Metal
Solutions

TRL 7
Premium

EOS Aluminium AlF357
Material Data Sheet

EOS Aluminium AlF357
Light Weight & Corrosion Resistance

EOS Aluminium AlF357 is an ideal material for applications requiring a combination of low weight and mechanical/thermal load endurance. It is a beryllium free derivative of the A357 (AlSi7Mg0.6) alloy. Parts built of EOS Aluminium AlF357 can be machined, shot-peened and polished in the as-built or heat treated state. For this product, a T6-like heat treatment may be utilized to enhance the overall mechanical properties.

Main Characteristics:

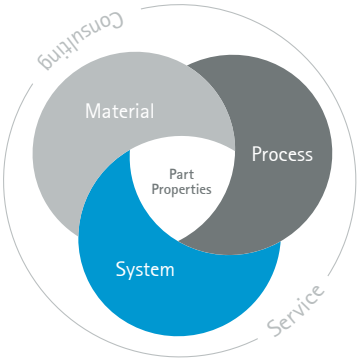
- Light-weight
- Corrosion resistance
- High dynamic load bearing capacity

Typical Applications:

- Aerospace industry applications
- Defense and automotive industries
- Structural components requiring high strength

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

Chemical composition of the EOS Aluminium AlF357 powder is in compliance with SAE AMS 4289 standard.

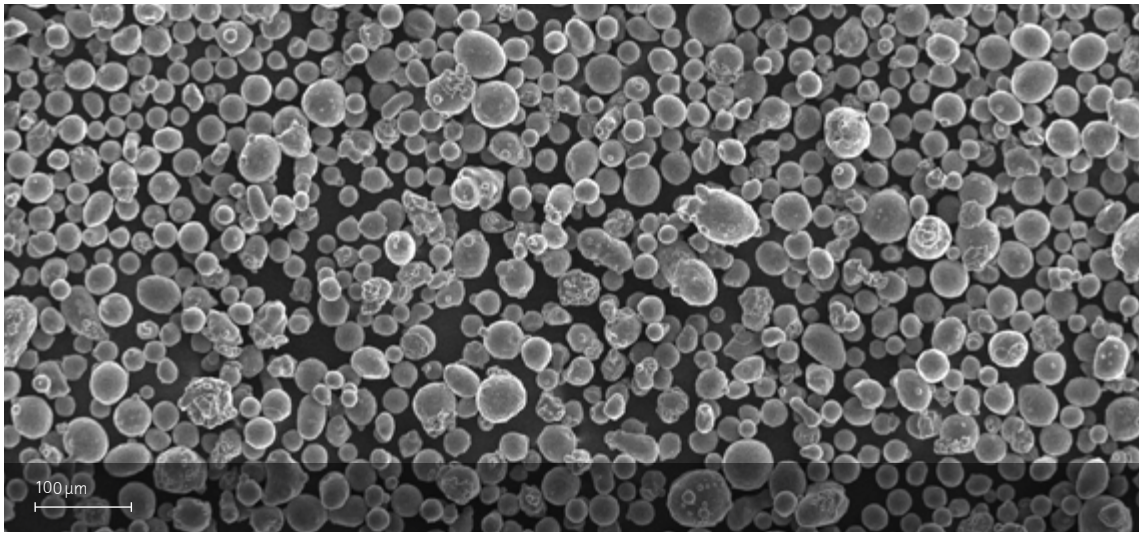
Powder chemical composition (wt.-%)

