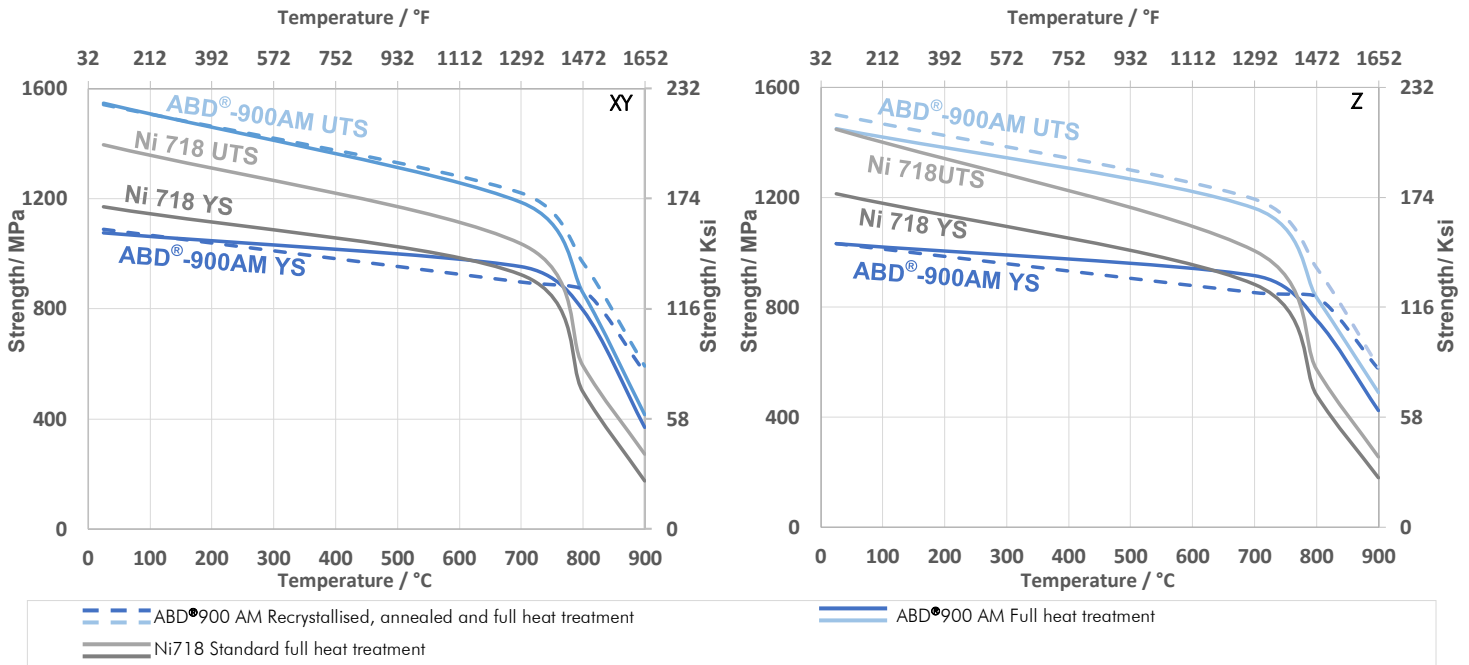
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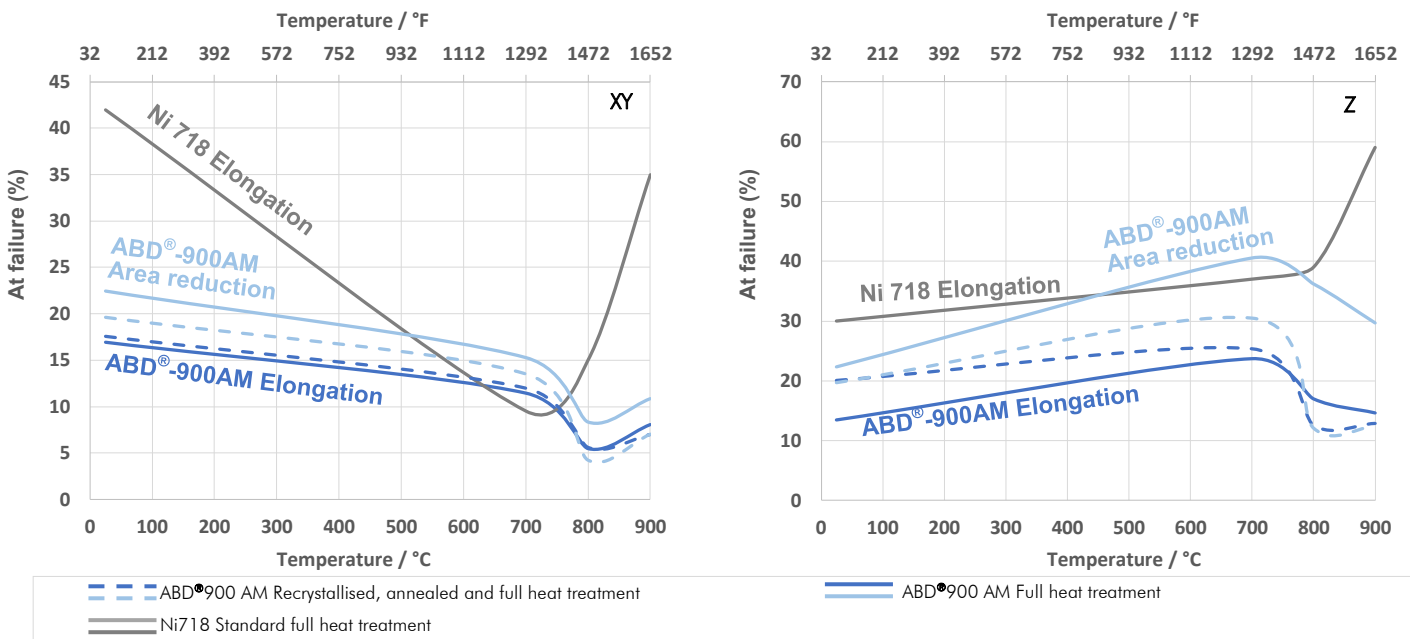


