

# 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:

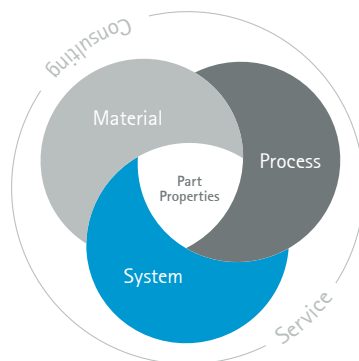
- Light-weight
- Corrosion resistance
- High dynamic load bearing capacity

### 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.-%)

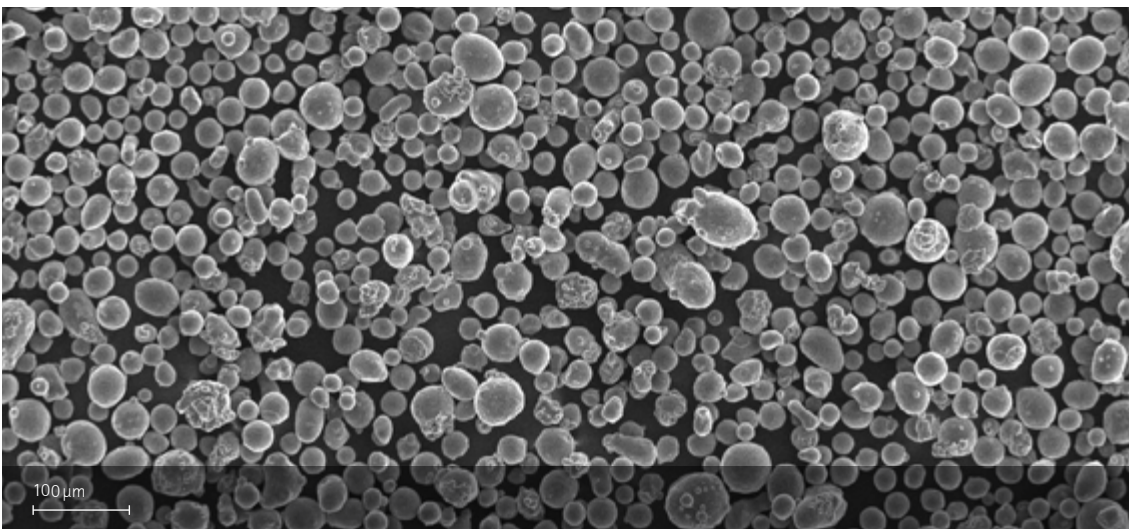
Element	Min.	Max.
Al	Balance	
Si	6.5	7.5
Fe	-	0.10
Cu	-	0.20
Mn	-	0.10
Mg	0.40	0.7
Zn	-	0.10
Ti	0.04	0.20
Be	-	0.002
Other elements, each	-	0.05
Other elements, total	-	0.15

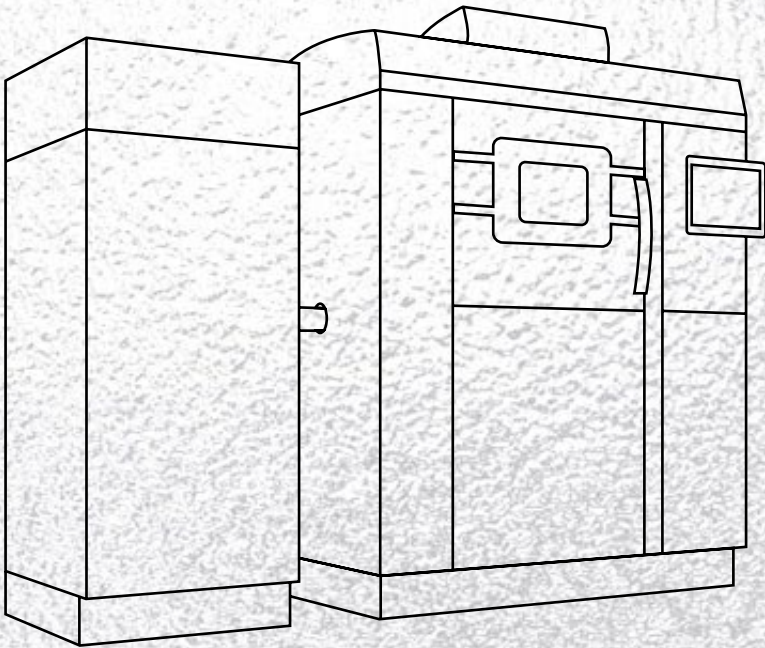
### Powder particle size

Generic particle size distribution

20 – 90  $\mu\text{m}$

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 AIF357 for EOS M 290

### Process Information

System set-up	EOS M 290
EOS ParameterSet	M 290 AIF357 030 V1
EOSPAR name	AIF357_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 mm <sup>3</sup> /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:

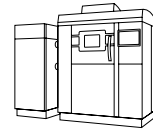
#### Solution Annealing:

30 minutes at 540 °C ( $\pm 6$  °C) measured from the part, followed by instant quenching in water at room temperature.