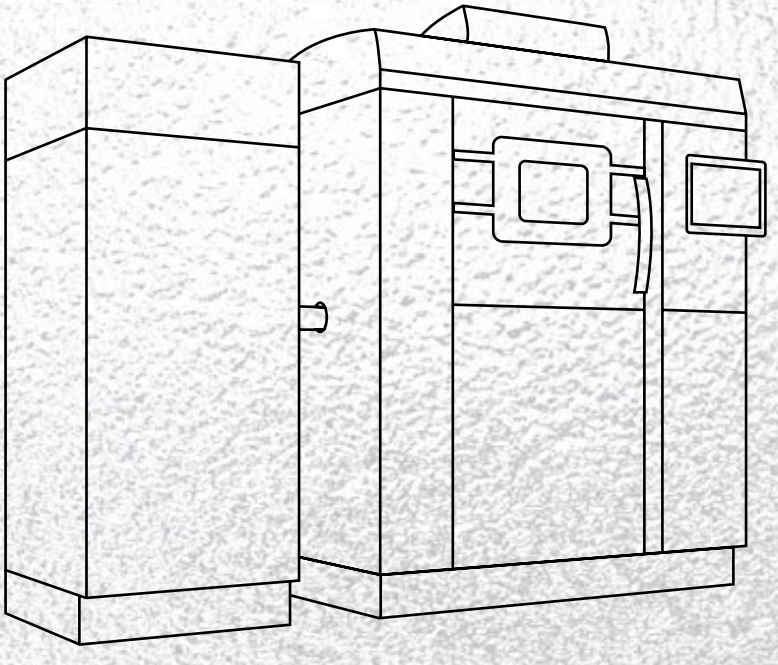
Element	Min.	Max.
Al	Balance	
Si	6.5	7.5
Fe	-	0.10
Cu	-	0.20
Mn	-	0.10
Mg	0.40	0.7
Zn	-	0.10
Ti	0.04	0.20
Be	-	0.002
Other elements, each	-	0.05
Other elements, total	-	0.15

Powder particle size

Generic particle size distribution	20 – 90 µm

SEM image of EOS Aluminium AlF357 powder.





EOS Aluminium AlF357
for EOS M 290

Process Information
Heat Treatment
Physical Part Properties
Mechanical Properties
Additional Data

EOS Aluminium AlF357 for EOS M 290
Process Information

System set-up	EOS M 290
EOS ParameterSet	M 290 AlF357 030 V1
EOSPAR name	AlF357_030_M291_100
Software requirements	EOSPRINT 2.5 or newer EOSYSTEM 2.10 or newer
Powder part no.	9011-0049
Recoater blade	EOS HSS blade
Inert gas	Nitrogen
Sieve	106 µm

Additional information	
Layer thickness	30 µm
Volume rate	5.8 mm³/s

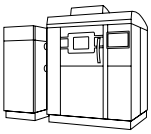
Heat Treatment

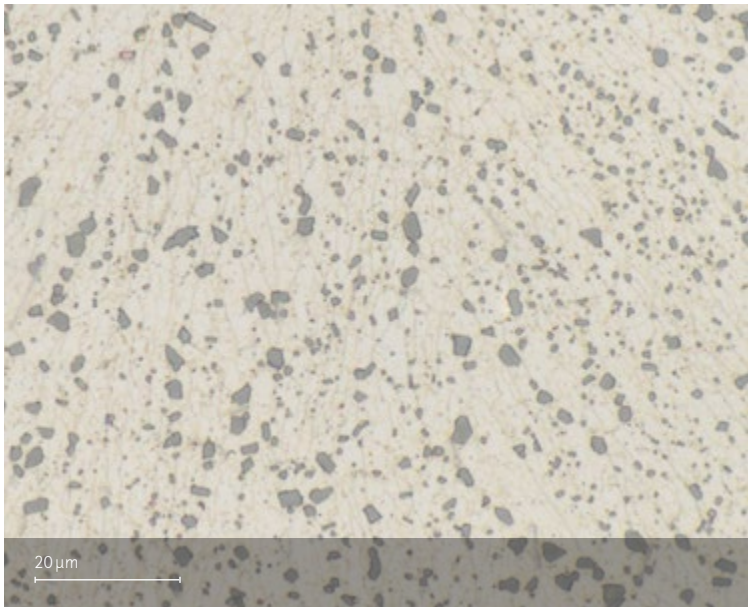
Laser melting process comprises extremely fast melting and re-solidification. Due to the layerwise manufacturing method, the parts exhibit anisotropic properties depending on the building direction. Suitable heat treatments can be used to meet the needs of various applications, e.g. to reduce the anisotropy. Conventionally cast components of this type of aluminum alloy are often heat treated using a T6 cycle consisting of solution annealing, quenching and age hardening. A T6-like heat treatment has been specifically developed to increase the ductility and yield strength, and to reduce the anisotropy of the built parts, consisting of the following cycles:

Solution Annealing:
30 minutes at 540 °C (±6 °C) measured from the part, followed by instant quenching in water at room temperature.