TENSILE PROPERTIES



Tensile properties of additively manufactured ABD[®]-900AM and Ni718, evaluated at a strain rate of 10⁻³s⁻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



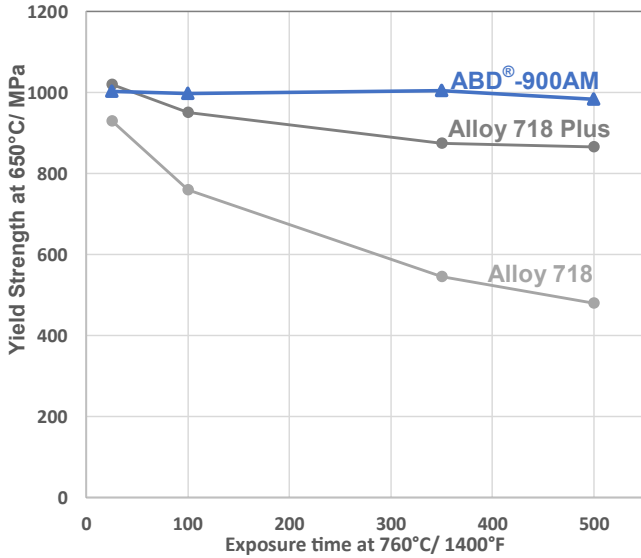
Tensile properties of additively manufactured ABD[®]-900AM and Ni718, evaluated at a strain rate of 10⁻³s⁻¹, all other test conditions in accordance to ASTM E8/E8M-16a/E21. No HIP applied. Elongation and Area Reduction were measured after failure as per the standards.

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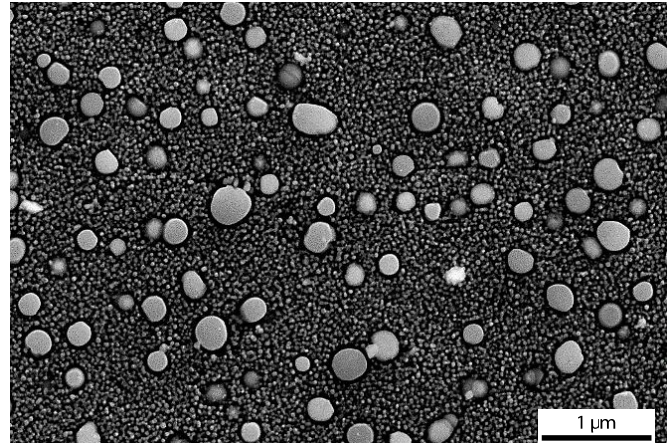


