AUBERT&DUVAL

STELLAR
Metal powders by AUBERT & DUVAL

Stellar MHA3300®

Powder for Additive Manufacturing

MATERIAL OVERVIEW

- Stellar MHA3300® is a new superalloy developed by Mitsubishi Power for Additive Manufacturing (AM).
- This carbide-strengthened Co-based alloy is designed for high temperature structural applications in aero-space engines and industrial gas turbines.
- This alloy has an excellent creep strength and tensile behavior, similar to alloy Ni939, while having better ductility at high temperature up to 850°C, as well as a good oxidation resistance and a good microstruc-ture stability to high temperature.

PRINTABILITY

Stellar MHA3300® parts show very low porosity content (below 0.02%) and are crack free in as-built state.

Standard laser parameters of SLM280, EOS290, Concept Laser M2 have been developed and are available under request.

KEY PROPERTIES

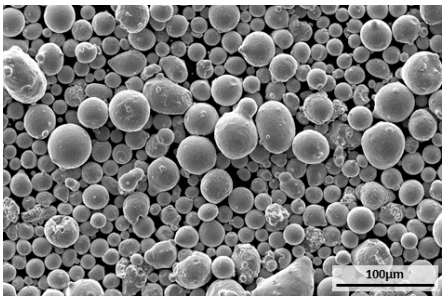
Mechanical[1] (900°C)	Yield strength (MPa)	Z 213 XY 201
	Ultimate tensile strength (MPa)	Z 306 XY 290
	Elongation at failure %	Z 73 XY 112.2
	Area reduction at failure %	Z 87 XY 96.9
Thermo-physical (25-1200°C)	Thermal conductivity ($W(m°C)^{-1}$)	12.4 - 29.3
	Specific heat ($J(kg°C)^{-1}$)	434 - 620
Physical	Density ($g\ cm^{-3}$)	8.73

[1]All measurements are performed after heat treatment without HIP.

POWDER CHARACTERISTICS

Particle size distributions:

Laser Powder Bed Fusion (LPBF): 15-53 µm
Electron Beam Melting (EBM): 45-106 µm
Directed Energy Deposition (DED): 45-106 µm
Custom size distributions available on request



Stellar MHA3300® is available for R&T and series production.

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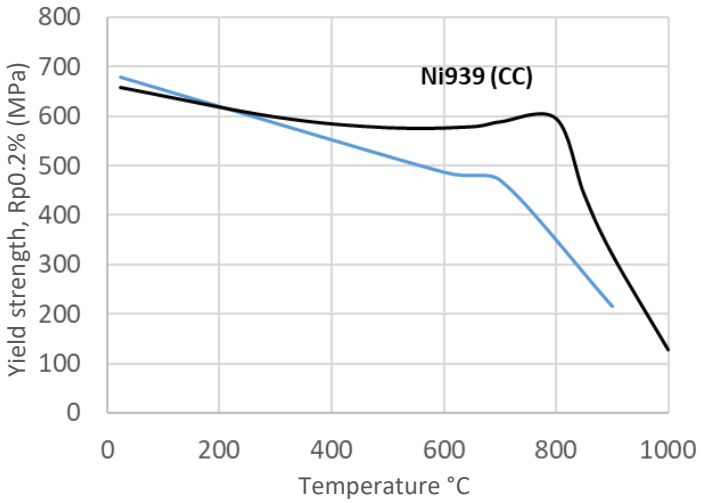
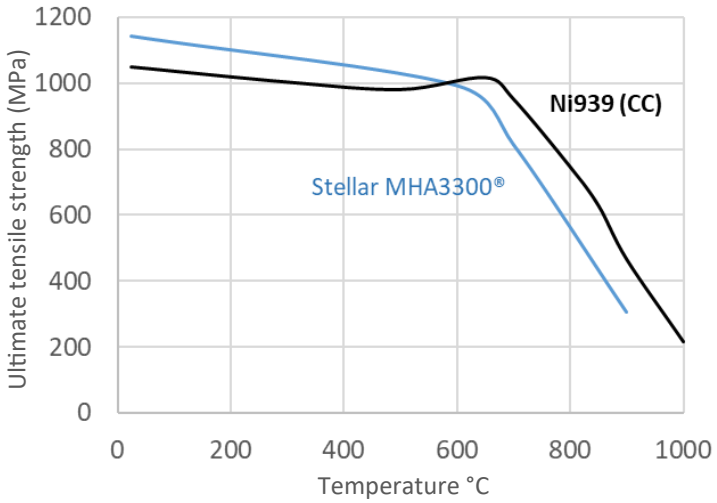
TENSILE PROPERTIES

