

Stellar ABD[®]-900AM

Powder for Additive Manufacturing

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

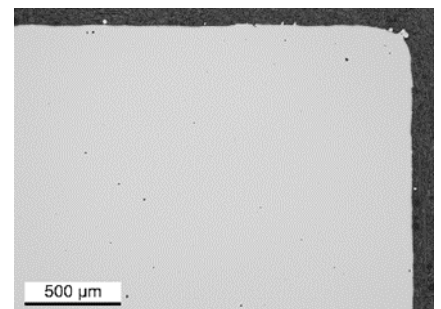
Mechanical ^{1,2} (900°C)	Yield strength (MPa)	z 574 xy 568
	Ultimate tensile strength (MPa)	z 582 xy 593
	Elongation at failure %	z 13 xy 7
	Area reduction at failure %	z 12 xy 7
Thermo-physical ³ (25-1200°C)	Thermal conductivity (W(m°C) ⁻¹)	11.0 - 30.1
	CTE (Linear)/ x10 ⁻⁶ °C ⁻¹	11.4 - 19.2
Physical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

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



POWDER CHARACTERISTICS

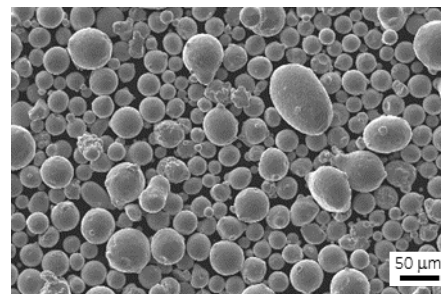
Particle size distributions:

Laser Powder Bed Fusion (LPBF): 15-53 μ m

Electron Beam Melting (EBM): 45-106 μ m

Directed Energy Deposition (DED): 45-106 μ m

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.

