AUBERT&DUVAL

made with ABD®

Pearl®Micro ABD®-900AM

Powder for Additive Manufacturing

PEARL Micro

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.

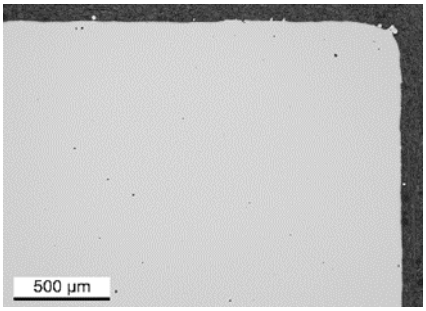
KEY PROPERTIES

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)/ $x10\text{-}6°C^{-1}$	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 µm.
[1]strain rate of $10^{-3}s^{-1}$, [2]after recrystallisation anneal and full heat treatment, [3]after full heat treatment, [4]as-printed

PRINTABILITY

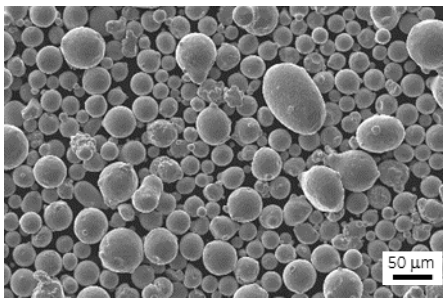
ABD®-900AM shows high part density and no cracking when printed with standard Ni 718 parameters.