Aging:
6 hours at 165 °C (±6 °C) measured from the part, followed by air cooling. This step is carried out with a maximum delay of 40 hours after the solution annealing.
The mechanical properties for the heat treated condition have been attained through the described heat treatment procedure.

Physical Part Properties





Heat treated microstructure. Etched according to internal procedure using Groesbeck reagent.

Microstructure of the produced parts (as manufactured state)

Defects	Result	Number of samples
Average defect percentage	0.03 %	20

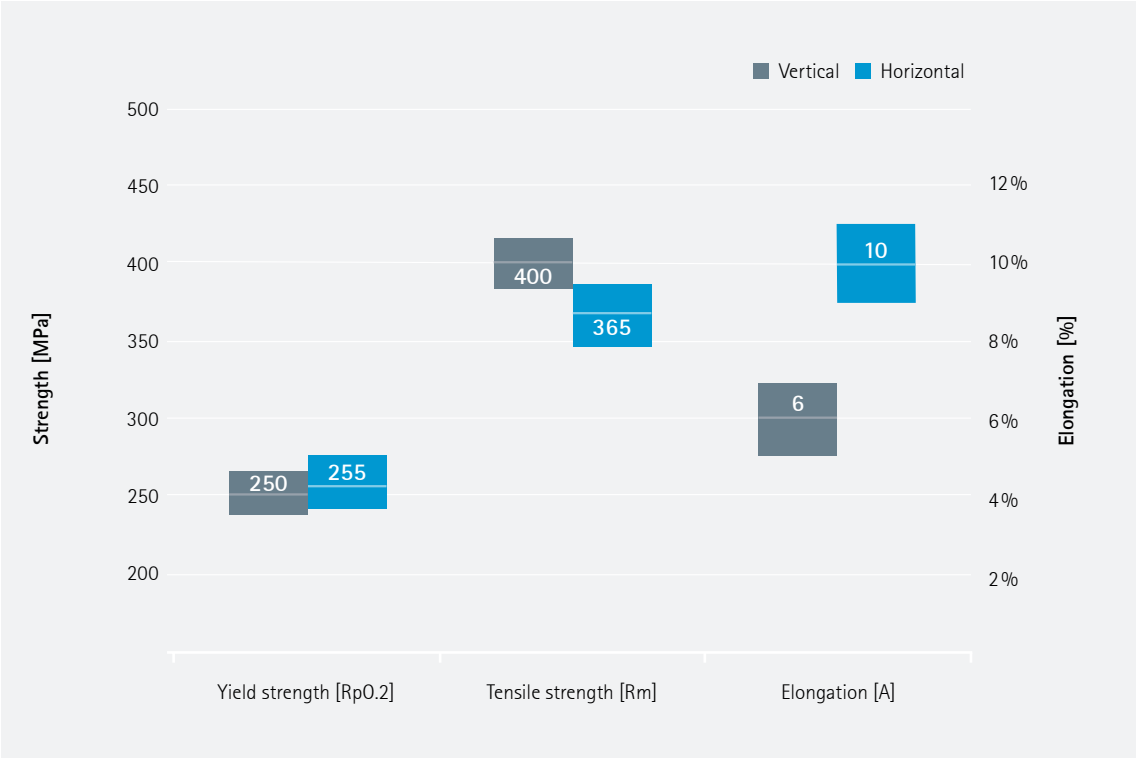
Density ISO 3369	Result	Number of samples
Average density	2.67 g/cm^3	1

The areal defect percentage was determined from cross-cuts of the built parts using an optical microscope fitted with a camera and analysis software. The analysis was carried out for sample area of 15 x 15 mm. The defects were detected and analyzed with an image capture/analysis software with an automatic histogram based filtering procedure on monochrome images. The density of the built specimen was measured according to ISO3369.

