Material
Data Sheet

EOS NickelAlloy IN738

Superalloy for use in high-stress and high-temperature applications

EOS NickelAlloy IN738

Main Characteristics:

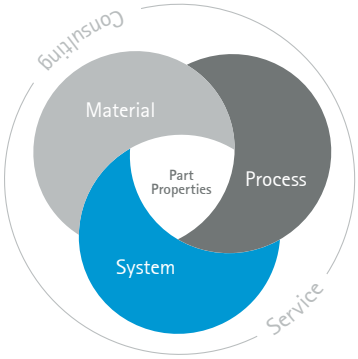
- High strength at high temperatures
- Creep resistance
- Oxidation resistance

Typical Applications:

- Gas turbine components
- Rocket engine turbopumps
- Marine and automotive turbochargers

The EOS Quality Triangle

EOS uses an approach that is unique in the AM industry, taking each of the three central technical elements of the production process into account: the system, the material and the process. The data resulting from each combination is assigned a Technology Readiness Level (TRL) which makes the expected performance and production capability of the solution transparent.



EOS incorporates these TRLs into the following two categories:

- Premium products (TRL 7-9): offer highly validated data, proven capability and reproducible part properties.
- Core products (TRL 3 and 5): enable early customer access to newest technology still under development and are therefore less mature with less data.

All of the data stated in this material data sheet is produced according to EOS Quality Management System and international standards.

Powder Properties

Powder and built part compositions are based on AMS 5410C.

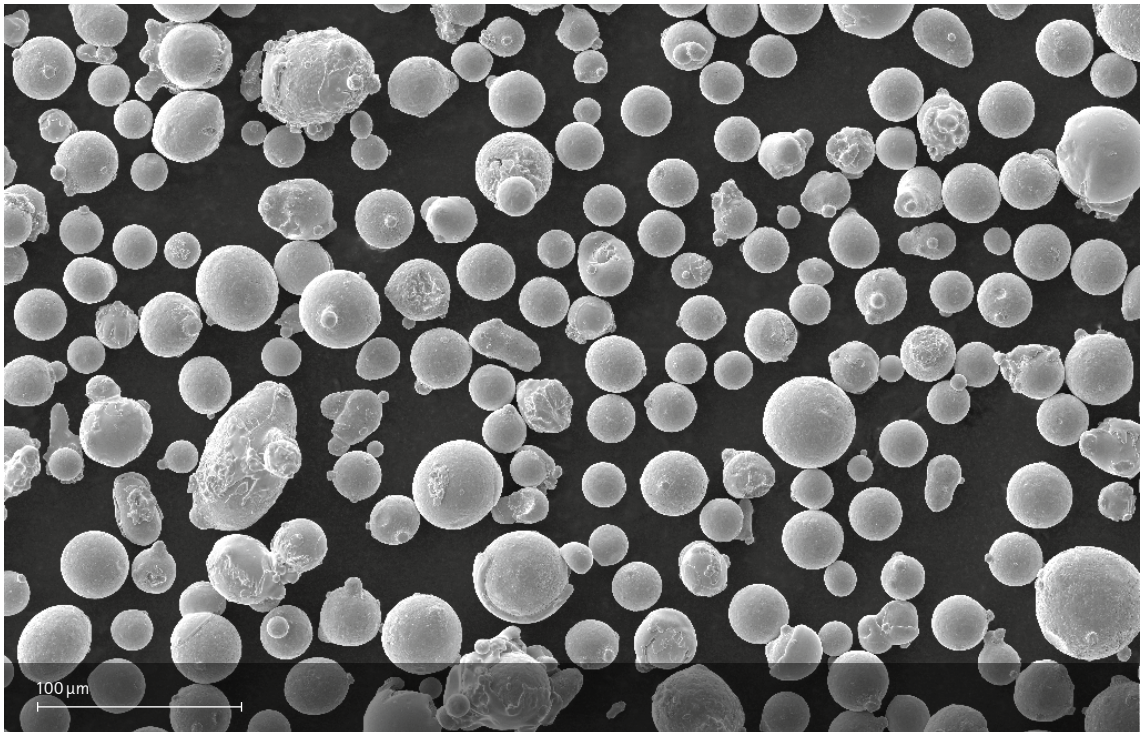
Powder chemical composition (wt.-%)

