COLIBRIUM ADDITIVE
a GE Aerospace company

22 Ti	24 Cr	26 Fe	27 Co	28 Ni	29 Cu	13 Al

Binder Jet Line Nickel 718

Parameters and Processes for Colibrium Additive Binder Jet Line

Nickel Alloy 718

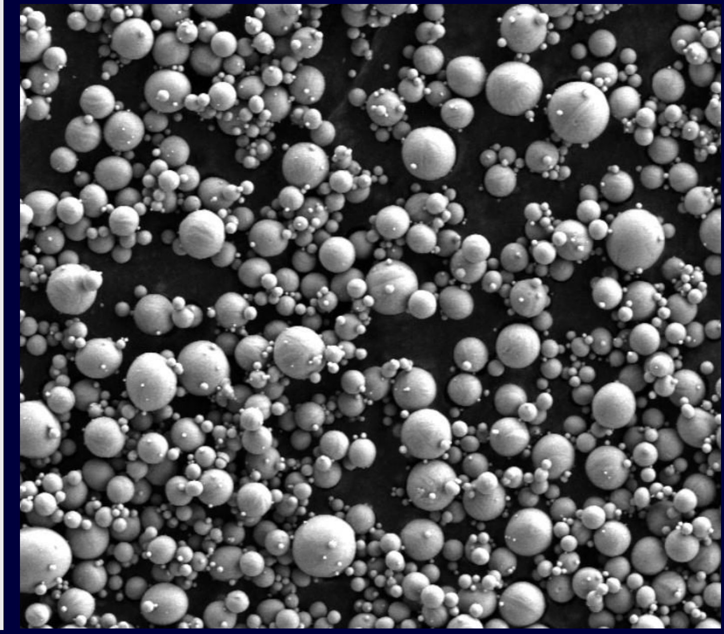
Nickel chromium superalloys like Nickel 718 are often used in high-stress and high-temperature environments. The excellent high temperature strength and creep resistance of this alloy derive from precipitation hardening which creates finely dispersed precipitates.

Nickel 718 is a metal that is also highly resistant to the corrosive effects of hydrochloric acid and sulfuric acid. The favorable weldability of Nickel 718 makes this alloy suitable for standard post-processing activities. Typical applications are high-quality components designed for thermally challenging environments such as rocket engines and gas turbine hot sections.

Nickel 718 Binder Jet

Through mechanical testing and bulk material characterization, this parameter and the applied post-processing route demonstrated properties that exceed cast requirements and match MIM minimums.

Compared to other powder bed additive manufacturing processes, binder jet offers economy of scale for customers requiring both part quantity and part variation with favorable cost: a build box 0.5 meters per side can be fully printed in approximately 18 hours.



Binder Jet Line Nickel 718

Machine Configuration

Colibrium Additive Binder Jet Line

Air atmosphere

Aqueous binder

Powder Chemistry

Nickel 718 powder conforms to SAE AMS5383

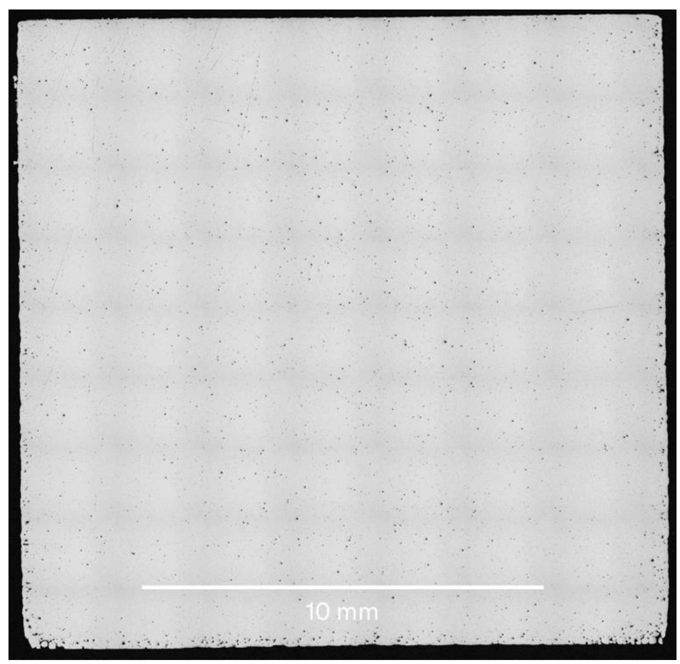
Parameter Information

This build parameter uses a 75 µm layer thickness and green parts are sintered for 600 minutes at 1320°C after a curing step. Sinter cycle optimization is encouraged for thin section parts.

