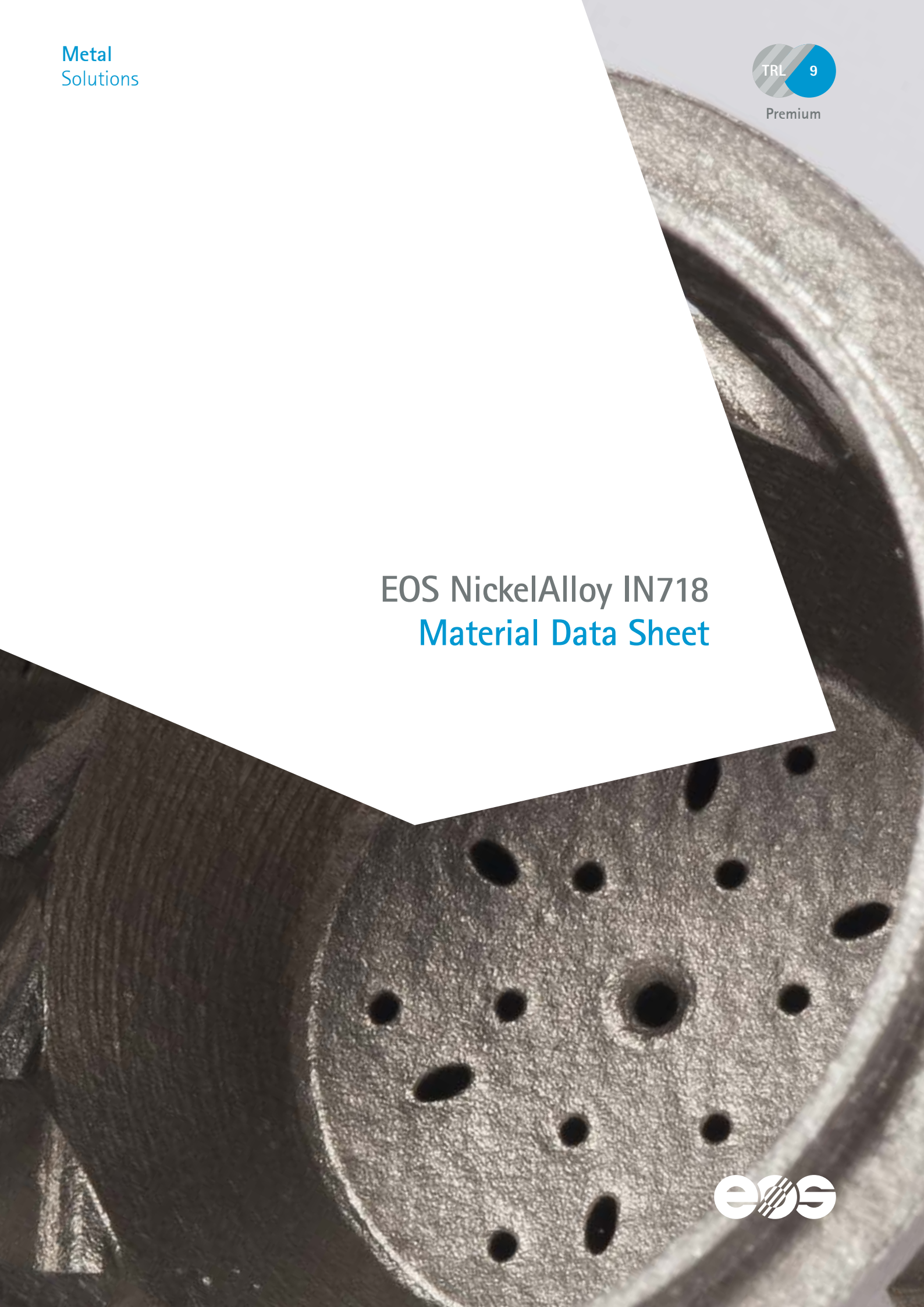
Metal
Solutions

TRL 9
Premium

EOS NickelAlloy IN718
Material Data Sheet



EOS NickelAlloy IN718
High Temperature Strength and Corrosion Resistance

EOS NickelAlloy IN718 is a precipitation-hardening nickel-chromium alloy that is characterized by having good tensile, fatigue, creep and rupture strength at temperatures up to 700 °C (1.290 °F). Parts built from EOS NickelAlloy IN718 can be easily post-hardened by precipitation-hardening heat treatments.