Stellar MHA3300® has a better strength than Ni939 by Conventional Casting (CC) at relatively low temperature and a little lower than Ni939 (CC) at higher temperature.

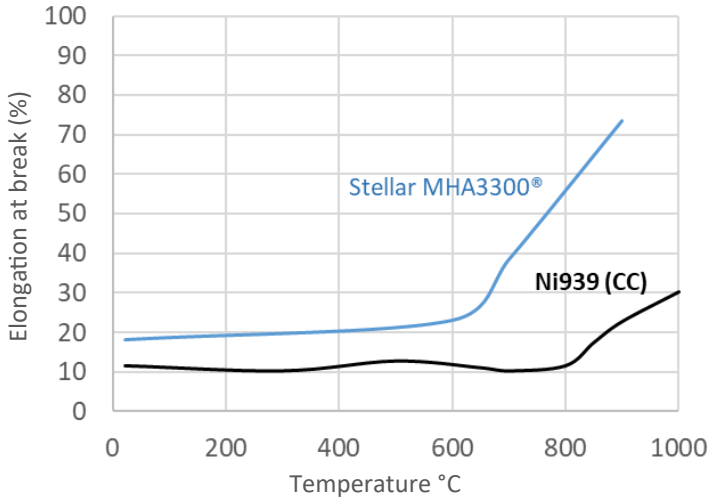


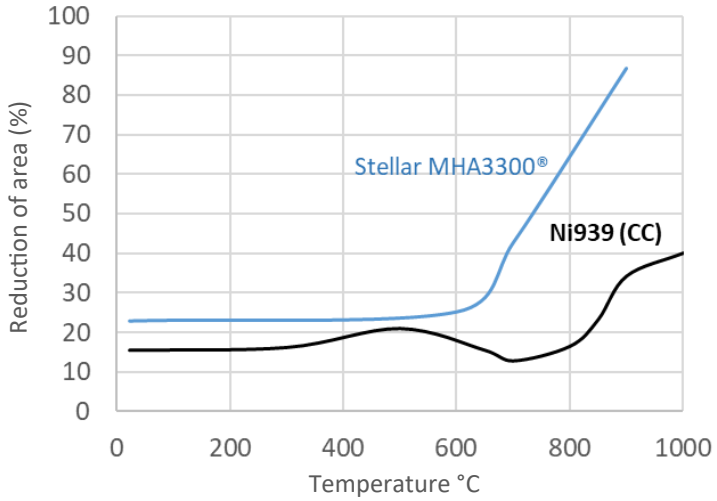


The Stellar MHA3300® test pieces are built by Concept Laser in vertical direction, and heat-treated. Test conditions in accordance to JIS G 0567:2020 evaluated at a strain rate of 0.3%/min until Yield strength and 7.5%/min until rupture.

TENSILE DUCTILITY & REDUCTION OF AREA

Stellar MHA3300® has better elongation and shrinkage properties than Ni939 (CC).