Thermal States

The post-processing route for this material was a three-step HIP + solution + age:

- Hot Isostatic Press (HIP): 1162°C for 4 hours at 100MPa
- Solution: 1050°C for 1 hour
- Age: 718°C for 8 hours followed by furnace cooling to 621°C for 8 hours



Residual Carbon

The carbon concentration after the full heat treatment met casting (AMS5383) and MIM (AMS5917) specification maximums.

Porosity

The average porosity after the full heat treatment was approximately 0.2% in parts with varying wall thicknesses (2 – 20 mm)

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Tensile Performance at Room Temperature

	0.2% Yield Strength (MPa)		Ultimate Tensile Strength (MPa)	
	H	V	H	V
HIP+SOLN+AGE	1045	1045	1260	1262

	Elongation (%)		Area Reduction (%)	
	H	V	H	V
HIP+SOLN+AGE	21	21	31	31

Tensile Performance at 535°C

	0.2% Yield Strength (MPa)		Ultimate Tensile Strength (MPa)	
	H	V	H	V
HIP+SOLN+AGE	895	893	1038	1036

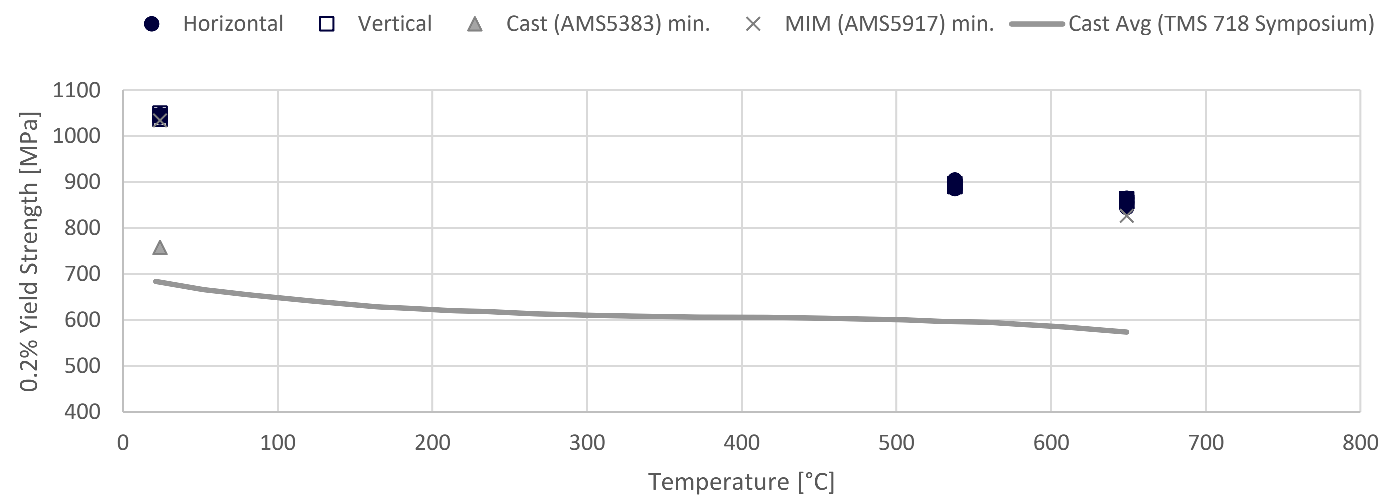
	Elongation (%)		Area Reduction (%)	
	H	V	H	V
HIP+SOLN+AGE	20	19	36	33