Element	Typical
Cr	16
Co	9
Al	3.5
Ti	3.5
W	2.5
Mo	2
Ta	2
Nb	1
C	0.1
Zr + B	0.1

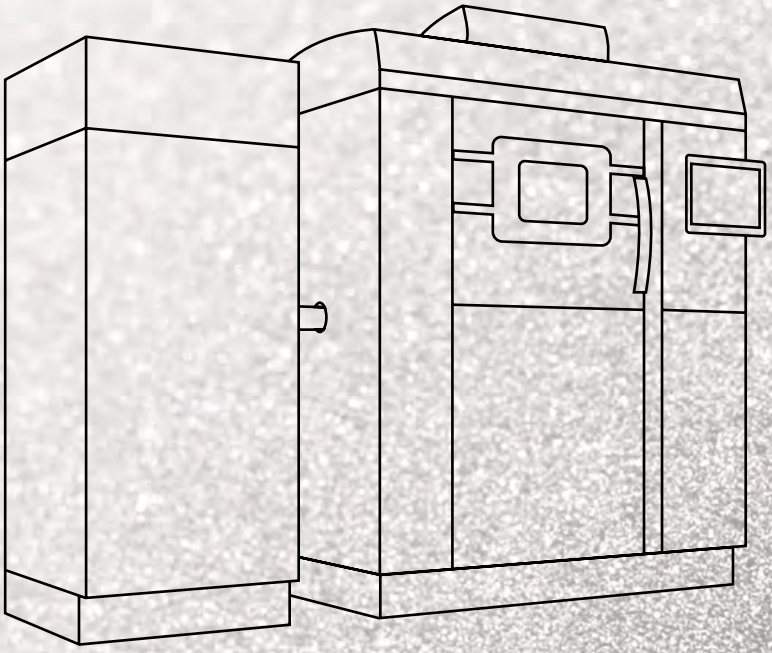
Powder particle size

Generic particle size distribution	20-63 µm

SEM micrograph of EOS NickelAlloy IN738 powder.



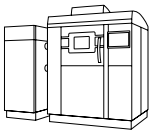
TRL 5
Core



EOS NickelAlloy IN738
for EOS M 290 | 40 µm

Process Information
Heat Treatment
Physical Part Properties
Mechanical Properties
Additional Data

EOS NickelAlloy IN738 for EOS M 290 | 40 µm
Process Information



System set-up	EOS M 290
EOSPAR name	IN738_040_CoreM291_100
Software requirements	EOSPRINT 2.15 or newer EOSYSTEM 2.19 or newer
Powder part no.	9030-0020
Recoater blade	HSS
Nozzle	Grid
Inert gas	Ar
Sieve	63 µm

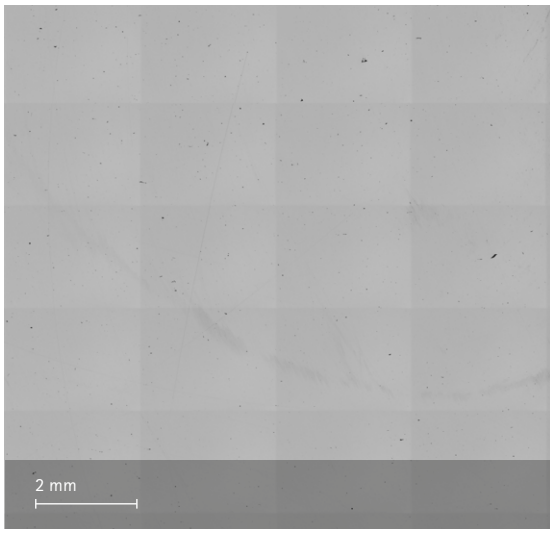
Additional information	
Layer thickness	40 µm
Volume rate	2.7 mm^3/s

Heat Treatment

EOS NickelAlloy IN738 is susceptible to formation of macrocracks upon heat treatment, depending on part geometry. Following are recommendations to mitigate the risk of macrocrack formation: (1) shot peening of parts prior to heat treatment; (2) a combined stress relieve and solution treatment plus HIP treatment using pre-pressurization. Detailed information on the heat treatment can be found in application note.

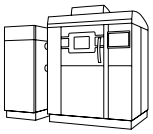
Preferred post-processing chain for EOS NickelAlloy IN738

Chemical and Physical Properties of Parts



Defects	Result	Number of samples
Average defect percentage	0.05 %	5

Mechanical Properties in Heat Treated Condition



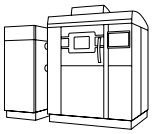
Typical tensile properties heat treated ISO 6892-1/6892-2

		Yield strength $R_{p0.2}$ [MPa]	Tensile strength R_m [MPa]	Elongation at break A [%]
25°C heat treated	horizontal	1122	1265	4.5
	vertical	1044	1412	9.4
850°C heat treated	horizontal	482	694	11
	vertical	477	720	20.3