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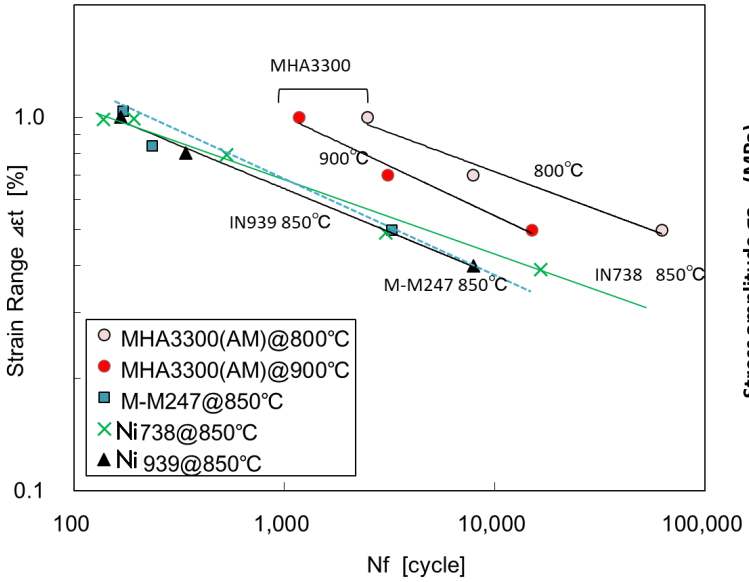
LOW CYCLE FATIGUE (LCF)

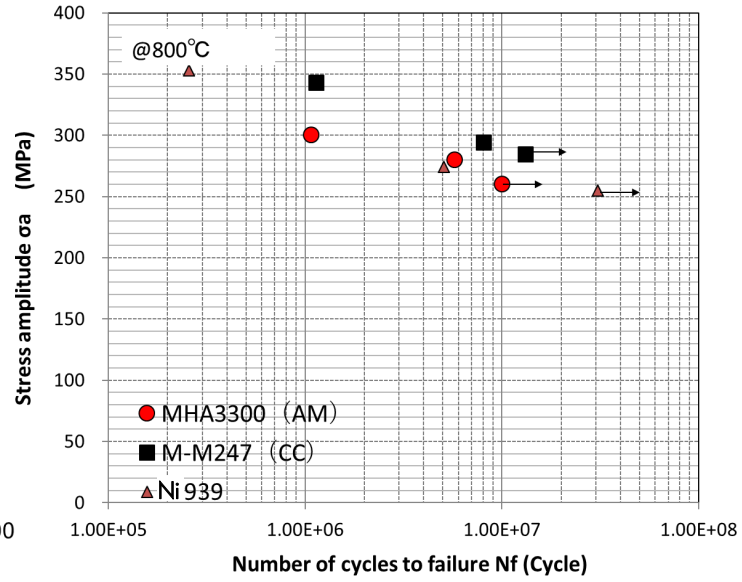
Stellar MHA3300® has superior low cycle fatigue properties than commercial casting alloys M-M247, Ni939 and Ni738.



The Stellar MHA3300® test pieces are built by Concept Laser in vertical direction, and heat-treated. No HIP was performed. Test conditions in accordance to JIS Z 2279:1992.

HIGH CYCLE FATIGUE (HCF)

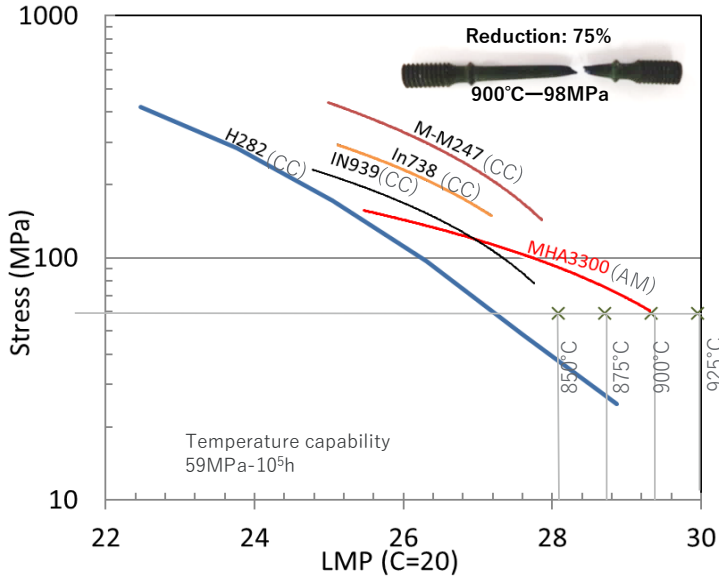
Stellar MHA3300® has comparable level high cycle fatigue properties as that of M-M247 and Ni939.