Main Characteristics:

- Good tensile, fatigue, creep and rupture strength at temperatures up to 700 °C (1.290 °F)
- Parts are easily precipitation hardened
- Parts can be machined, spark-eroded, welded, micro shot-peened, polished and coated in both as-built and age-hardened states

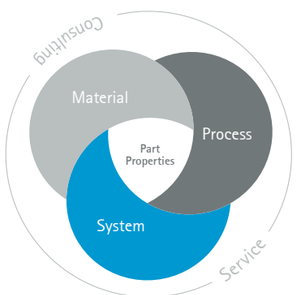
Typical Applications:

- Gas turbine components
- Instrumentation parts
- Power industry parts
- Process industry parts

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 – together simply described as the Quality Triangle. EOS focuses on delivering reproducible part properties for the customer.

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



Powder Properties

The chemical composition of EOS NickelAlloy IN718 is in compliance with UNS N07718, AMS 5662, AMS 5664, W.Nr 2.4668, DIN NiCr19Fe19NbMo3.

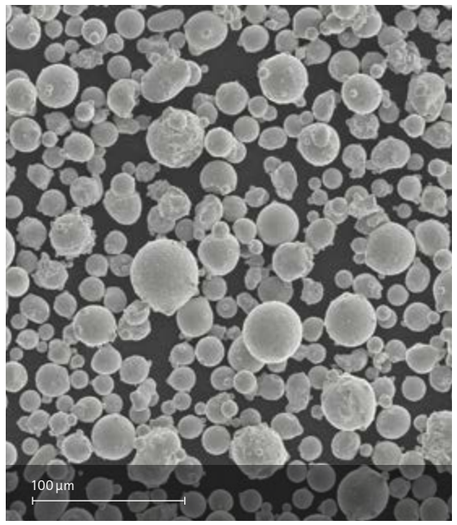
Powder chemical composition (wt.-%)

Element	Min.	Max.
Fe	Rem.	
Ni	50.00	55.00
Cr	17.00	21.00
Nb	4.75	5.50
Mo	2.80	3.30
Ti	0.65	1.15
Al	0.20	0.80
Co	-	1.00
Cu	-	0.30
Si	-	0.35
Mn	-	0.35
Ta	-	0.05
C	-	0.08
S	-	0.015
P	-	0.015
B	-	0.006
Pb	-	0.0005
Se	-	0.0020
Bi		0.00003

Powder particle size

Generic particle size distribution	20-55 µm

SEM picture of EOS NickelAlloy IN718 powder.



Process Information

System set-up	EOS M 290
EOS material set	IN718 Performance 2.0
EOSPAR name	IN718_040_PerformanceM291_2xx
Software requirements	EOSPRINT 1.7 or newer, EOSPRINT 2.6 or newer, EOSYSTEM 2.9 or newer
Powder part no.	9011-0020
Recoater blade	EOS HSS Blade
Nozzle	EOS Grid Nozzle
Inert gas	Argon
Sieve	63 µm

Additional information	
Layer thickness	40 µm
Volume rate	4.2 mm³/s
Min. wall thickness	Typical 0.3 - 0.4 mm

Heat Treatment

Heat treatment procedure conform to Aerospace Material Specification AMS 2774 and AMS 5662.
As manufactured microstructure for additively manufactured IN718 consists of gamma phase (γ). Heat treatment for IN718 is required to produce desired microstructure and part properties (gamma double prime precipitates, γ"). Heat treatment is also used to relieve stresses.

Step 1:
Solution Annealing: hold at 954 °C (1.750 °F) for 1 hour per 25 mm (0.98 inch) of thickness, air (/argon) cool

Step 2:
Ageing Treatment: hold at 718 °C (1.325 °F) 8 hours, furnace cool to 621 °C (1.150 °F) and hold at 621 °C (1.150 °F) for total precipitation time of 18 hours, air (/argon) cool

Chemical and Physical Properties of Parts

Heat treated microstructure. Etched according to ASTM E407-07.

Defects	Result	Number of samples
Average defect percentage	0.03 %	10
Density, ISO3369	**Result**	**Number of samples**
Average density	min 8.15 g/cm³	10

Mechanical Properties in Heat Treated State

Tensile properties heat treated (acc. AMS 2774 and AMS 5662)