#### Aging:

6 hours at 165 °C ( $\pm 6$  °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



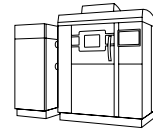
*Heat treated microstructure.  
Etched according to internal  
procedure using Groesbeck reagent.*

### 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 <sup>3</sup>	1

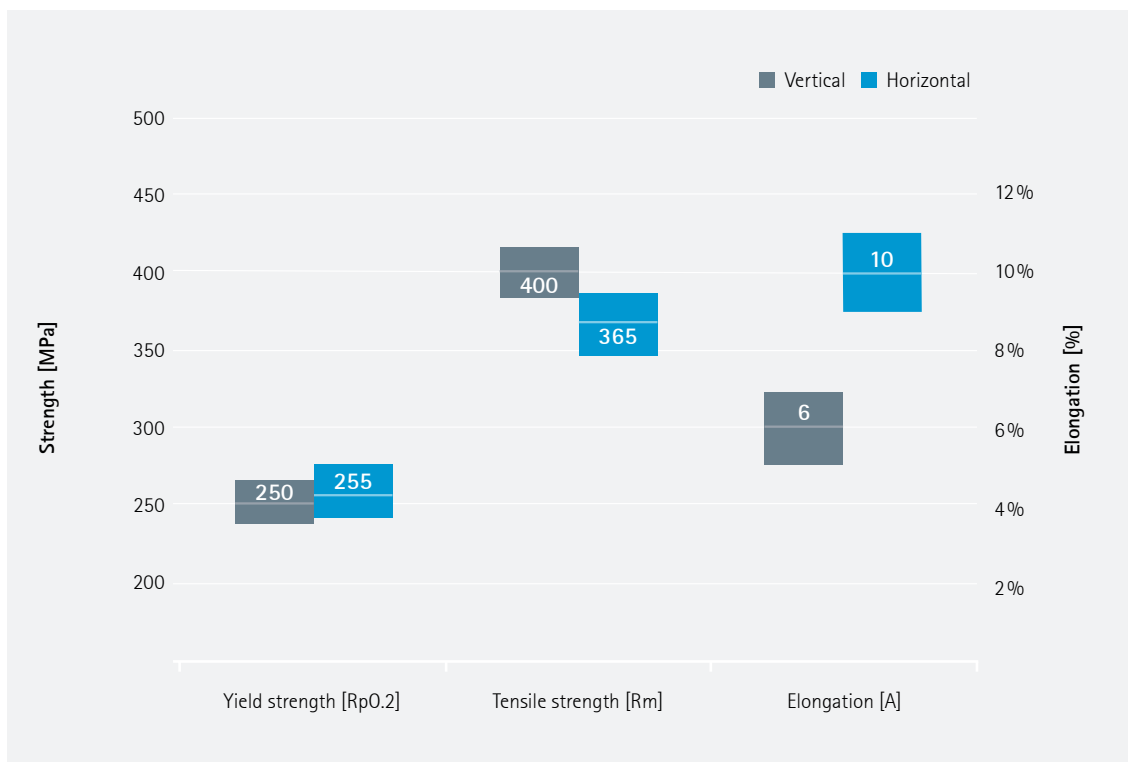
The areal defect percentage was determined from cross-cuts of the built parts using an optical microscope fitted with a camera and analysis software. The analysis was carried out for sample area of 15 x 15 mm. The defects were detected and analyzed with an image capture/analysis software with an automatic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