LONG TERM STABILITY



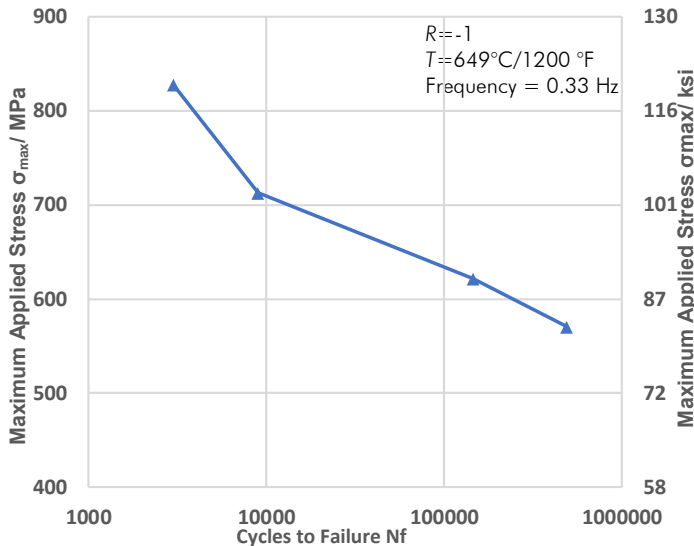
Tensile properties of additively manufactured ABD[®]-900AM after full heat treatment cycle followed by long term heat exposure. Yield strength evaluated at 650 °C with a strain rate of 10⁻⁴ s⁻¹. Data for Alloy 718 and Alloy 718Plus taken from "Advanced Materials and Processes, December 2006"

Yield Strength at 1400°F/ksi



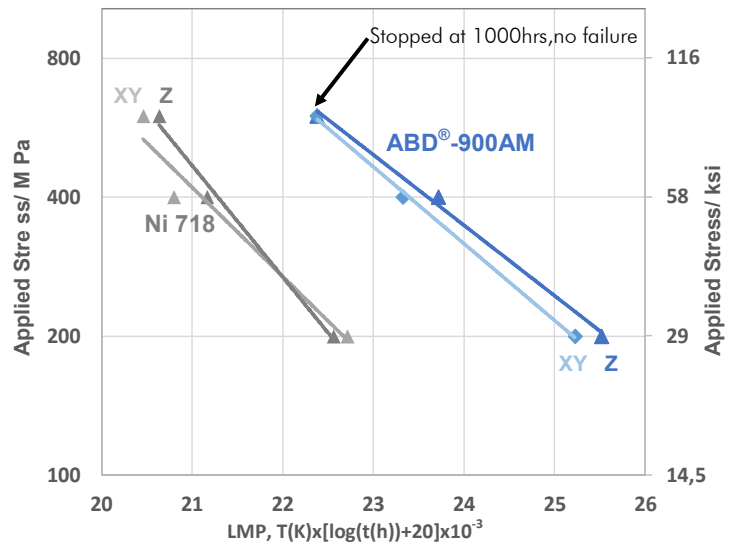
SEM image of fully heat-treated ABD[®]-900AM after electro-chemical etching in 10% phosphoric acid showing the bi-modal γ'-phase distribution: 50 and 200 nm

FATIGUE PROPERTIES



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

STRESS RUPTURE PROPERTIES

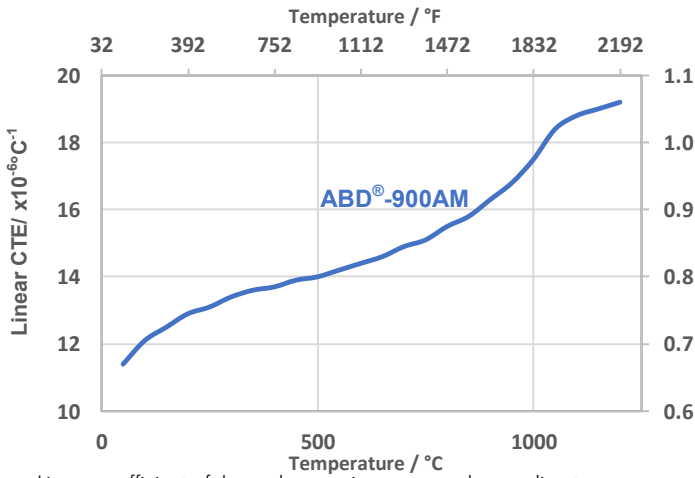


Stress rupture properties of additively manufactured ABD[®]-900AM after recrystallisation anneal and full heat treatment cycle. Tested in accordance to ASTM E139. Larson-Miller Parameter evaluated with Temperature (T) in Kelvin and Time (t) in hours. Ni718 is additively manufactured and fully heat treated.