POWDER CHARACTERISITICS

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



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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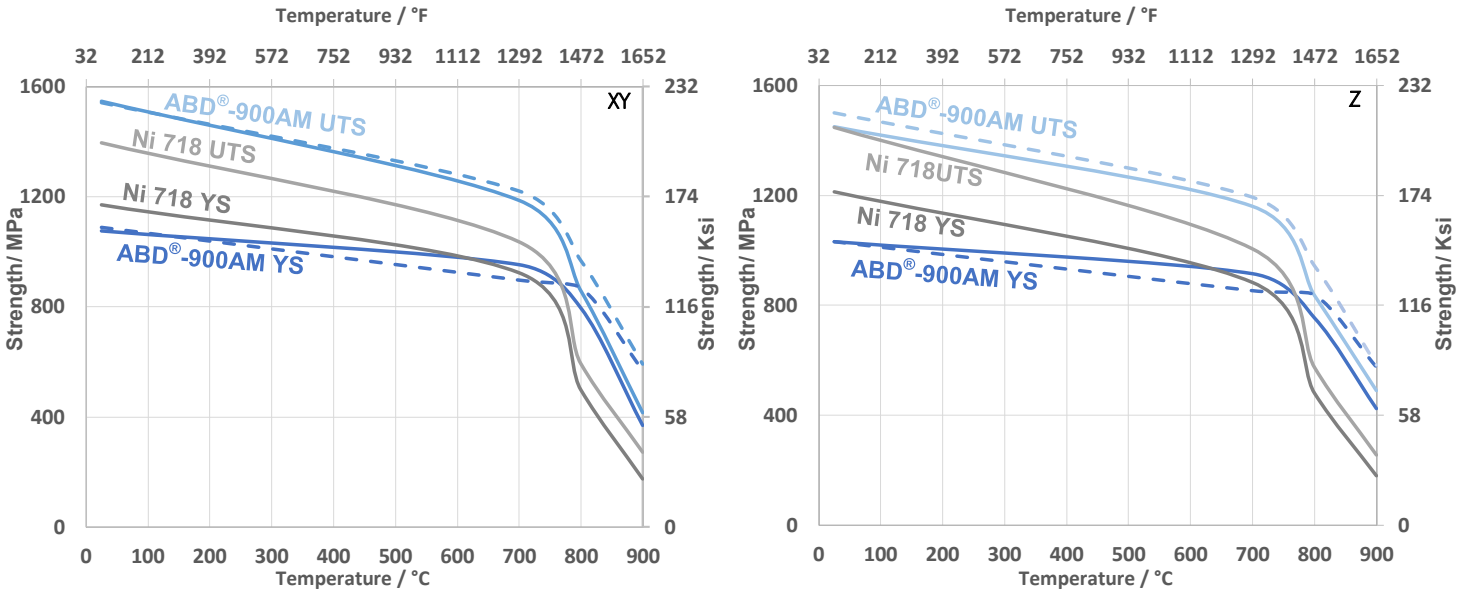
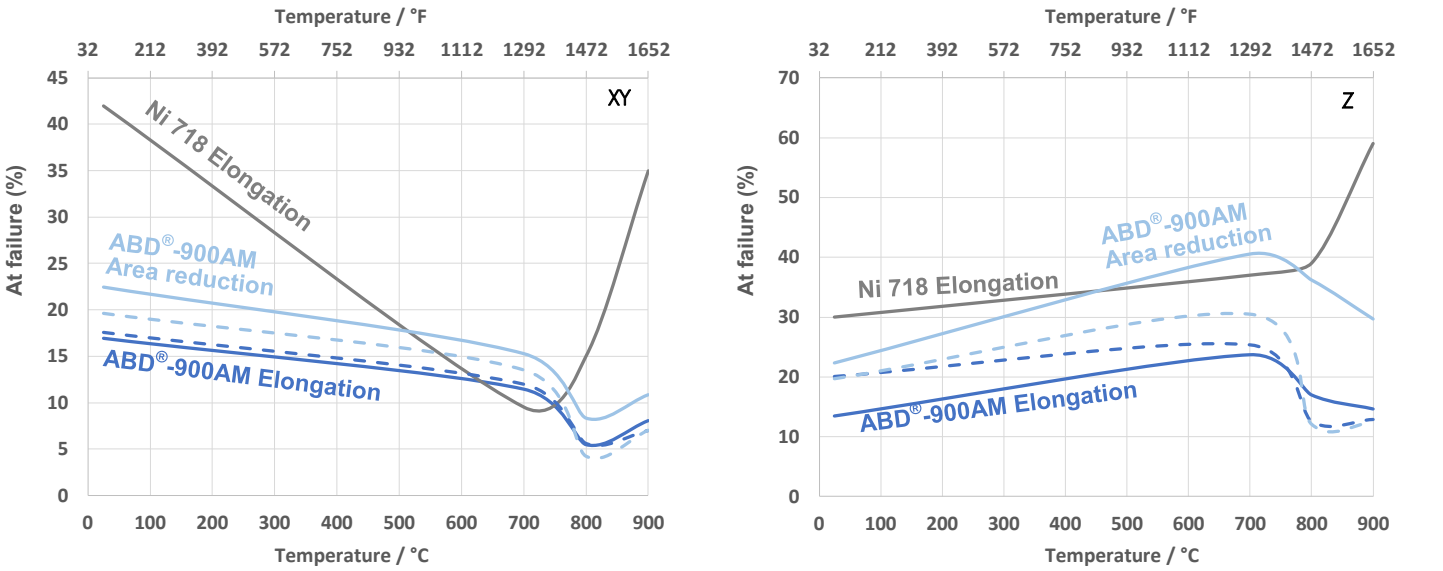
TENSILE PROPERTIES



Tensile properties of additively manufactured ABD®-900AM and Ni718, evaluated at a strain rate of $10^{-3}s^{-1}$, all other test conditions in accordance to ASTM E8/E8M-16a/E21. No HIP applied. Yield Strength (YS) shown is $Rp_{0.2\%}$ stress, Ultimate