# 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

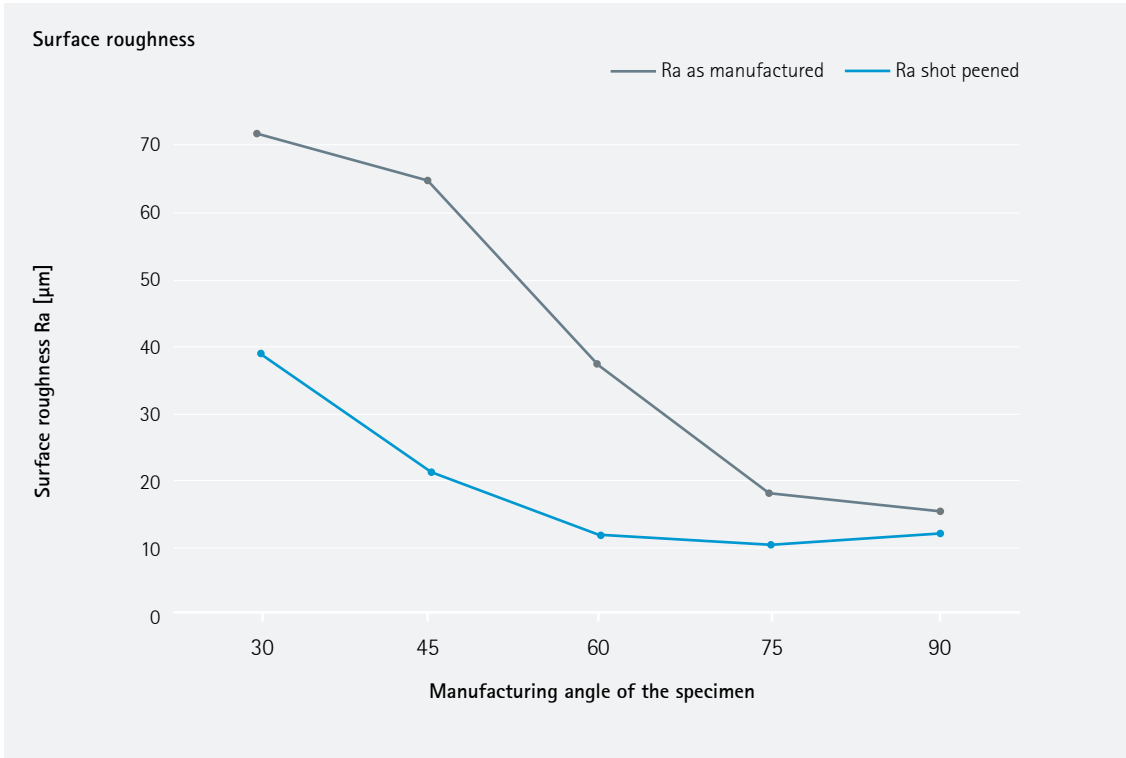
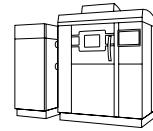


The testing was done according to EN 2002-001 2005 on round specimen machined according to standard Annex C. Results of both horizontal and vertical building direction are presented.

## 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



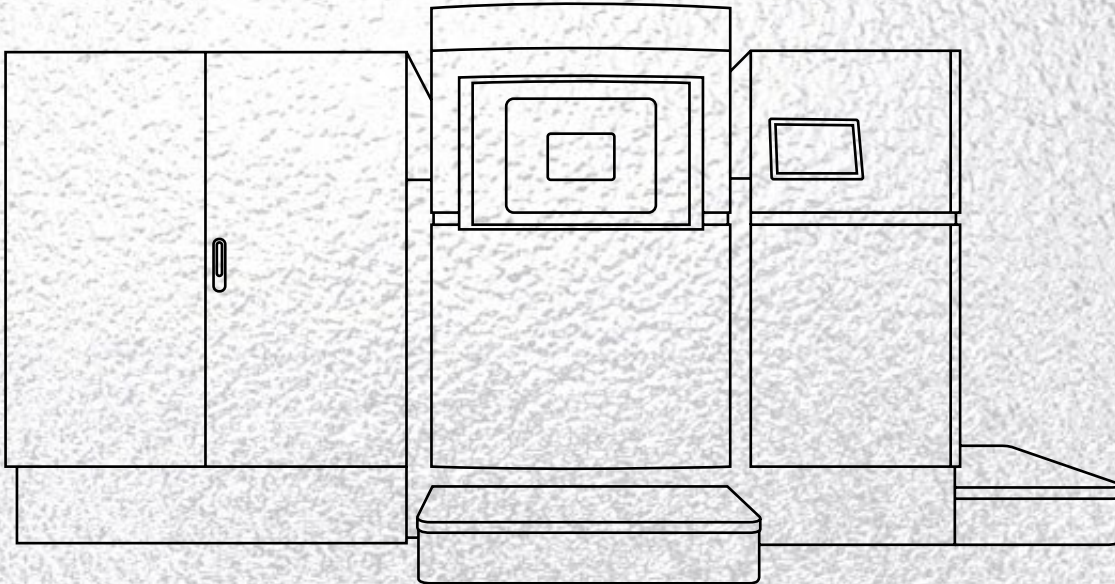
The surface quality was characterized by optical profiling from down-facing surfaces according to internal procedure. The 90 degree angle corresponds to vertical surface.