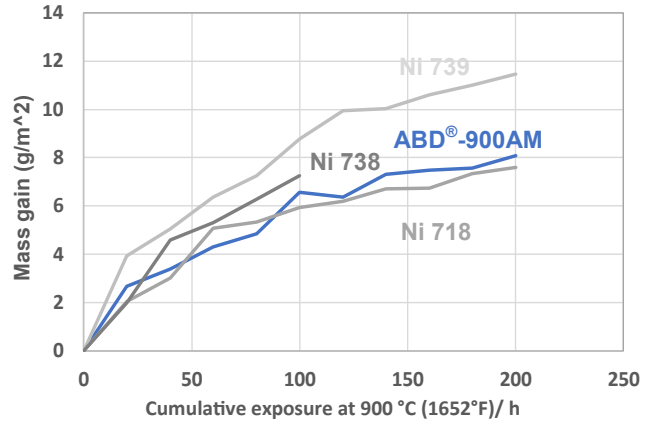
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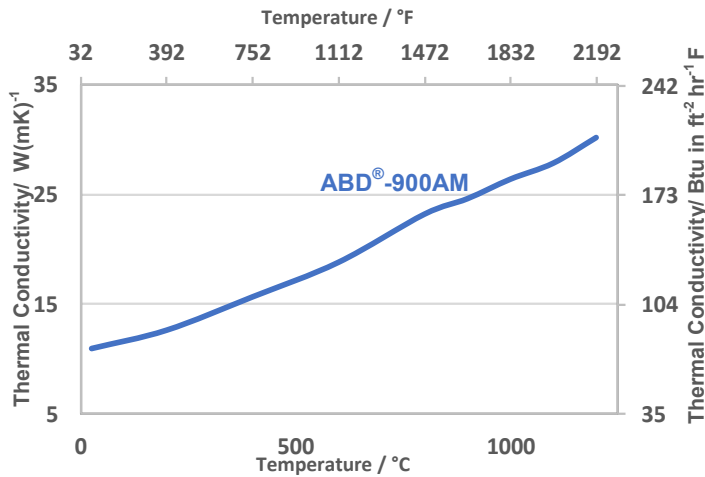
THERMOPHYSICAL PROPERTIES



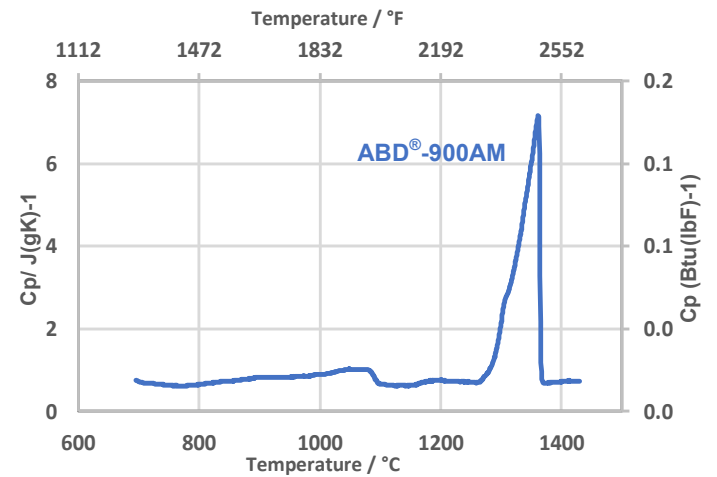
Linear coefficient of thermal expansion measured according to ASTM E228. Average of heating and cooling curves.¹



Mass gain of 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 according to 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

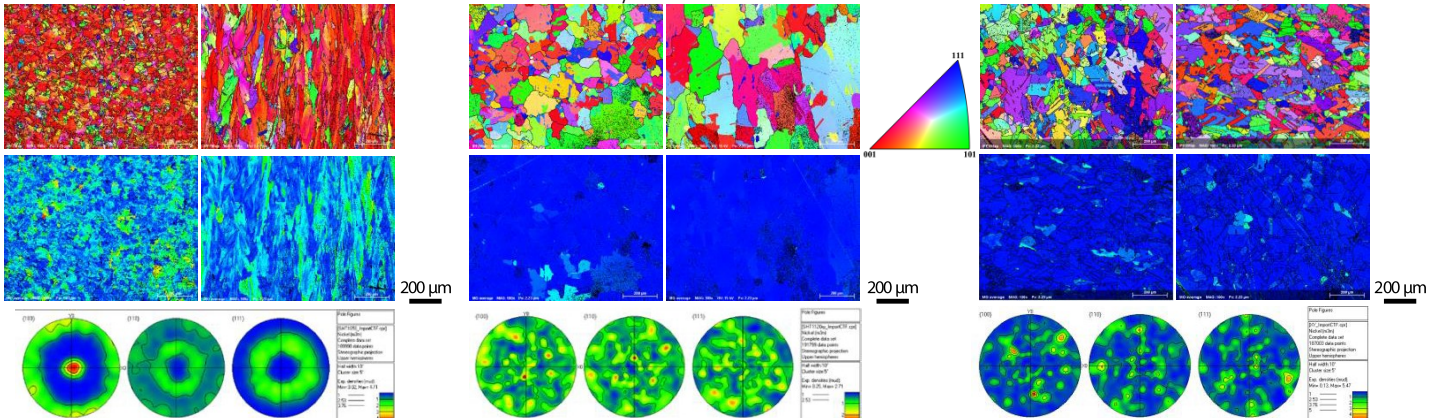
¹ABD[®]-900AM after full heat treatment, ²ABD[®]-900AM in an as-printed condition

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 / 3 hrs



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

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