EOS Aluminium AlF357 for EOS M 290
Mechanical Properties

Mechanical properties (as manufactured state)

	Yield strength Rp0.2 [MPa]	Tensile strength Rm [MPa]	Elongation at break A [%]	Number of samples
Vertical	250	400	6	84
Horizontal	255	365	10	72

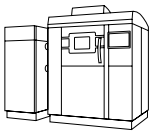


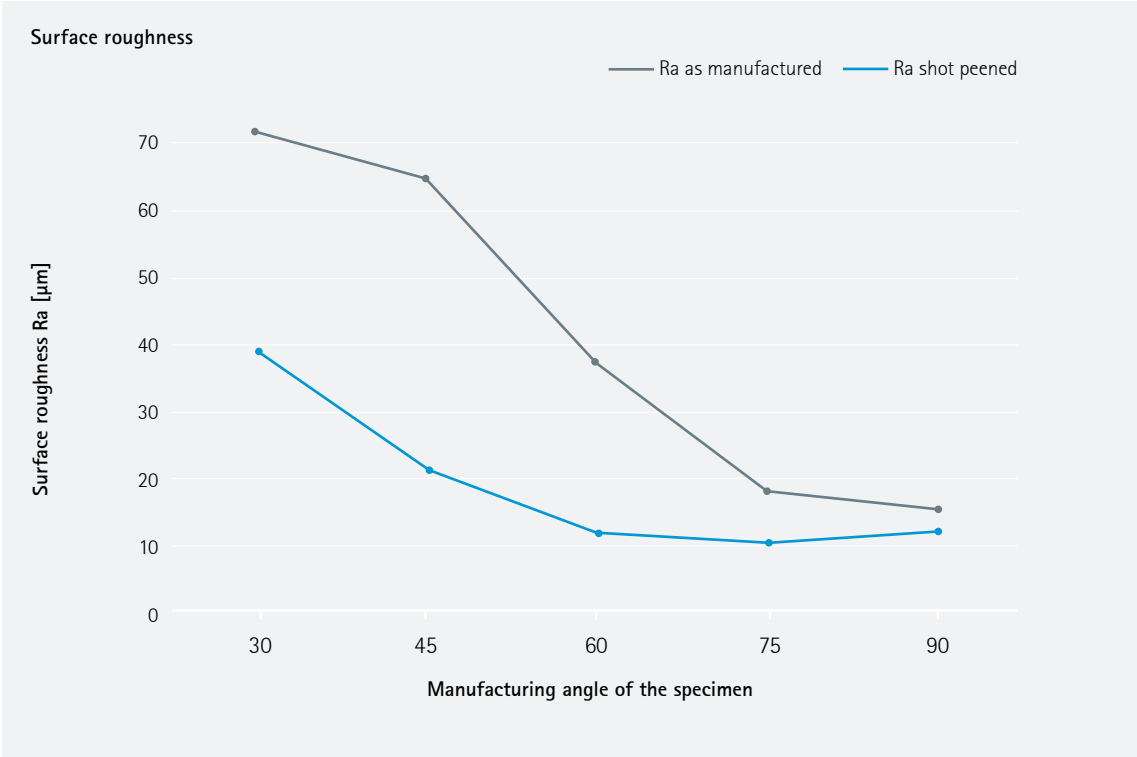
The testing was done according to EN 2002-001 2005 on round specimen machined according to standard Annex C. Results of both horizontal and vertical building direction are presented.

Typical Mechanical properties (heat treated state)

	Yield strength Rp0.2 [MPa]	Tensile strength Rm [MPa]	Elongation at break A [%]	Number of samples
Vertical	265	330	11.5	56
Horizontal	270	340	11.5	28