### AIF357 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 AIF357 for EOS M 400

### Process Information

System set-up	EOS M 400
EOS ParameterSet	M 400 AIF357 060 V1
EOSPAR name	AIF357_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 mm <sup>3</sup> /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:

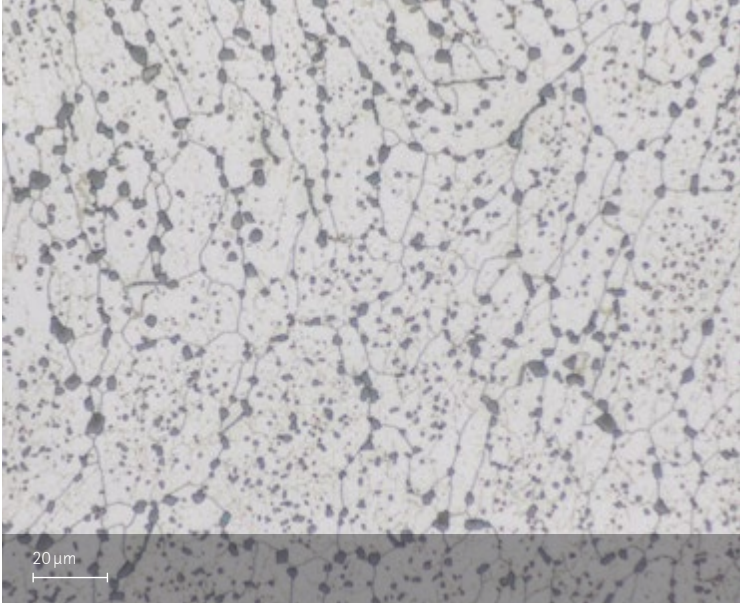
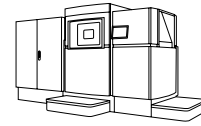
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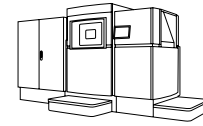
*Heat treated microstructure.  
Etched according to internal  
procedure using Groesbeck reagent.*

### 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 <sup>3</sup>	10

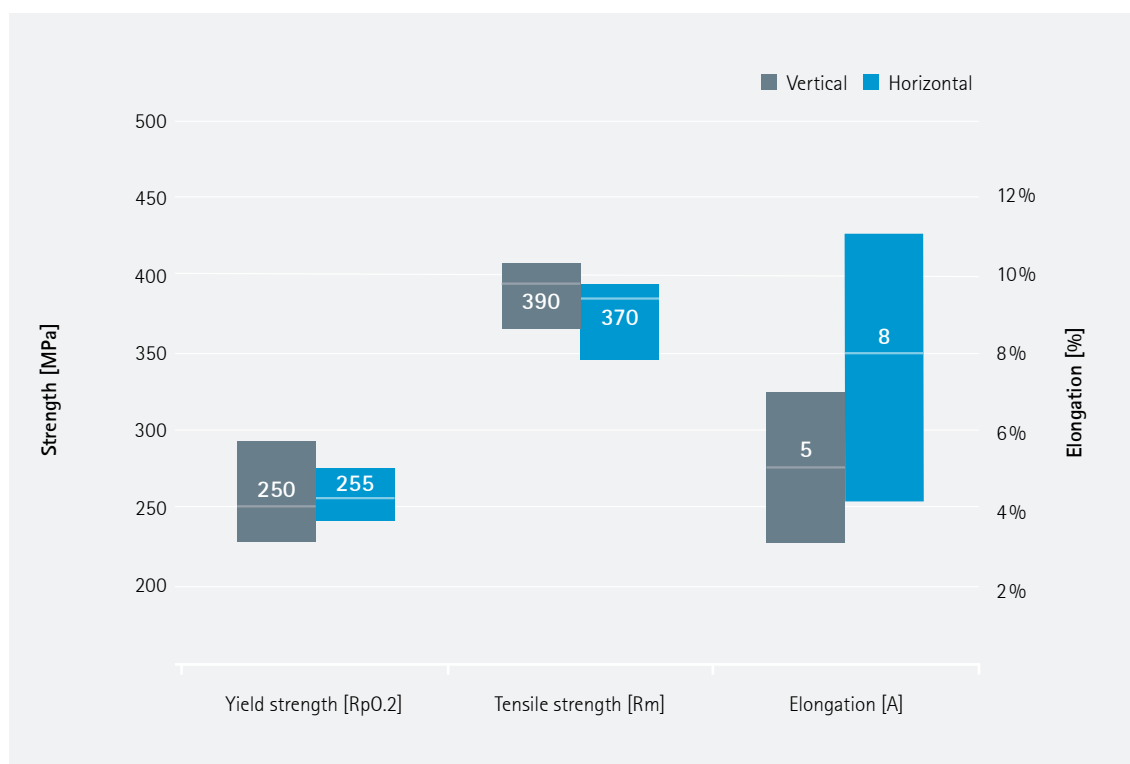
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## Mechanical Properties



