

## EOS ToolSteel CM55 Material Data Sheet

# EOS ToolSteel CM55

EOS ToolSteel CM55 is a cobalt free ultra high strength steel for tooling and engineering solutions. Its alloying elements and moderate carbon content form a strong and stable structure for demanding applications. The properties of this steel make it suitable for cold- and hot-working tools. Producing mechanical engineering and powertrain components is well suited for this steel.

## Main Characteristics:

- Cobalt free
- High strength and hardness
- Stable for use in elevated temperatures

## Typical Applications:

- Cold working tools
- Hot working tools
- Parts for mechanical engineering
- Powertrain components

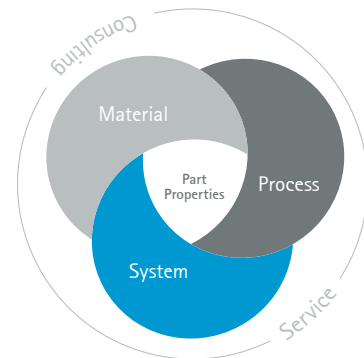
## The EOS Quality Triangle

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.



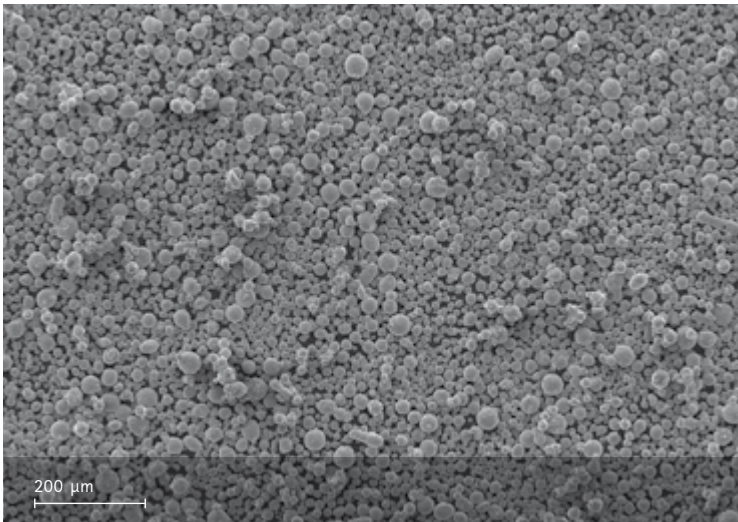
## Powder Properties

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

Element	Min.	Max.
Fe	Balance	
Cr	5.0	8.0
Ni	5.0	8.0
Mo	0.5	1.2
Al	2.0	2.6
V	0.1	0.25
C	0.1	0.25

### Powder particle size

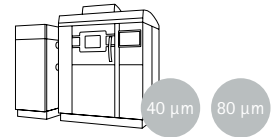
Generic particle size distribution	15 - 63 $\mu\text{m}$
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*SEM image of powder*

## EOS ToolSteel CM55 for EOS M 290 | 40/80 $\mu\text{m}$

### Process Information



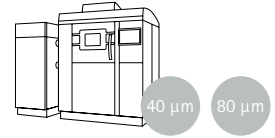
System set-up		EOS M 290
EOSPAR name	CM55_Ar_040_080_CoreM291 CM55_N2_040_080_CoreM291	
Software requirements	EOSPRINT 2.10 or newer EOSYSTEM 2.14 or newer	
Powder part no.	9030-0016	
Recoater blade	Ceramic	
Nozzle	EOS grid nozzle	
Inert gas	Argon or Nitrogen	
Sieve	75 $\mu\text{m}$	

#### Additional information

Layer thickness	40 $\mu\text{m}$ , 80 $\mu\text{m}$ Et 40/80 $\mu\text{m}$ Skin
Volume rate	4.1 $\text{mm}^3/\text{s}$ (40 $\mu\text{m}$ ), 7.8 $\text{mm}^3/\text{s}$ (80 $\mu\text{m}$ ), 4.1 – 7.8 $\text{mm}^3/\text{s}$ (40/80 $\mu\text{m}$ Skin*)
Typical dimensional change after heat treatment	+0.2 %

\* Volume rate depends on the part dimensions and skin thickness.

## Chemical and Physical Properties of Parts



Chemical composition of printed parts matches the chemistry of EOS ToolSteel CM55 powder.