Additional Data



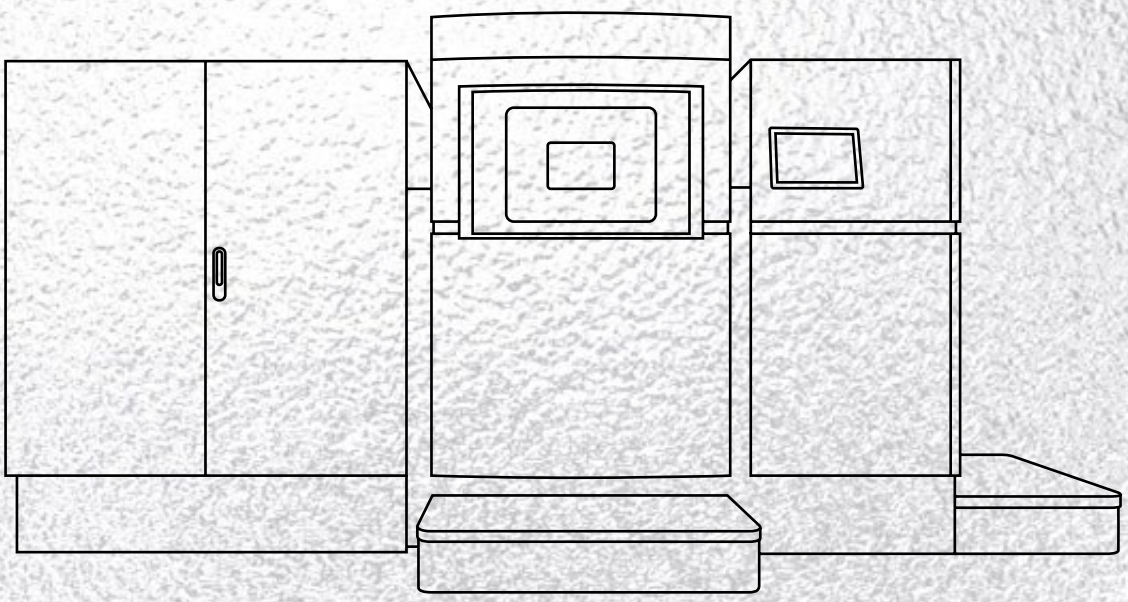


The surface quality was characterized by optical profiling from down-facing surfaces according to internal procedure. The 90 degree angle corresponds to vertical surface.

AlF357 thermal and electrical conductivity

Typical values for F357	Thermal conductivity as built W/m·K	Thermal conductivity T6 W/m·K	Electrical conductivity as built % IACS	Electrical conductivity T6 % IACS
Horizontal	140	150	28-36	35-40
Vertical	140	150		

Thermal conductivity measured according to ISO 22007-2, Hot Disk slab method (xy-plane) and Hot Disk 1D-method (Z-direction). Electrical conductivity measured according to ASTM E1004 Standard Test Method for Determining Electrical Conductivity Using the Electromagnetic (Eddy Current) Method.



EOS Aluminium AlF357
for EOS M 400

Process Information
Heat Treatment
Physical Part Properties
Mechanical Properties
Additional Data

EOS Aluminium AlF357 for EOS M 400
Process Information

System set-up	EOS M 400
EOS ParameterSet	M 400 AlF357 060 V1
EOSPAR name	AlF357_060_FlexM400_100
Software requirements	EOSPRINT 1.6 or newer EOSYSTEM 2.6 or newer
Powder part no.	9011-0049
Recoater blade	EOS HSS blade
Inert gas	Nitrogen
Sieve	106 µm

Additional information	
Layer thickness	60 µm
Volume rate	17 mm³/s

Heat Treatment

Laser melting process comprises extremely fast melting and re-solidification. Due to the layerwise manufacturing method, the parts exhibit anisotropic properties depending on the building direction. Suitable heat treatments can be used to meet the needs of various applications, e.g. to reduce the anisotropy. Conventionally cast components of this type of aluminum alloy are often heat treated using a T6 cycle consisting of solution annealing, quenching and age hardening. A T6-like heat treatment has been specifically developed to increase the ductility and yield strength, and to reduce the anisotropy of the built parts, consisting of the following cycles:

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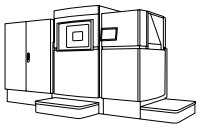
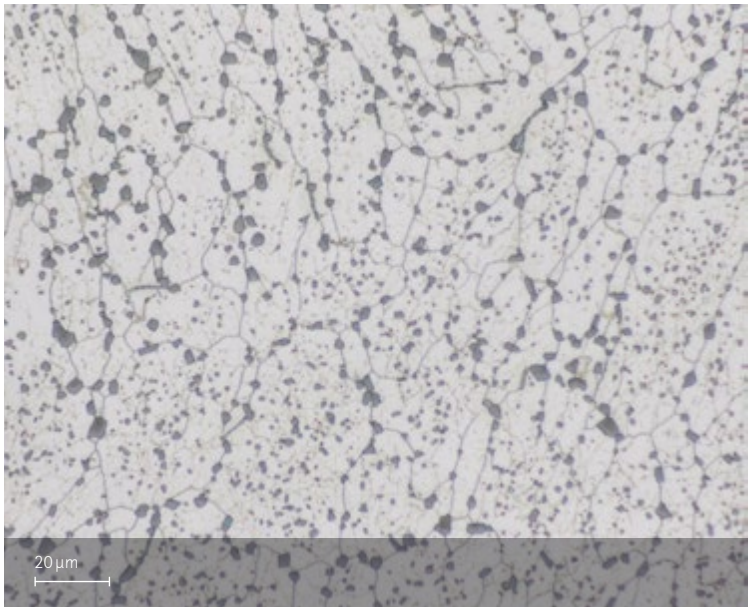
Physical Part Properties