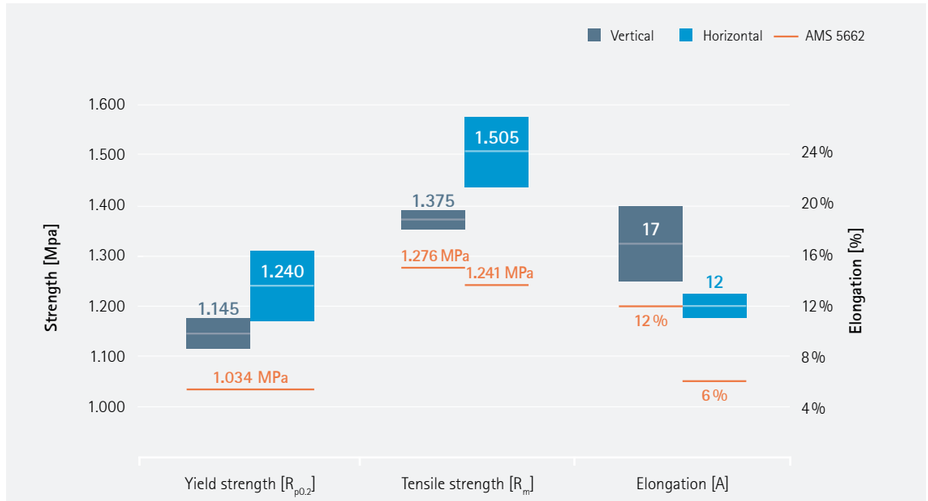
	Yield strength $R_{p0.2}$ [MPa]	Tensile strength R_m [MPa]	Elongation at break A [%]	Number of samples
Vertical	1.145	1.375	17	54
Horizontal	1.240	1.505	12	26

Hardness as per ISO 6508-1

Hardness, HRC	47
Number of samples	45

Hardness as per DIN EN ISO 6506-1:2014

Hardness, HB	466
Number of samples	10



** T90: Tolerance intervals provide upper and lower bounds where 90 % of the population falls with 95 % confidence. Tolerance intervals are based on validation data / QA statistics and are not directly transferrable to other systems.*

Tensile properties as manufactured

	Yield strength $R_{p0.2}$ [MPa]	Tensile strength R_m [MPa]	Elongation at break A [%]	Number of samples
Vertical	650	970	32	41
Horizontal	800	1090	25	36

Additional Data

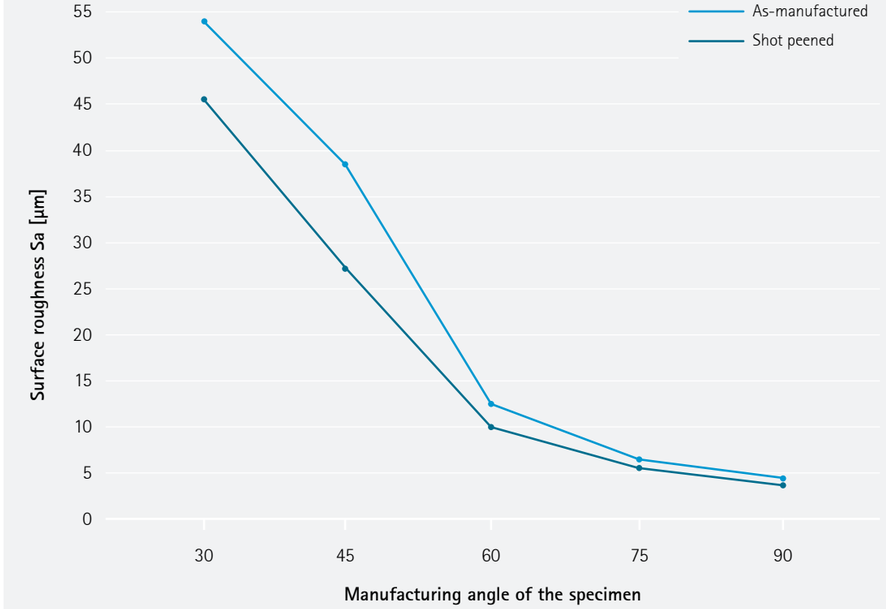
Coefficient of Thermal Expansion ASTM E228-17

Temperature	25-100 °C	25-200 °C	25-300 °C	25-400 °C	25-500 °C	25-600 °C	25-700 °C
CTE	13,1*10^{-6}/K	13,7*10^{-6}/K	14,1*10^{-6}/K	14,4*10^{-6}/K	14,7*10^{-6}/K	15,0*10^{-6}/K	15,5*10^{-6}/K

Surface Roughness

Horizontal surface	As-manufactured Sa 4.5 µm	Shot Peened Sa 3.8 µm
Vertical and angled surfaces according to figure		

Surface roughness



The surface quality was characterized by optical measurement method according to internal procedure. The 90 degree angle corresponds to vertical surface.

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Cover: This image shows a possible application.