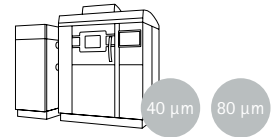
Micrograph etched, heat treated state  
Etchant: Oxalic acid

Defects	Result
Porosity	40 μm / 0.07 % 80 μm / 0.12 %
Density, ISO3369	≥ 7.5 g/cm <sup>3</sup>

### Typical mechanical properties

Heat treated to 55 HRC	Yield strength $R_{p0.2}$ [MPa]	Tensile strength $R_m$ [MPa]	Elongation at break A [%]	Modulus of elasticity [GPa]
40 μm horizontal	1740	2040	4	230
40 μm vertical	1730	2030	4	
80 μm horizontal	1710	2020	2.5	
80 μm vertical	1700	2010	2.5	

Tensile testing as per ISO 6892-1. Modulus of elasticity testing according to EN ISO 6892-1 Method A, Range 1 (0.00007 1/s).



## Heat Treatment

EOS ToolSteel CM55 can be heat treated to different hardness levels by adjusting the aging temperature. Final state of use is achieved by a two step heat treatment. First step is hardening where a strong martensitic microstructure is formed. The final hardness and strength is obtained in an aging treatment where strengthening phases and precipitates form.

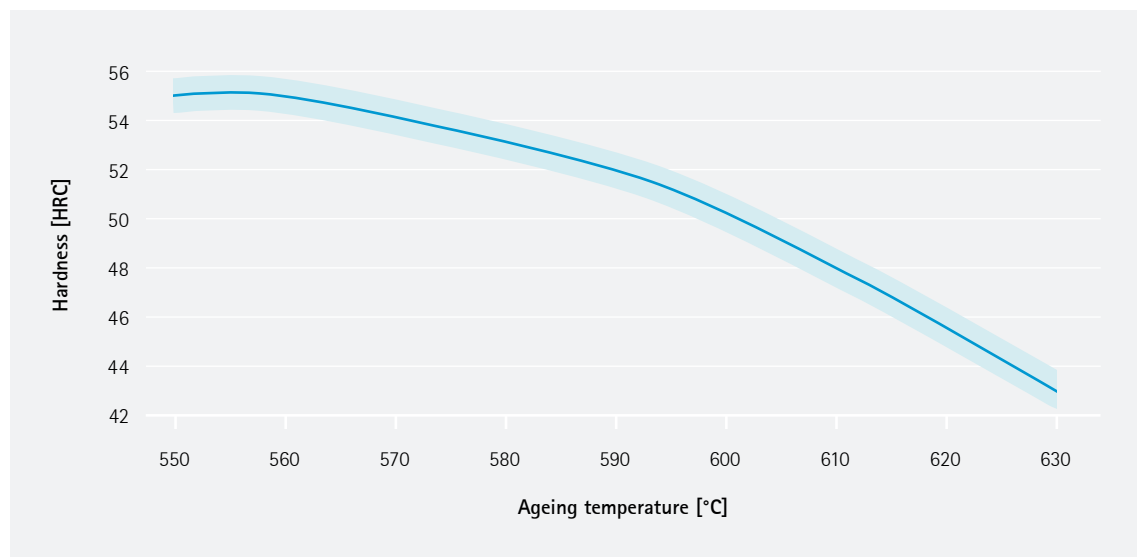
### 1. Hardening

2 hours in 950 °C measured from the part when thoroughly heated through. Rapid gas cooling or quenching in oil. Cooling to room temperature before aging treatment.

### 2. Aging

4 hours in 550 °C - 630 °C depending on the desired hardness. Hold time when parts have thoroughly heated through. Air cooling or equivalent cooling rate. Peak strength and hardness is achieved by aging at 550 °C, stated data in this document represents this state. For lower hardness and strength choose aging temperature according to the graph below.

### Hardness and Aging Temperature



## Additional Data

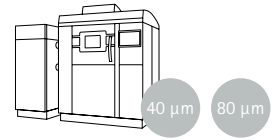
### Impact toughness

Heat treated to 55 HRC

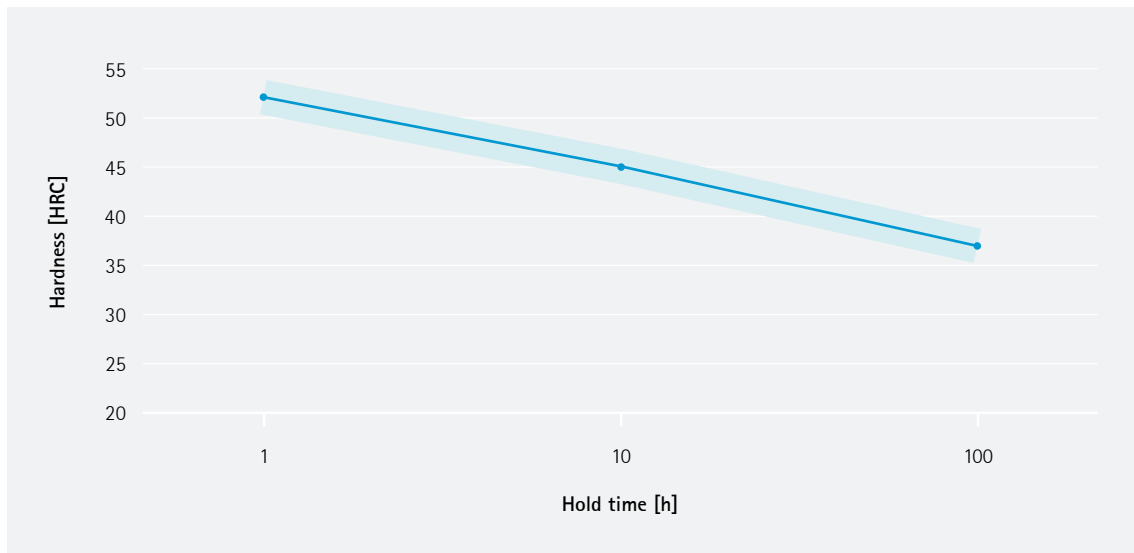
Typical impact toughness [J]