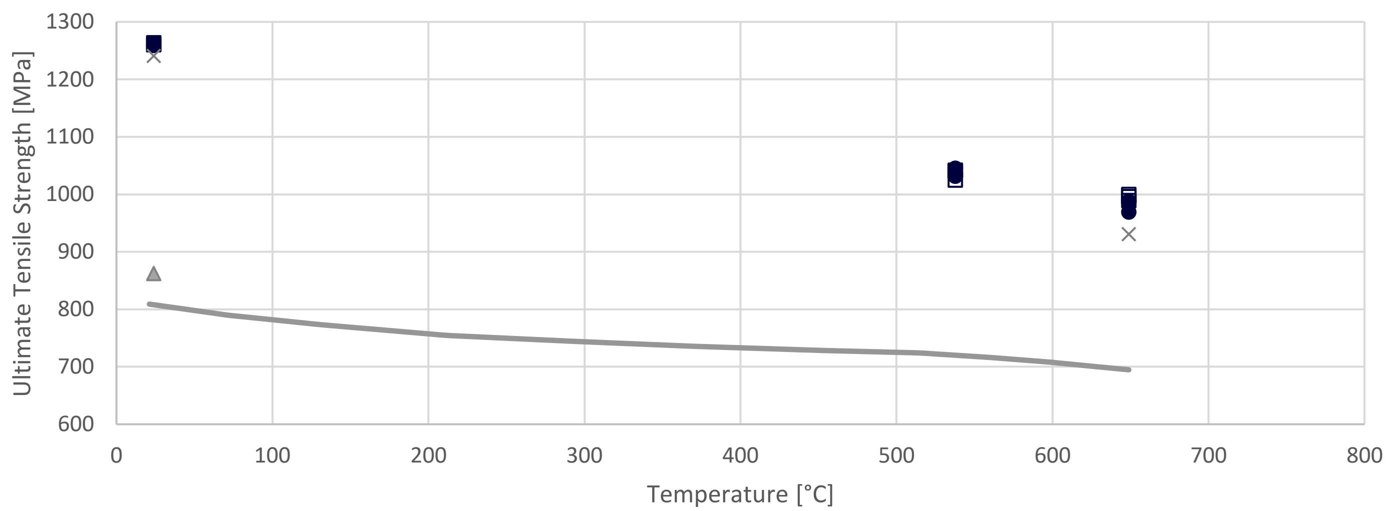
Tensile Performance at 650°C

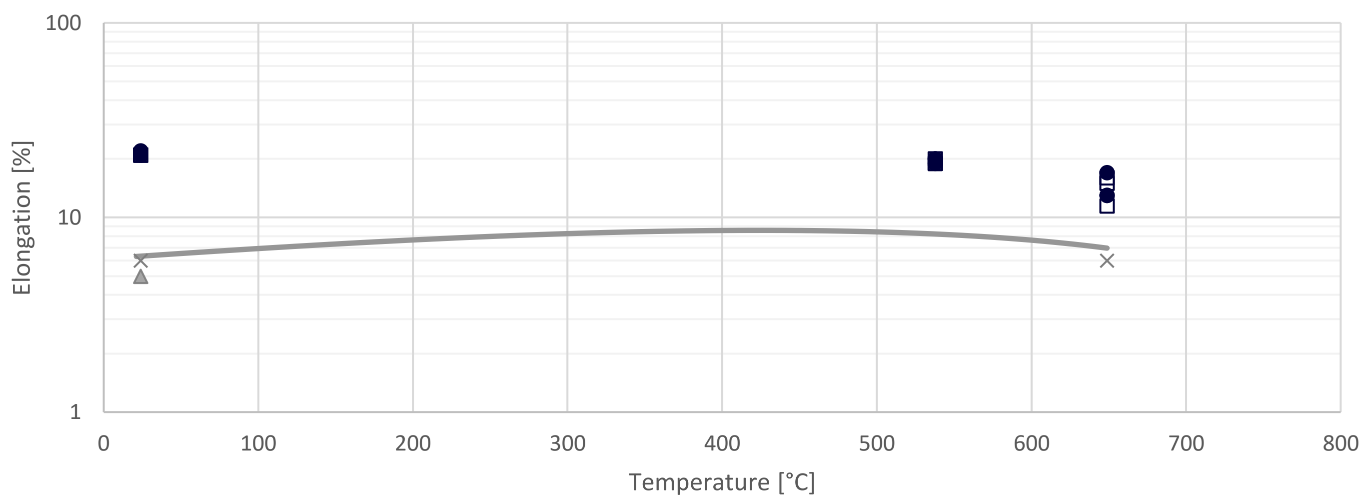
	0.2% Yield Strength (MPa)		Ultimate Tensile Strength (MPa)	
	H	V	H	V
HIP+SOLN+AGE	855	859	982	995