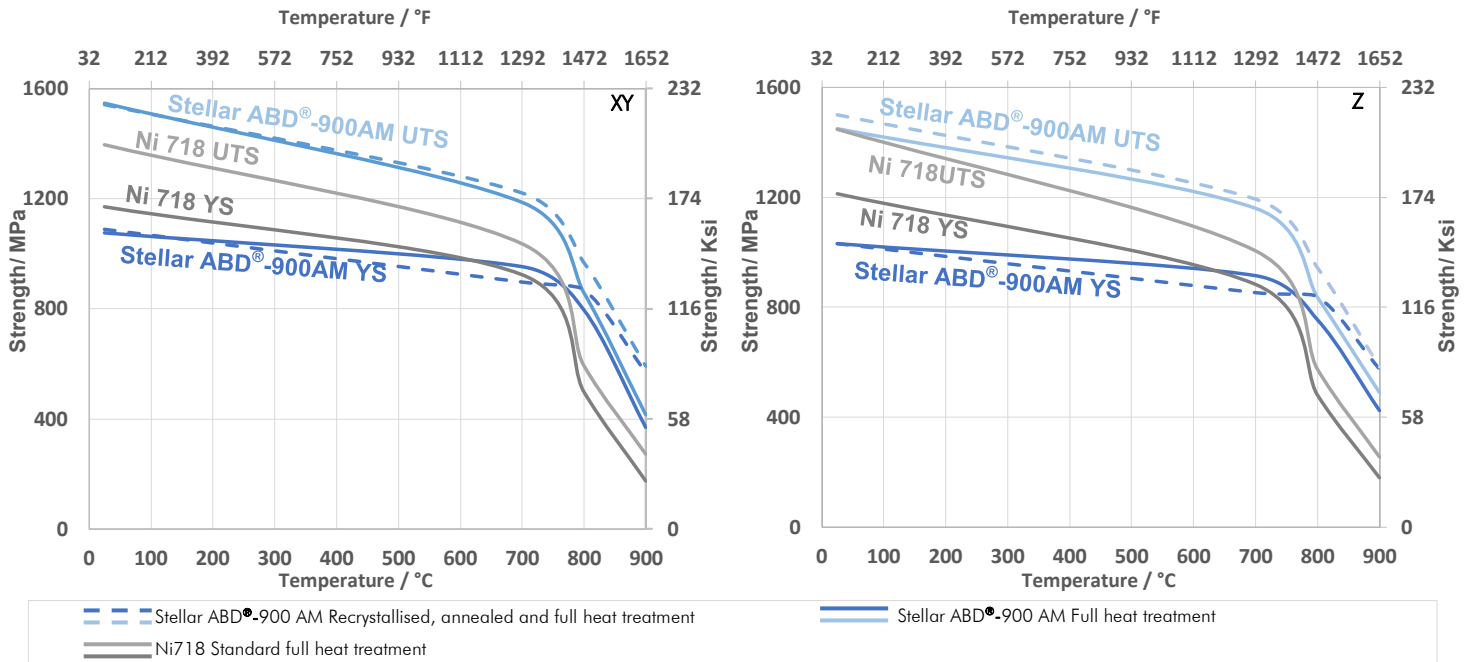
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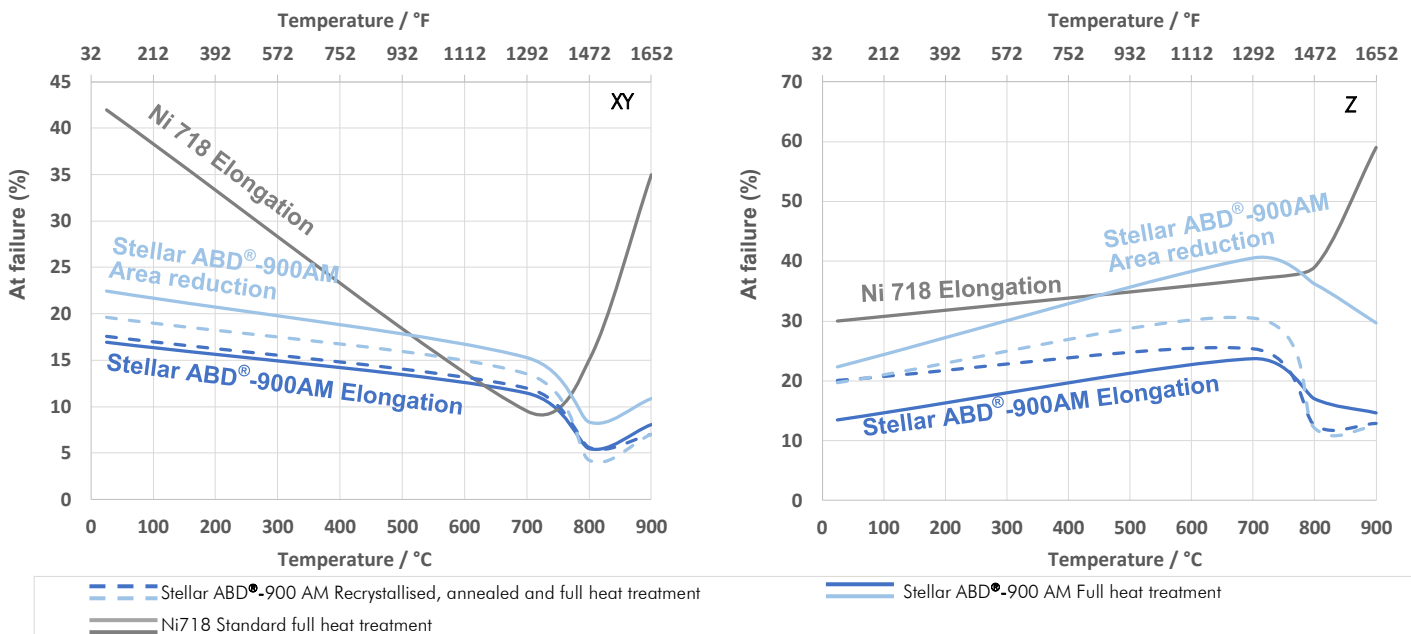
The data provided in this document represent typical or average values rather than maximum or minimum guaranteed values. The applications indicated for the grades described are given by guidance only in order to help the reader in his/her personal assessment. Please note that these do not constitute a guarantee whether implicit or explicit as to whether the grade selected is suited for specific requirements. Aubert & Duval's liability shall not, under any circumstances, extend to product selection or to the consequences of this selection.

