

# EOS Aluminium Al2139 AM Material Data Sheet

# EOS Aluminium Al2139 AM

## Highest Strength Aluminum Alloy in AM

EOS Aluminium Al2139 AM is a 2000-series high strength alloy specifically designed for AM. It demonstrates outstanding performance in elevated temperatures up to 200 °C. Excellent strength properties include yield and tensile strength around 500 MPa in heat treated state and allow lightweight part design. The fast and simple heat treatment procedure enables an affordable part production.

### Main Characteristics:

- Unmatched strength in temperatures between 50-200 °C
- Robust one-step heat treatment
- Parts can be electropolished and anodized

### Typical Applications:

- Aerospace
- Racing
- Transportation & Mobility
- Lightweight designs

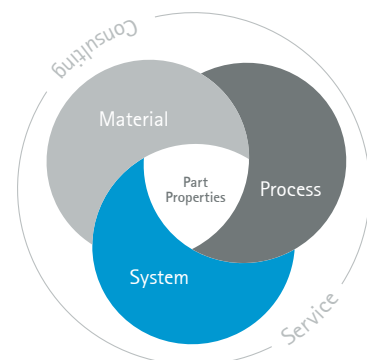
### The EOS Quality Triangle

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.

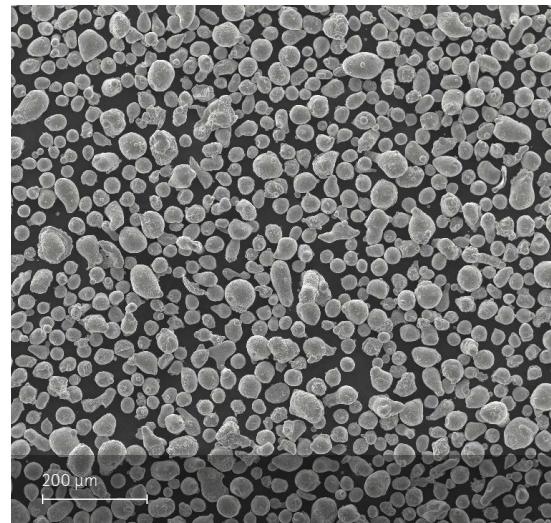


## Powder Properties

The chemical composition of the EOS Aluminium Al2139 AM powder is modified from Aluminium Association Teal Sheet for Al2139 (wrought aluminum alloys).

### Powder chemical composition (wt.-%)

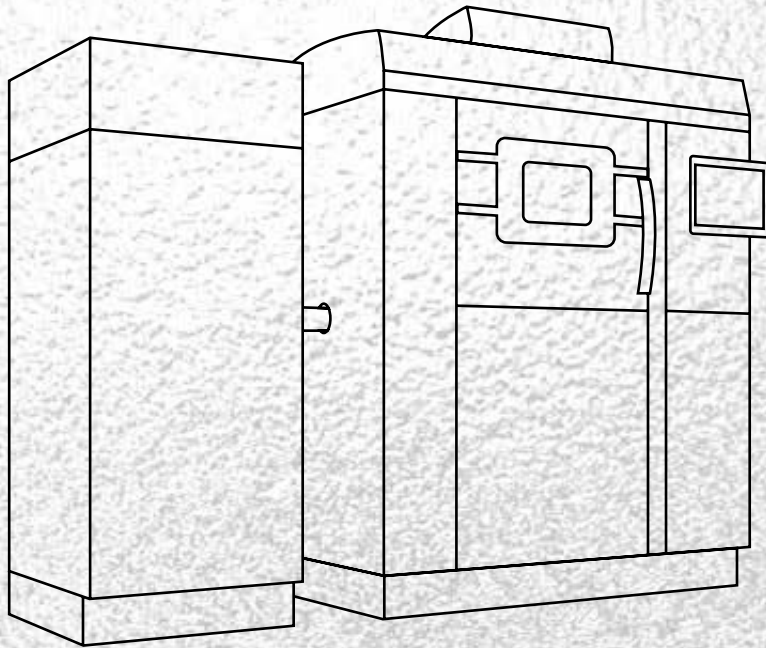
Element	Approximate Composition
Al	Balance
Cu	4.5 - 5.5
Mg	>0.8
Ag	0.15 - 0.6
Mn	0.2 - 0.6
Zn	<0.25
Si	<0.1
Fe	<0.15
Cr	<0.05
V	<0.05
Other metallic additions	<4



SEM micrograph of EOS Aluminium Al2139 AM powder.