TENSILE DUCTILITY & REDUCTION OF AREA



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

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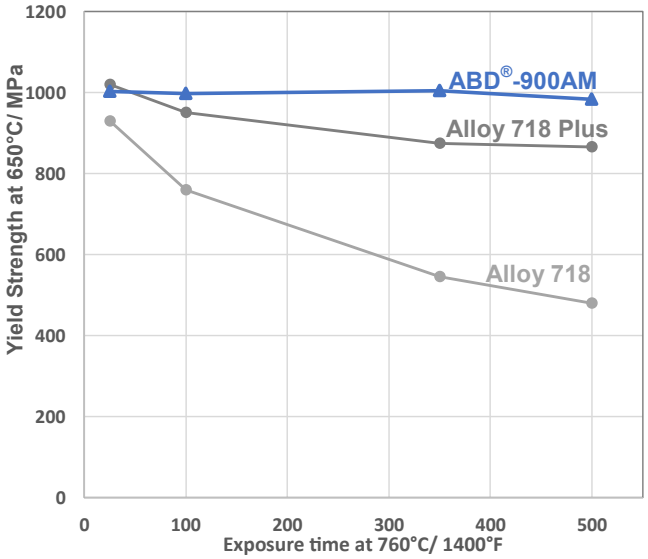
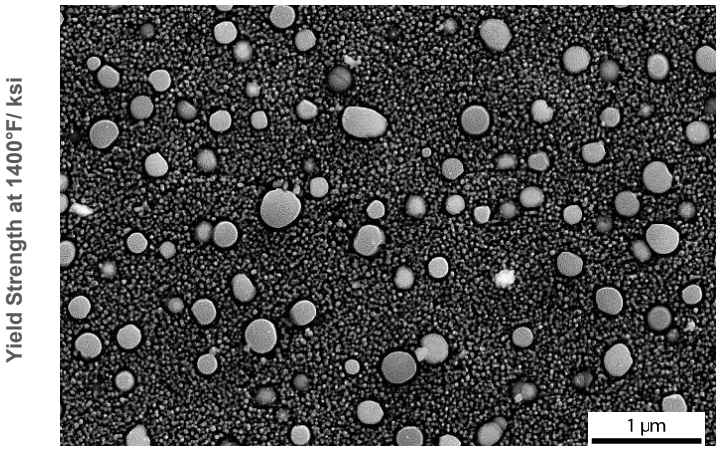
LONG TERM STABILITY

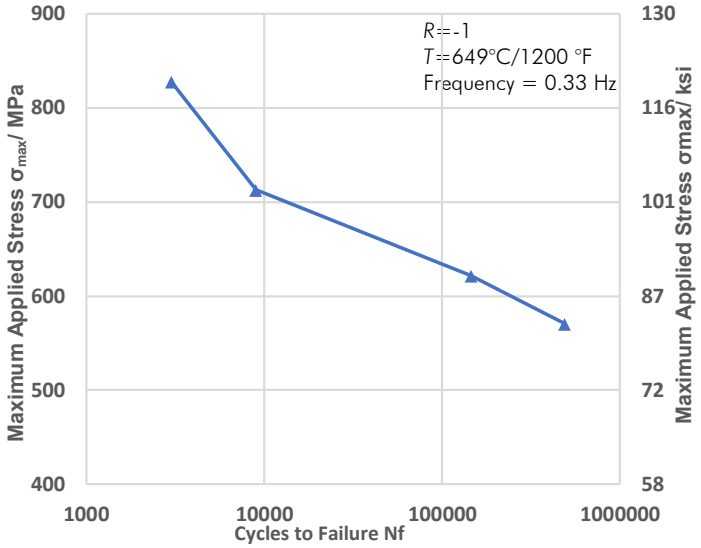


Tensile properties of additively manufactured ABD®-900AM after full heat treatment cycle followed by long term heat exposure.
Yield strength evaluated at 650 °C with a strain rate of 10^{-4} s^{-1}.
Data for Alloy 718 and Alloy 718Plus taken from *"Advanced Materials and Processes, December 2006"*