### 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

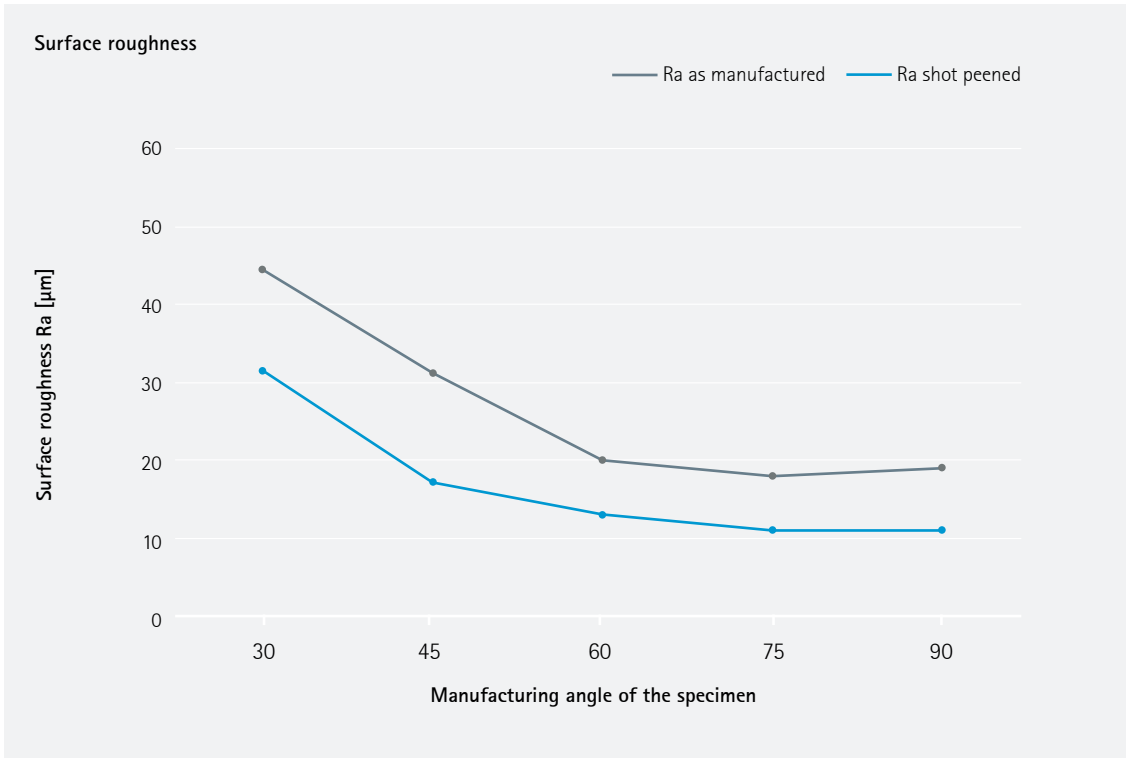
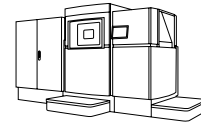


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Cover: This image shows a possible application.

The quoted values refer to the use of this material with above specified type of EOS DMLS system, EOSYSTEM and EOSPRINT software version, parameter set and operation in compliance with parameter sheet and operating instructions. Part properties are measured with specified measurement methods using defined test geometries and procedures. Further details of the test procedures used by EOS are available on request. Any deviation from these standard settings may affect the measured properties. The data correspond to EOS knowledge and experience at the time of publication and they are subject to change without notice as part of EOS' continuous development and improvement processes. EOS does not warrant any properties or fitness for a specific purpose, unless explicitly agreed upon. This also applies regarding any rights of protection as well as laws and regulations.