Heat treated microstructure. Etched according to internal procedure using Groesbeck reagent.

Microstructure of the produced parts (as manufactured state)

Defects	Result	Number of samples
Average defect percentage	0.16 %	30

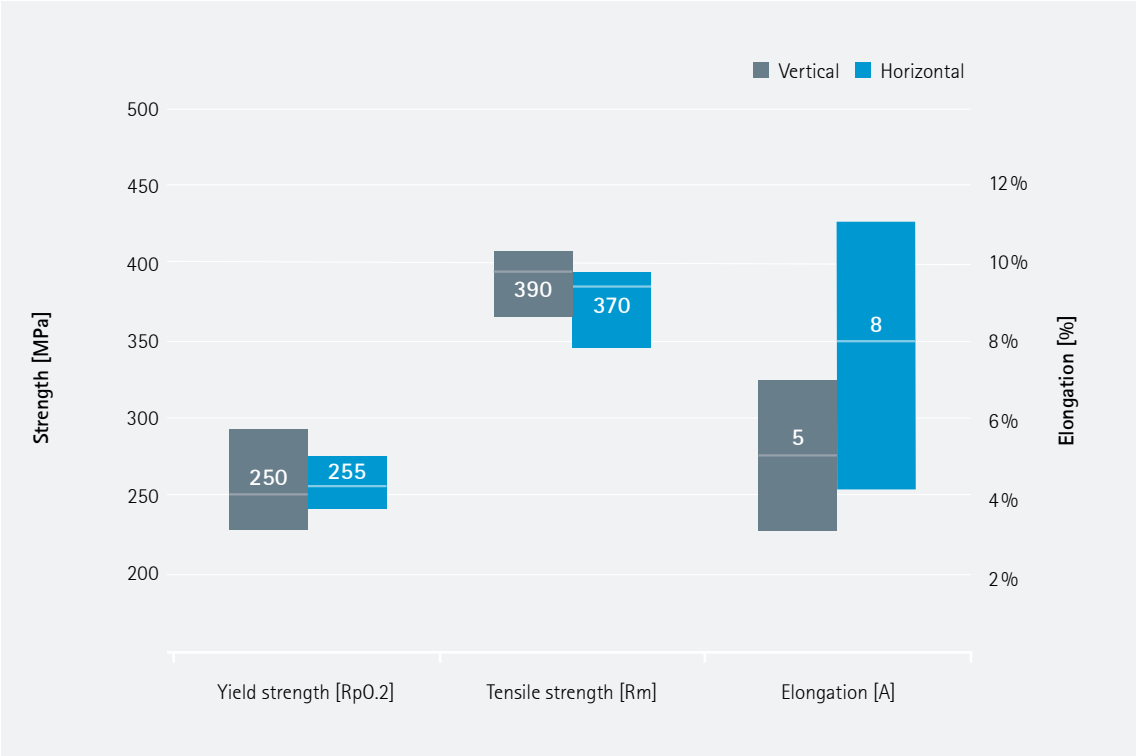
Density ISO 3369	Result	Number of samples
Average density	2.67 g/cm^3	10

The areal defect percentage was determined from cross-cuts of the built parts using an optical microscope fitted with a camera and analysis software. The analysis was carried out for sample area of 15 x 15 mm. The defects were detected and analyzed with an image capture/analysis software with an automatic histogram based filtering procedure on monochrome images. The density of the built specimen was measured according to ISO3369.