	Elongation (%)		Area Reduction (%)	
	H	V	H	V
HIP+SOLN+AGE	14	14	19	17

Tensile Property Comparisons







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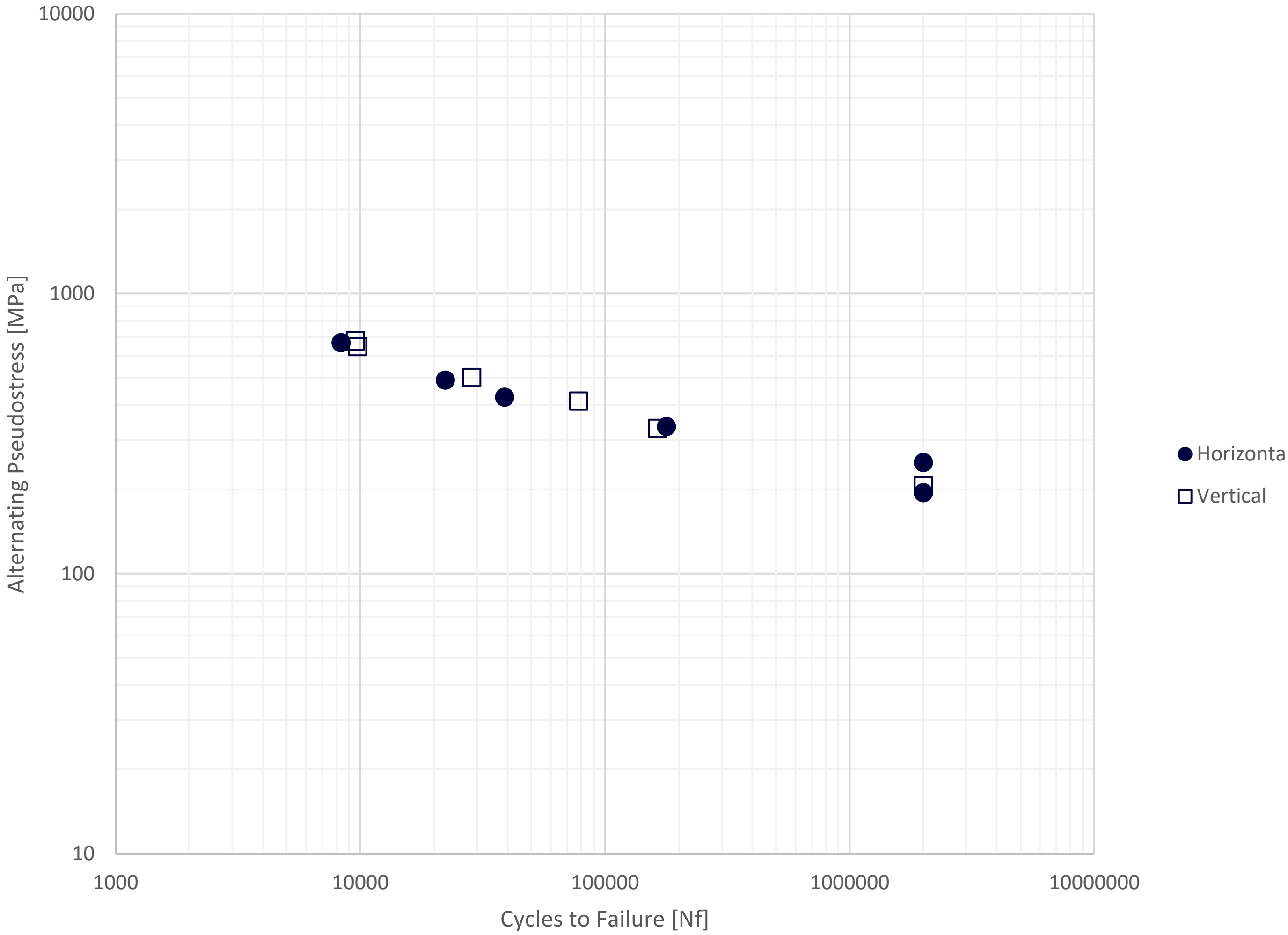
Axial Fatigue Performance (H and V) at 315°C and R = 0



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Data Sheet Nomenclature and Notation

H: Horizontal, X or Y.
V: Vertical, Z.
Other angles are measured from horizontal.

Tensile evaluations were executed against ASTM E8 and E21; surfaces were in a machined state.

Fatigue characterization was performed according to ASTM E606 with machined surfaces.