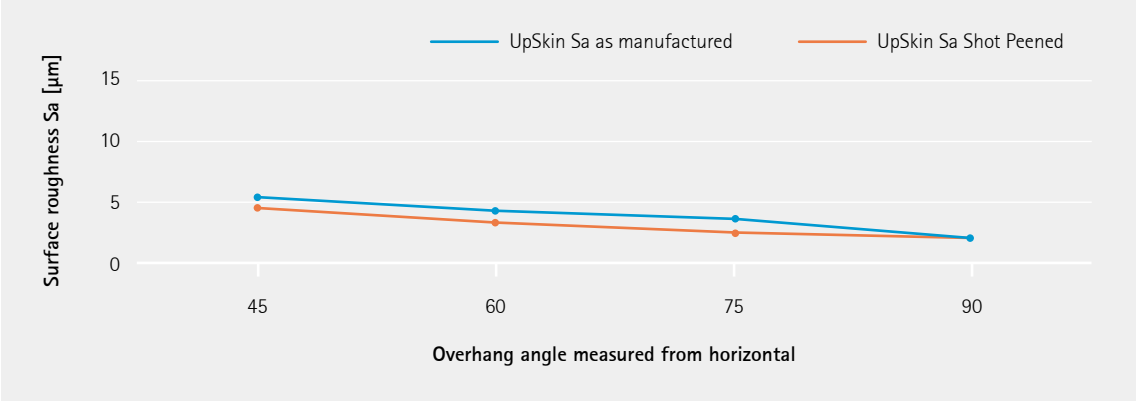
Stress rupture

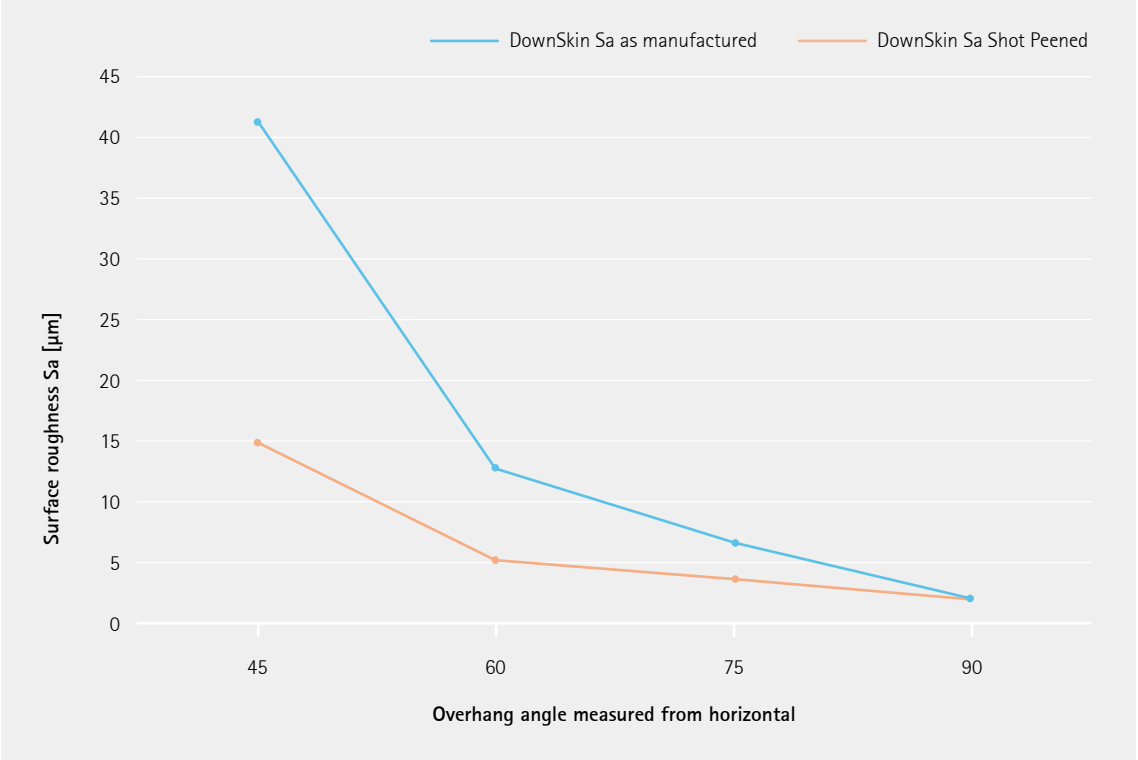
		Time to rupture [hrs]	Rupture Elongation A [%]
982°C/151 MPa heat treated	horizontal	3.4	6.5
	vertical	15	25
850°C/250 MPa heat treated	horizontal	83.3	6.5
	vertical	352	17

Additional Data



Surface Roughness





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Cover: This image shows a possible application.

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