The Stellar MHA3300® test pieces are built by Concept Laser in vertical direction, and heat-treated. No HIP was performed. Test conditions in accordance to JIS Z 2286:2003.

STRESS RUPTURE PROPERTIES

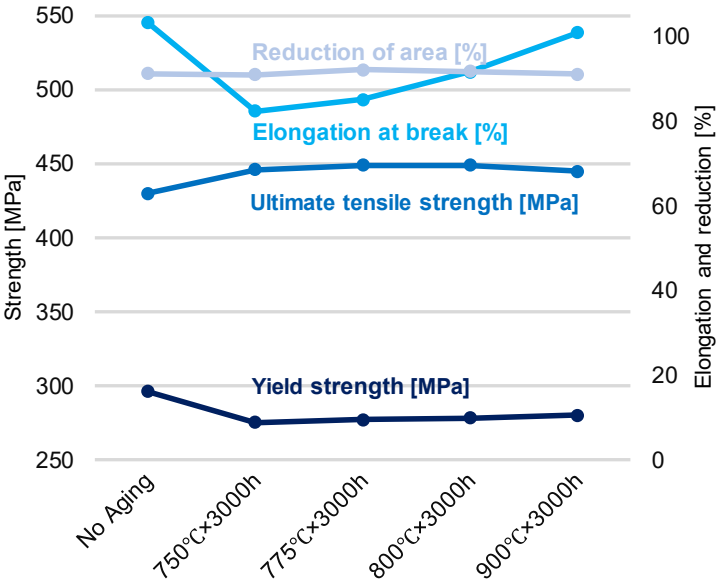
The temperature capability of Stellar MHA3300® is close to 900°C (creep rupture: 59MPa-105h). Stellar MHA3300® shows much better better creep elongation than cast material at high temperatures.
It is suitable alloy for gas turbine static blade and shroud at high temperature in low stress conditions.



The Stellar MHA3300® test pieces are built by Concept Laser in vertical direction, and heat-treated. No HIP was performed. Test conditions in accordance to JIS Z 2271:2010.

LONG TERM STABILITY

Stellar MHA3300® is confirmed to have very good microstructure stability at high temperature.
No degradation of tensile behavior is seen by 800°C tensile test after aging for 3000 h from 750 to 900°C.



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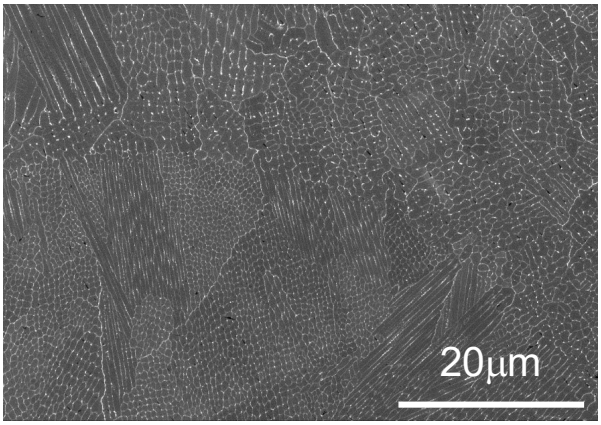
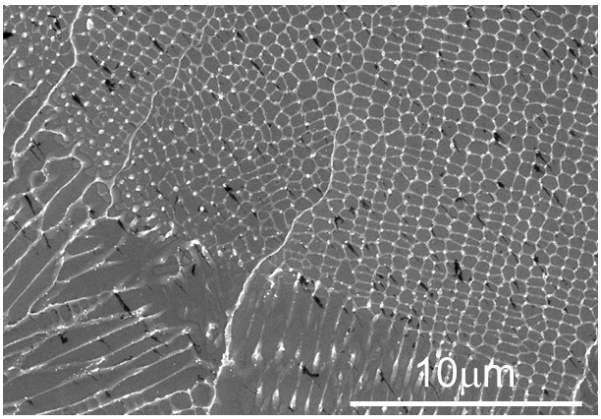
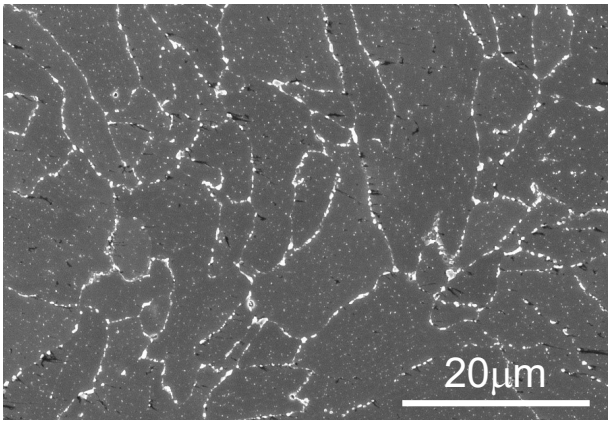
MICROSTRUCTURE & HEAT TREATMENT