EOS Aluminium AlF357 for EOS M 400
Mechanical Properties

Mechanical properties (as manufactured state)

	Yield strength Rp0.2 [MPa]	Tensile strength Rm [MPa]	Elongation at break A [%]	Number of samples
Vertical	250	390	5	111
Horizontal	255	370	8	84



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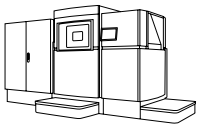

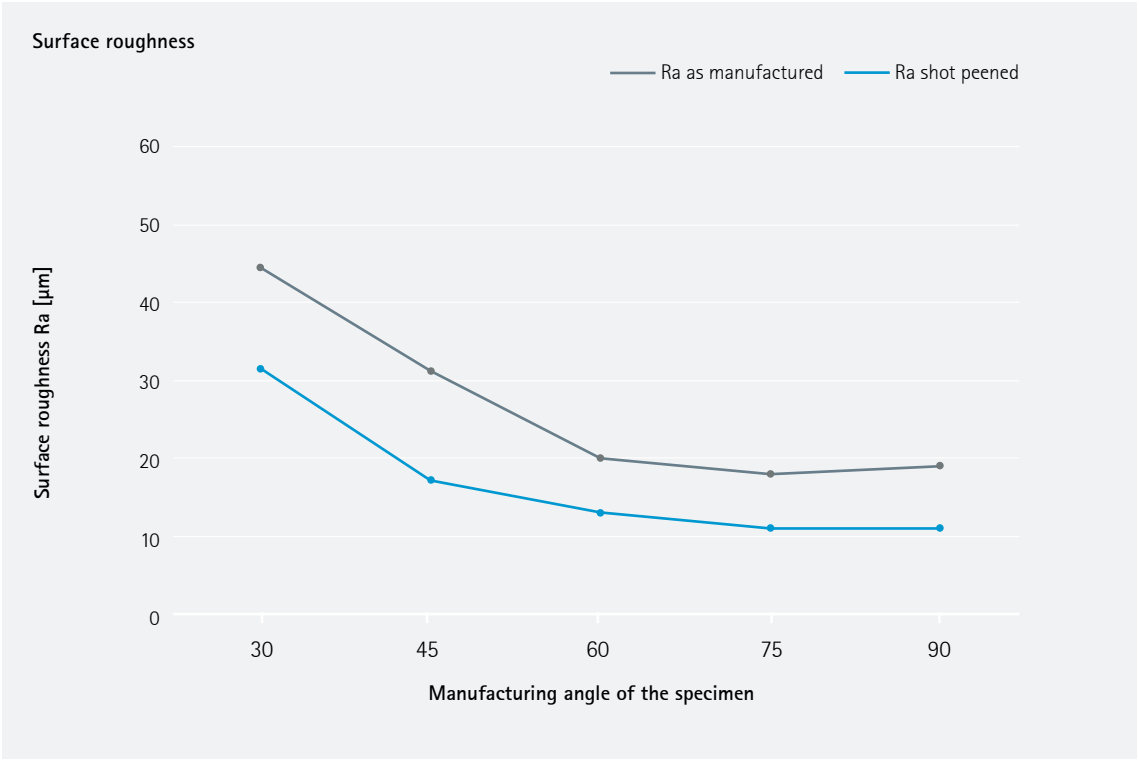

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Headquarters

EOS GmbH
Electro Optical Systems
Robert-Stirling-Ring 1
D-82152 Krailling/Munich
Germany
Phone +49 89 893 36-0
info@eos.info

www.eos.info
EOS
EOSGmbH
EOS.global
#ShapingFuture

Further EOS Offices

EOS France
Phone +33 437 49 76 76

EOS Greater China
Phone +86 21 602307 00

EOS India
Phone +91 44 39 64 80 00

EOS Italy
Phone +39 02 33 40 16 59

EOS Japan
Phone +81 45 670 0250

EOS Korea
Phone +82 2 6330 5800

EOS Nordic & Baltic
Phone +46 31 760 46 40

EOS North America
Phone +1 877 388 7916

EOS Singapore
Phone +65 6430 0463

EOS UK
Phone +44 1926 675 110

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Cover: This image shows a possible application.