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 $R_{p0.2\%}$ stress, Ultimate Tensile Strength (UTS) is stress at maximum force.

TENSILE DUCTILITY & REDUCTION OF AREA



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.

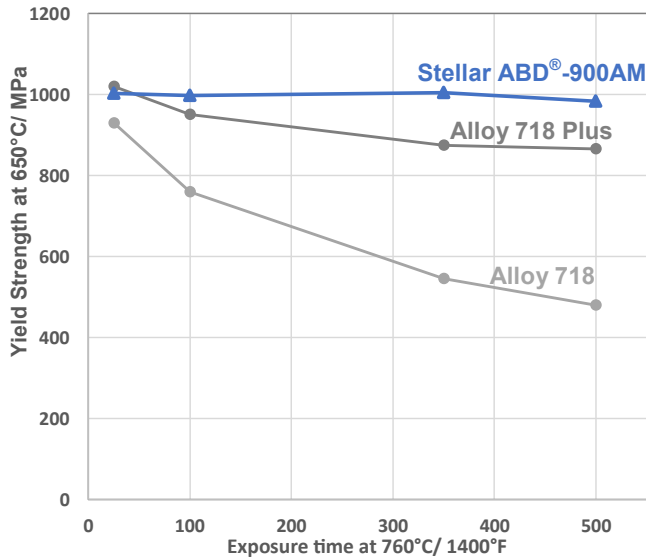
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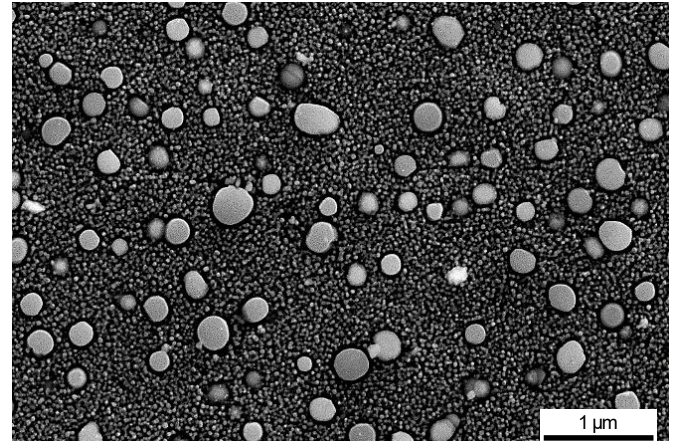
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LONG TERM STABILITY



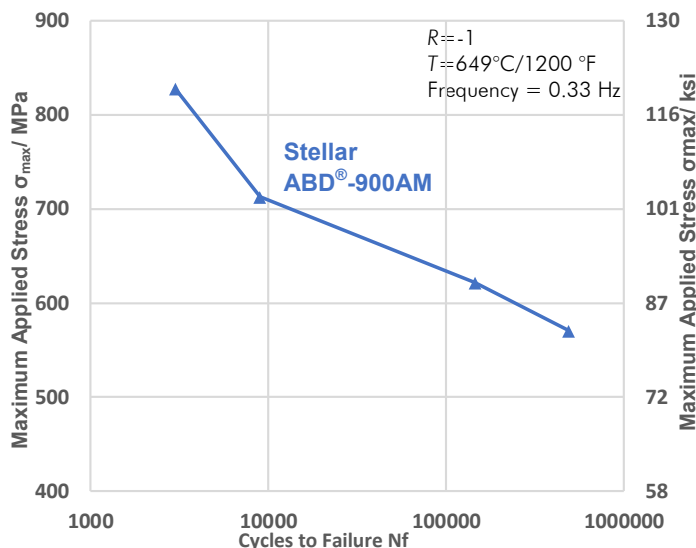
Tensile properties of additively manufactured ABD[®]-900AM after full heat treatment cycle followed by long term heat exposure. Yield strength evaluated at 650 °C with a strain rate of 10⁻⁴ s⁻¹. Data for Alloy 718 and Alloy 718Plus taken from "Advanced Materials and Processes, December 2006"