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Testing according to ISO 148-1, V-notch at room temperature.



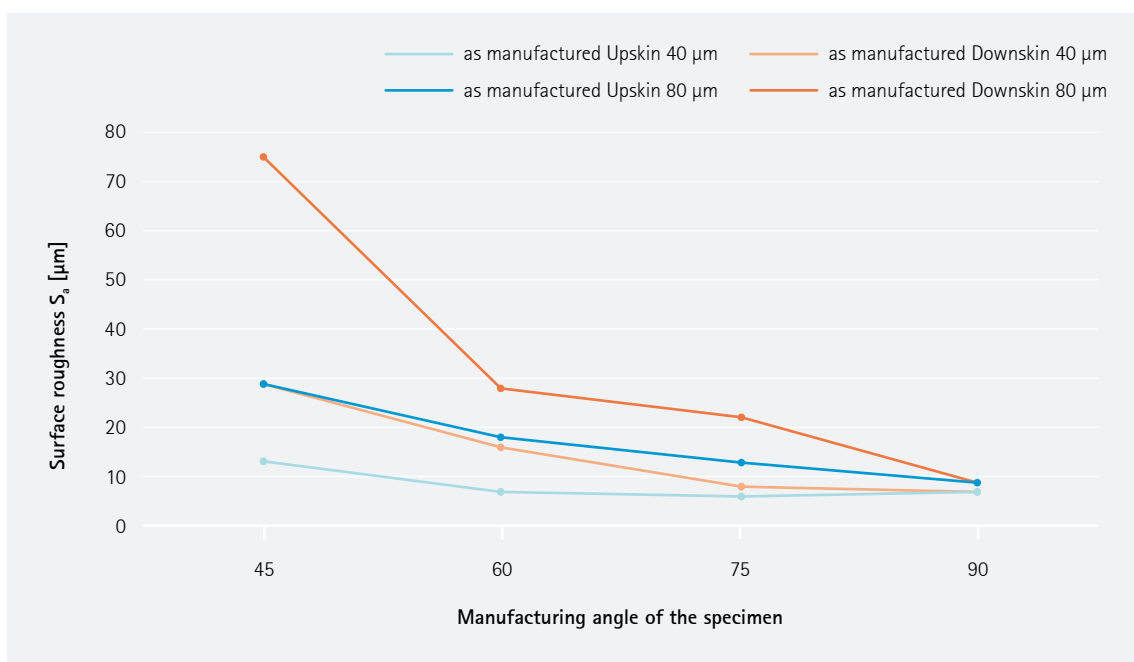
### Temper resistance, 600 °C



### Coefficient of Thermal Expansion ASTM E228

Temperature	25 - 100 °C	25 - 200 °C	25 - 300 °C	25 - 400 °C	25 - 500 °C	25 - 600 °C
CTE	$10.6 \cdot 10^{-6}/K$	$11.5 \cdot 10^{-6}/K$	$12.0 \cdot 10^{-6}/K$	$12.4 \cdot 10^{-6}/K$	$12.7 \cdot 10^{-6}/K$	$13.2 \cdot 10^{-6}/K$

### Surface Roughness



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Cover: This image shows a possible application.

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### Important Note

This data sheet specifies the powder properties of the EOS powder type referenced above. If you purchase powder from EOS, EOS will deliver such powder in conformity with the version of this data sheet prevailing at the time of your order. If you purchase powder from any source other than EOS, EOS makes no warranties or representations with respect to powder properties to you whatsoever, and claims with respect to the quality or properties of EOS powder are available only against the seller of such powder in accordance with your agreement with the seller, not against EOS. - EOS data sheets are subject to change without notice. This data sheet does not constitute a guaranty or warranty of properties or fitness for a specific purpose and may not be relied upon as such.