### Powder particle size

Generic particle size distribution	20-63 µm
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## EOS Aluminium Al2139 AM for EOS M 290 | 60 $\mu$ m

Process Information  
Heat Treatment  
Physical Part Properties  
Mechanical Properties  
Additional Data

## EOS Aluminium Al2139 AM for EOS M 290 | 60 µm

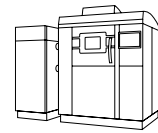
### Process Information

Process with good buildability, productivity and excellent mechanical properties after heat treatment also at elevated temperatures. Part and support design for high strength aluminium is required.

System set-up	EOS M 290
EOSPAR name	Al2139AM_060_CoreM291_110
Software requirements	EOSPRINT 2.7 or newer EOSYSTEM 2.11 or newer
Powder part no.	9030-0008
Recoater blade	HSS
Nozzle	EOS grid nozzle
Build platform temperature	175 °C
Inert gas	Argon
Sieve	75 µm

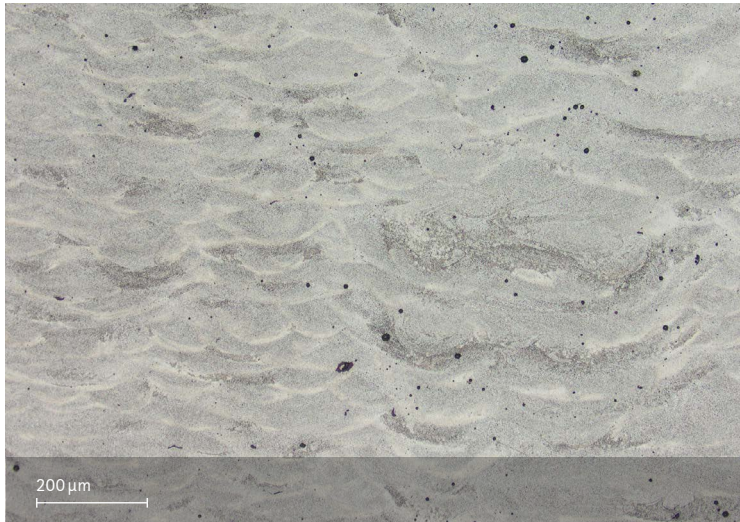
#### Additional information

Layer thickness	60 µm
Volume rate	7.2 mm <sup>3</sup> /s
Minimum wall thickness	0.4 mm



## Chemical and Physical Properties of Parts<sup>1</sup>

The chemical properties of the parts are the same as that of the powder.



*Micrograph etched as manufactured*

Defects	Result
Porosity	0.2 - 0.3 %
Density, ISO3369	≥ 2.84 g/cm <sup>3</sup>

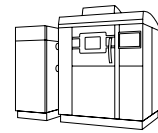
### Typical mechanical properties

	Yield strength R <sub>p0.2</sub> [MPa]	Tensile strength R <sub>m</sub> [MPa]	Elongation at break A [%]
Heat treated vertical	460	520	4
Heat treated horizontal	460	540	6
As manufactured vertical	350	380	6
As manufactured horizontal	350	380	8

Tensile testing as per ISO 6892-1, B10

### Typical hardness EN ISO 6506-1

Heat treated (T4)	162 HBW 2.5/62.5
As manufactured	112 HBW 2.5/62.5



## Heat Treatment

### EOS Aluminium Al2139 AM recommended

#### T4 Heat Treatment:

Solution annealing 45 min @ 490 °C, water quench.

Natural aging 3 days in room temperature.

#### Step 1:

Solution annealing of 45 minutes in 490 °C followed by immediate quenching to water.