Yield Strength at 1400°F/ksi



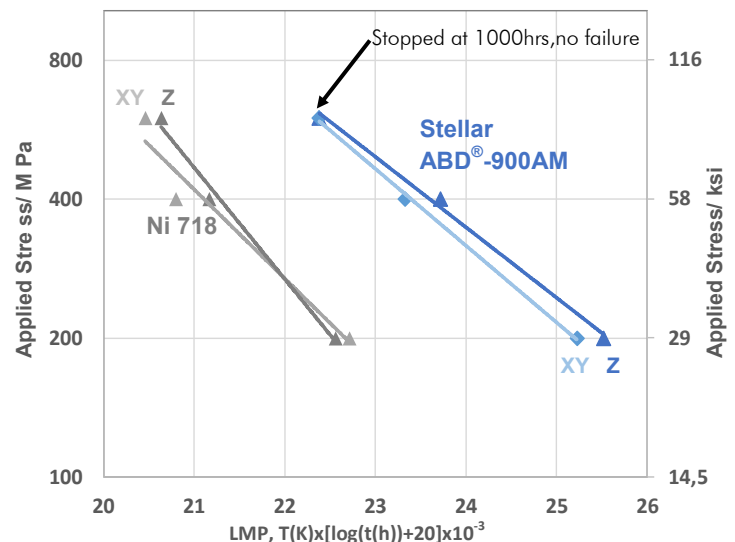
SEM image of fully heat-treated ABD[®]-900AM after electro-chemical etching in 10% phosphoric acid showing the bi-modal γ'-phase distribution: 50 and 200 nm

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.

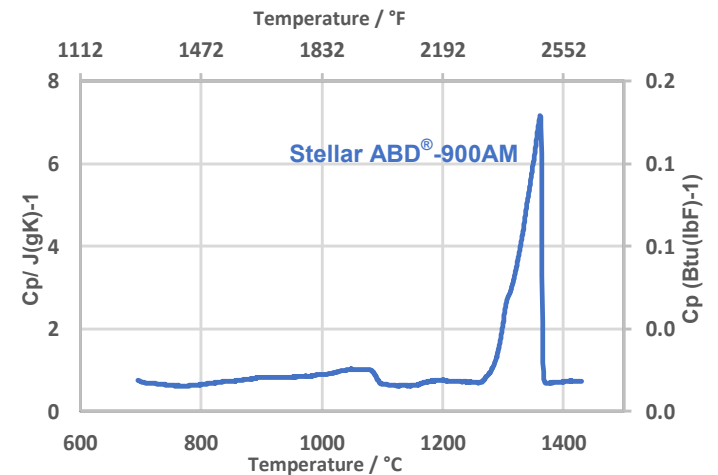
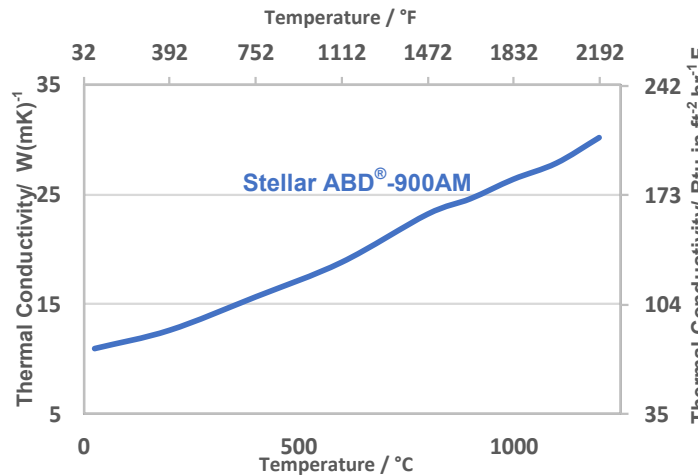
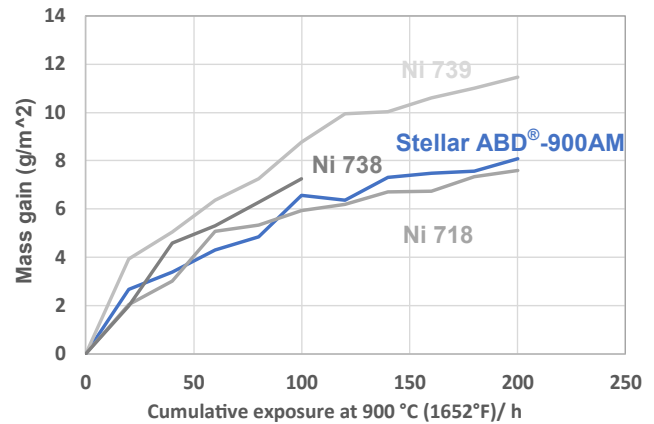
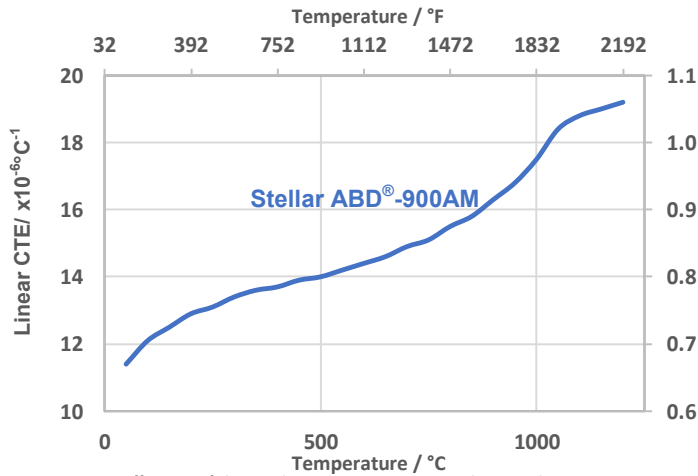
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THERMOPHYSICAL PROPERTIES