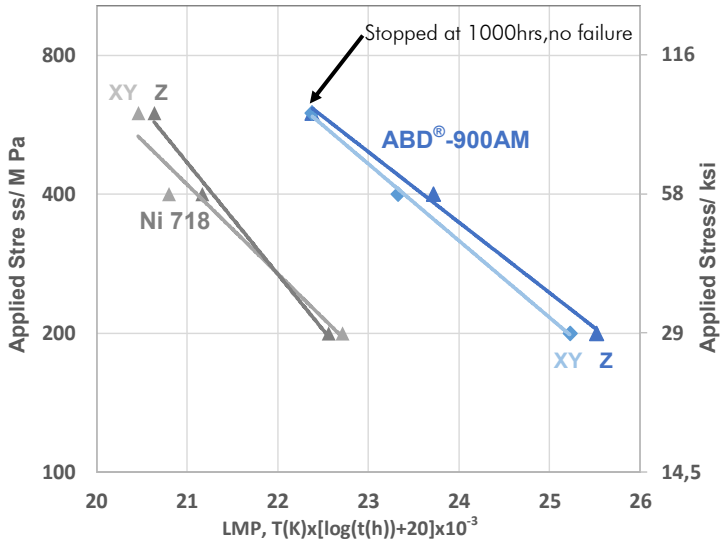
SEM image of fully heat-treated ABD®-900AM after electro-chemical etching in 10% phosphoric acid showing the bi-modal γ'-phase distribution: 50 and 200 nm

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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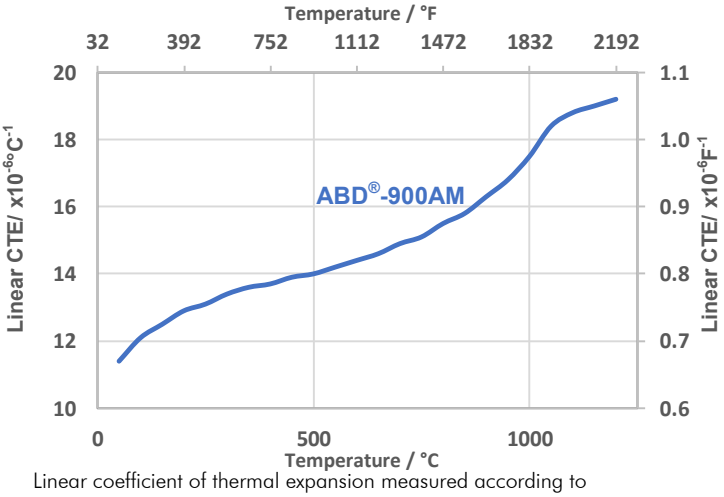
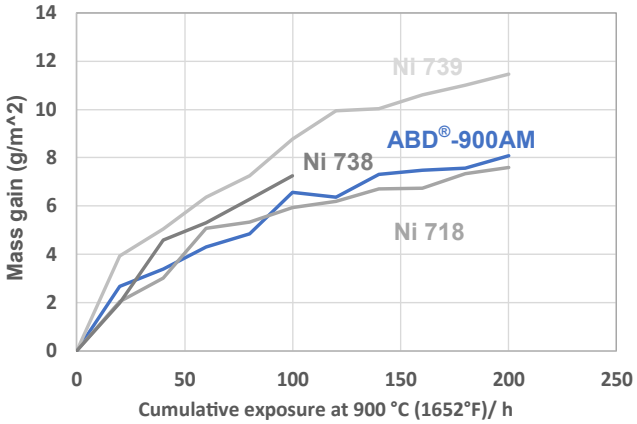
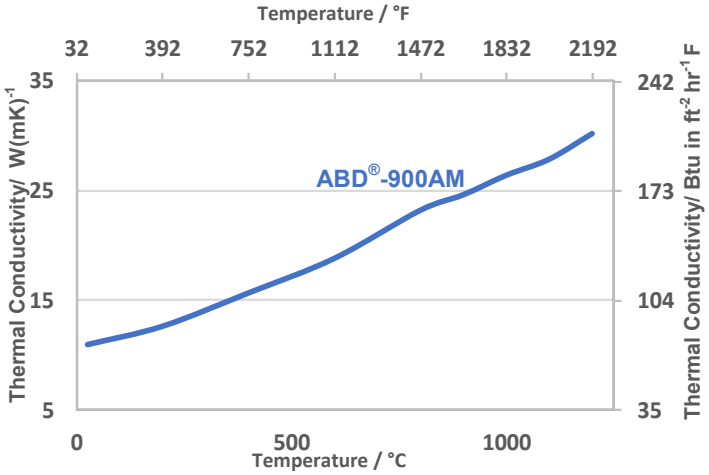
THERMOPHYSICAL PROPERTIES