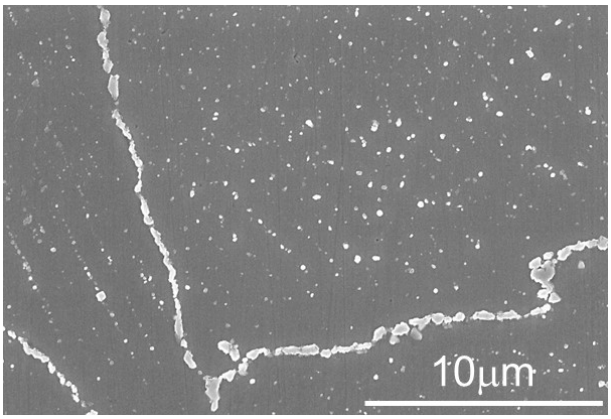
As-Built





After Heat treatment
1150°C, 4h 982°C, 4h





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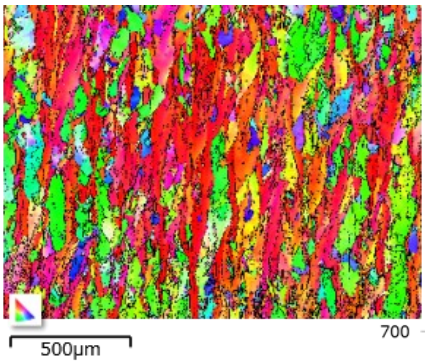
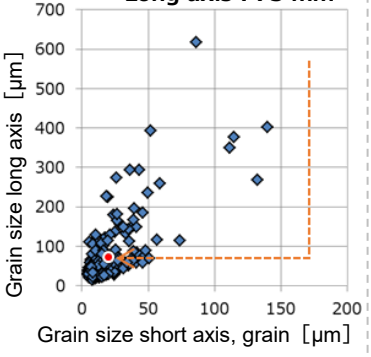
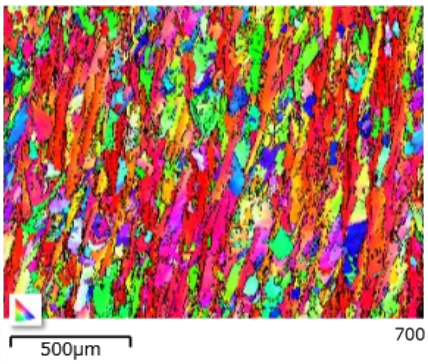


Vickers hardness 385 HV

Average size
Short axis: 20 mm
Long axis : 73 mm

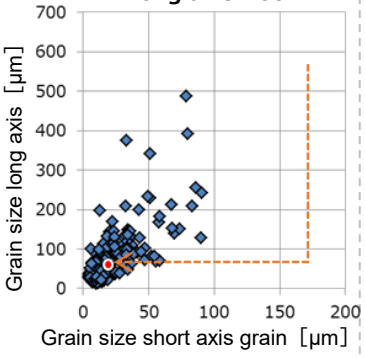


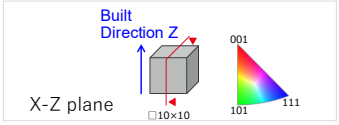
Heat-treated



Vickers Hardness after heat treatment 344 HV

Average size
Short axis: 18 mm
Long axis : 60 mm





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