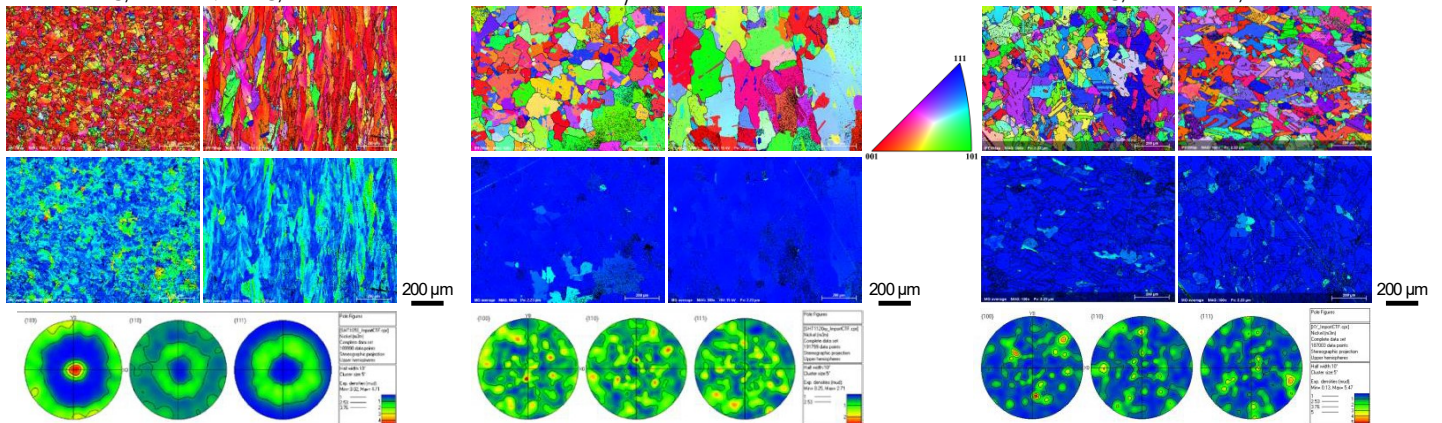
¹Stellar ABD[®]-900AM after full heat treatment, ²Stellar ABD[®]-900AM in an as-printed condition

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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