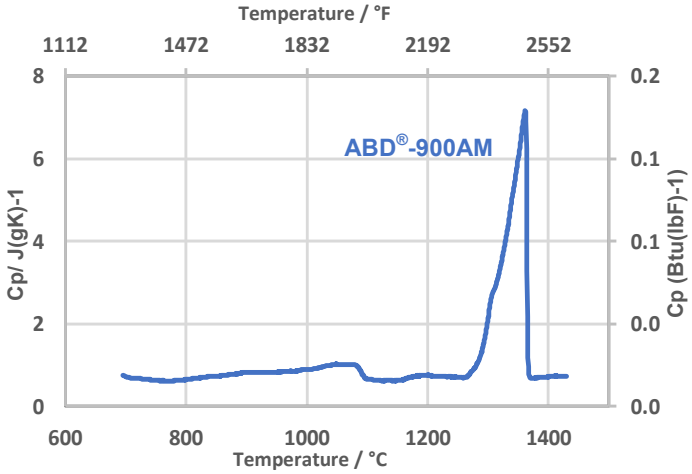
Linear coefficient of thermal expansion measured according to ASTM E228. Average of heating and cooling curves.[1]



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 (Cp), and thermal diffusivity (a): λ= ρCpa.[1]



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

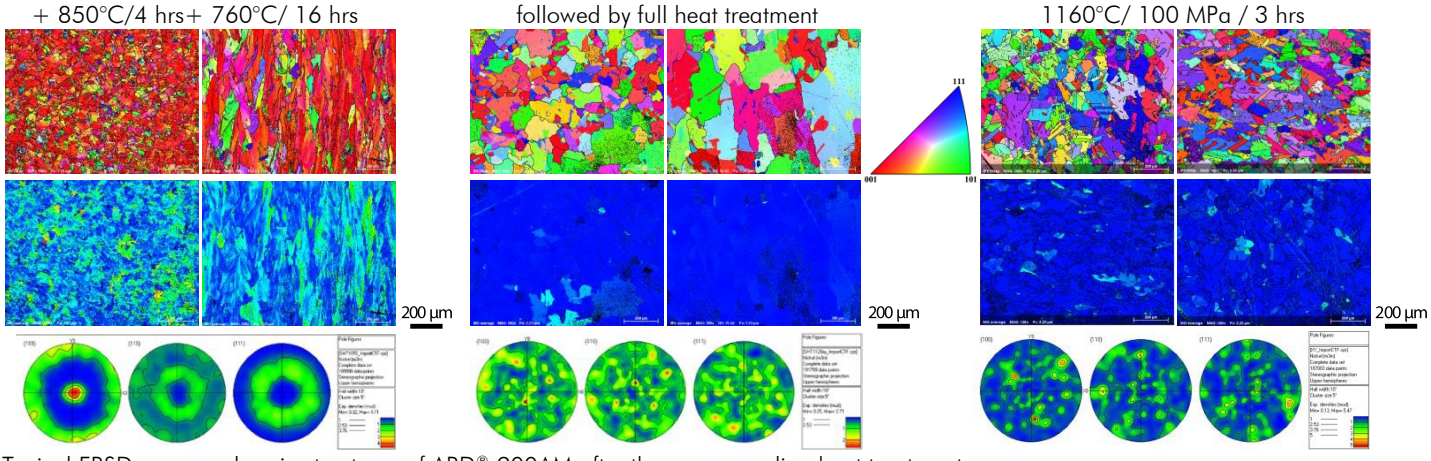
[1]ABD®-900AM after full heat treatment, [2]ABD®-900AM in an as-printed condition

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 ABD®-900AM after the corresponding heat treatments.

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