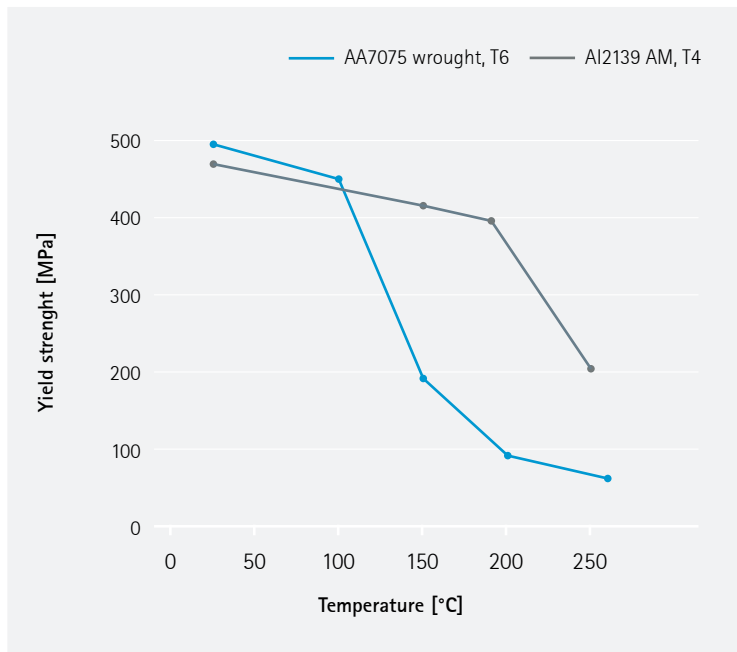
#### Step 2:

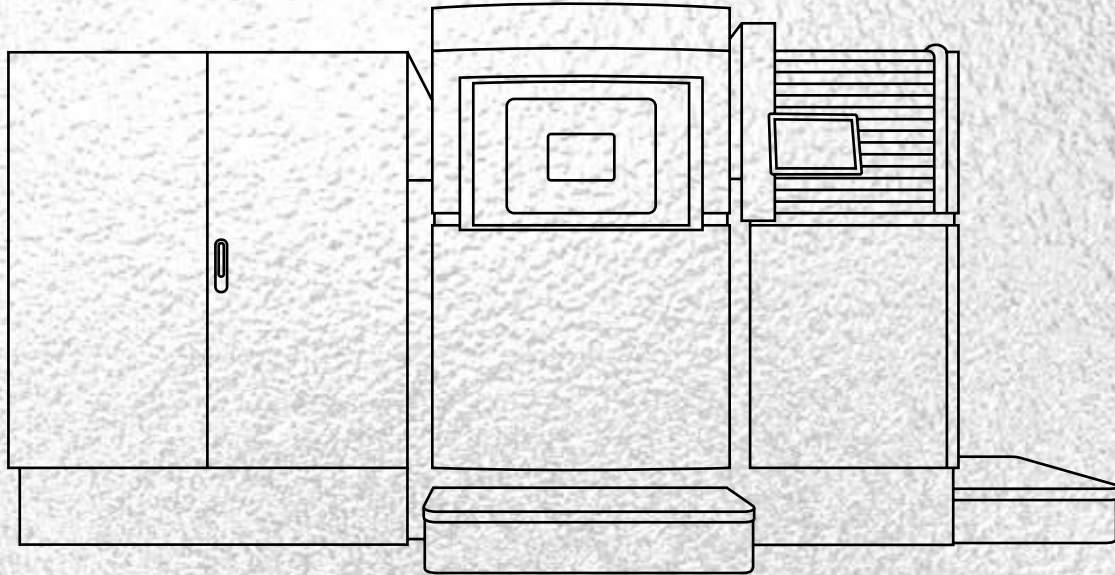
Natural aging in room temperature for 3 days.

## Additional Data<sup>1</sup>

### Elevated temperature properties

Elevated temperature tensile testing of EOS Aluminium Al2139 AM (T4) and a wrought grade reference material (T6 HT state) according to EN 2002-002.





## EOS Aluminium Al2139 AM for EOS M 400-4 | 50 $\mu\text{m}$

Process Information  
Heat Treatment  
Physical Part Properties  
Mechanical Properties  
Additional Data



## EOS Aluminium Al2139 AM for EOS M 400-4 | 50 µm

### Process Information

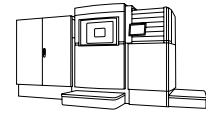
High performance process with good microstructure and excellent mechanical properties and low anisotropy after heat treatment. Good mechanical properties at elevated temperatures in heat treated condition. Process offers good buildability of small features with soft recoating. Part and support design for high strength aluminium is required.

System set-up	EOS M 400-4
EOSPAR name	Al2139AM_050_CoreM404 1.00
Software requirements	EOSPRINT 2.10 or newer EOSYSTEM 2.14 or newer
Powder part no.	9030-0008
Recoater blade	HSS or soft
Nozzle	Standard
Build platform temperature	195 °C
Inert gas	Argon
Sieve	75 µm

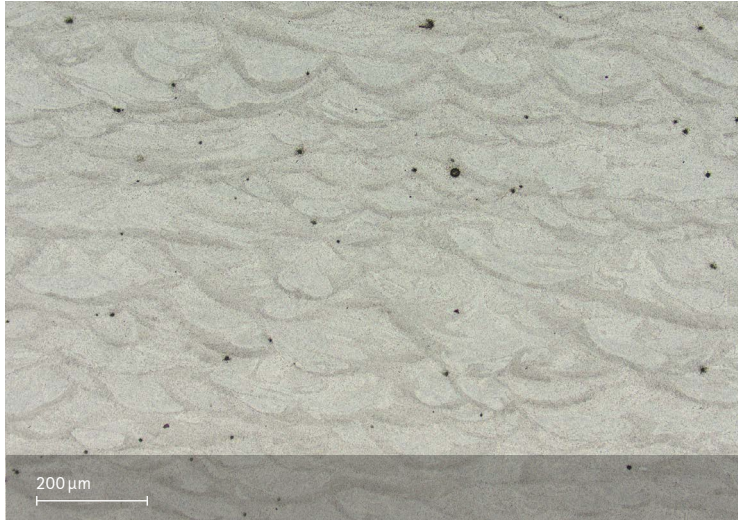
#### Additional information

Layer thickness	50 µm
Volume rate	4x 5.0 mm <sup>3</sup> /s
Minimum wall thickness	0.4 mm

## Chemical and Physical Properties of Parts<sup>1</sup>



The chemical properties of the parts are the same as that of the powder.



*Micrograph etched as manufactured*

Defects	Result
Average defect percentage	0.1 %
Density, ISO3369	$\geq 2.84 \text{ g/cm}^3$

### Typical mechanical properties

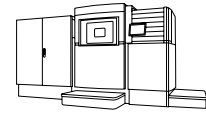
	Yield strength $R_{p0.2}$ [MPa]	Tensile strength $R_m$ [MPa]	Elongation at break A [%]
Heat treated vertical	450	530	6
Heat treated horizontal	460	550	7
As manufactured vertical	380	430	8
As manufactured horizontal	380	430	10

Tensile testing as per ISO 6892-1, B10

### Typical hardness EN ISO 6506-1

Heat treated (T4)	168 HBW 2.5/62.5
As manufactured	115 HBW 2.5/62.5

## Heat Treatment



### EOS Aluminium Al2139 AM recommended

#### T4 Heat Treatment:

Solution annealing 45 min @ 490 °C, water quench.

Natural aging 3 days in room temperature.

#### Step 1:

Solution annealing of 45 minutes in 490 °C followed by immediate quenching to water.

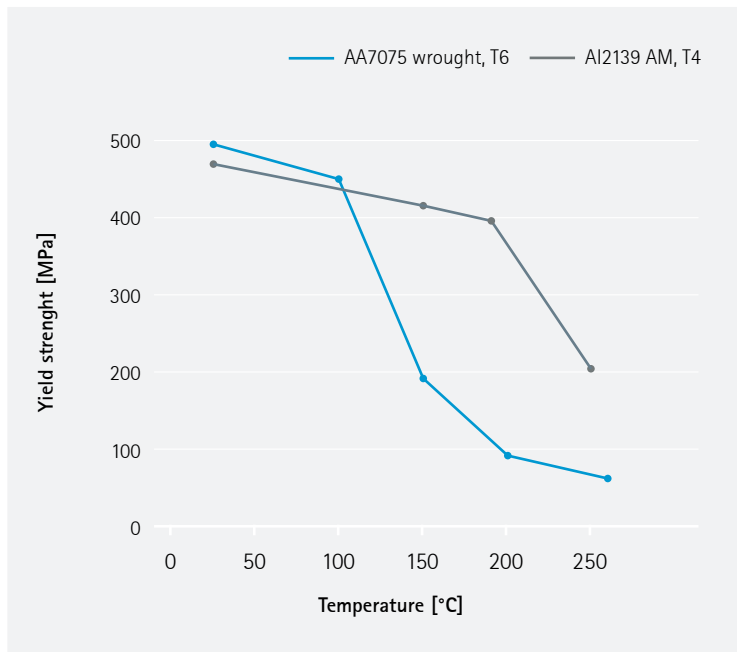
#### Step 2:

Natural aging in room temperature for 3 days.

## Additional Data<sup>1</sup>

### Elevated temperature properties

Elevated temperature tensile testing of EOS Aluminium Al2139 AM (T4) and a wrought grade reference material (T6 HT state) according to EN 2002-002.



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Cover: This image shows a possible application.

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