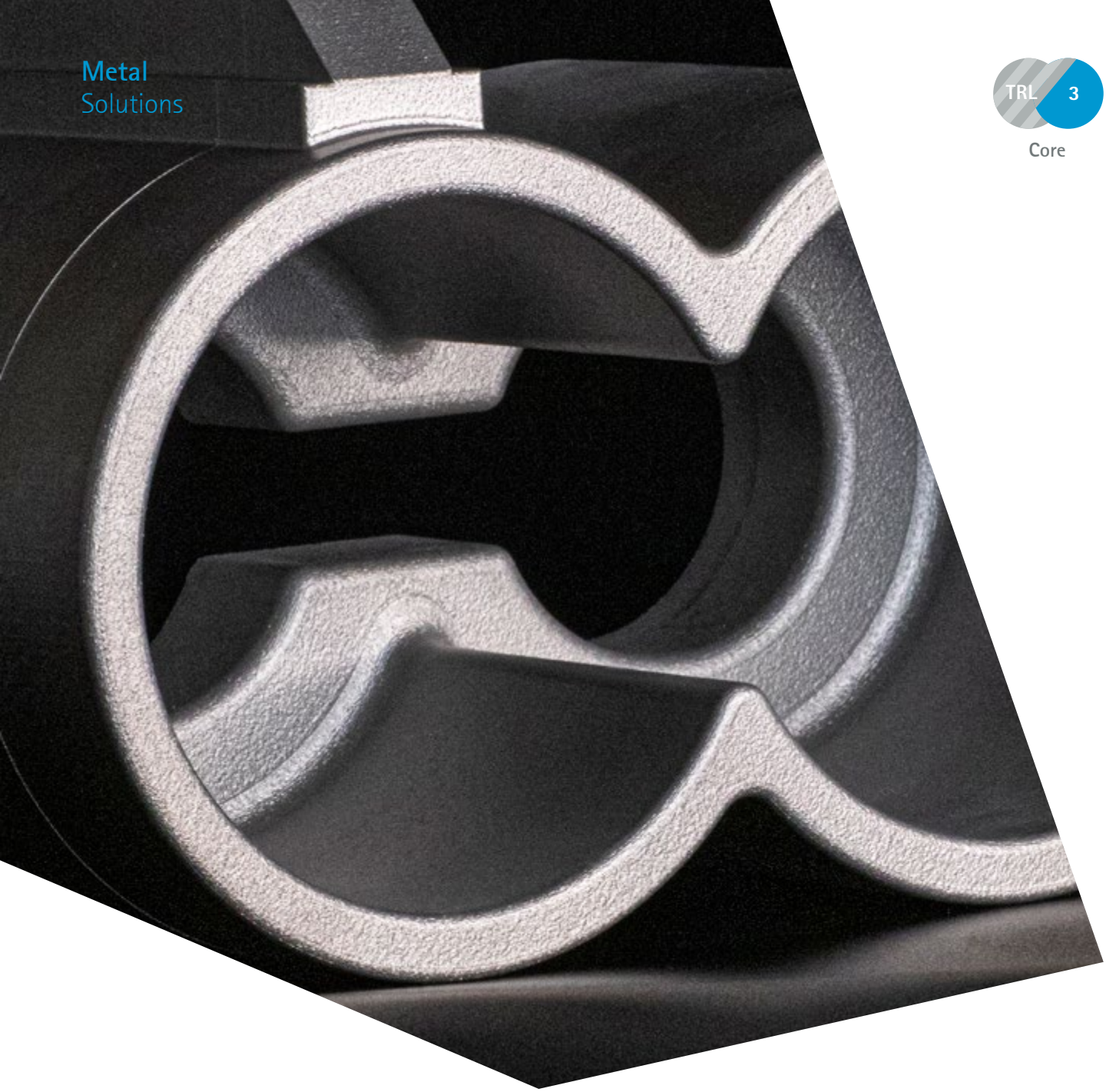
Metal
Solutions



TRL 3
Core

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:

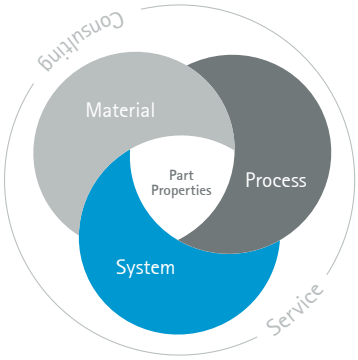
- Cobalt free
- High strength and hardness
- Stable for use in elevated temperatures

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.

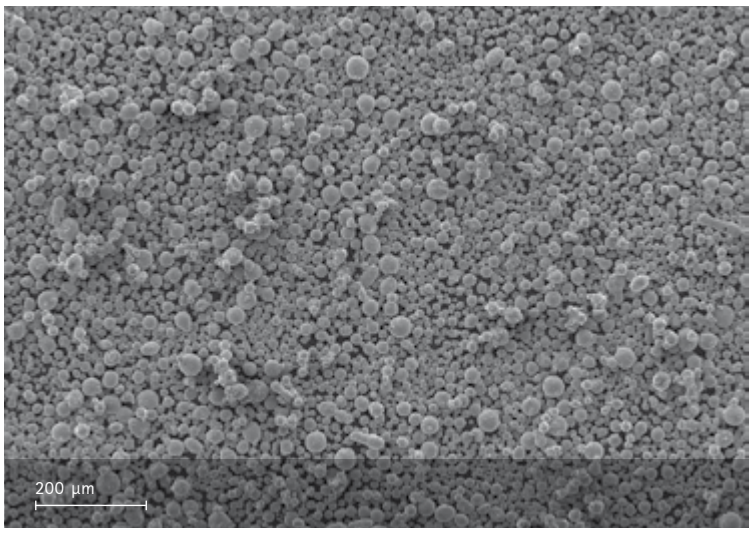
Powder Properties

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

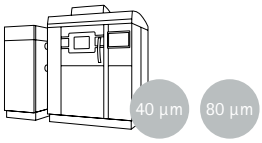
Generic particle size distribution	15 - 63 µm



SEM image of powder

EOS ToolSteel CM55 for EOS M 290 | 40/80 µm

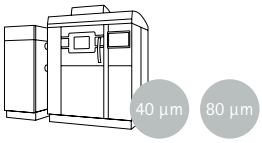
Process Information



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 µm

Additional information	
Layer thickness	40 µm, 80 µm & 40/80 µm Skin
Volume rate	4.1 mm³/s (40 µm), 7.8 mm³/s (80 µm), 4.1 - 7.8 mm³/s (40/80 µm 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.

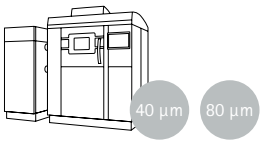
Micrograph etched, heat treated state
Etchant: Oxalic acid

Defects	Result
Porosity	40 µm / 0.07 % 80 µm / 0.12 %
Density, ISO3369	≥ 7.5 g/cm³

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	1 740	2 040	4	230
40 µm vertical	1 730	2 030	4	
80 µm horizontal	1 710	2 020	2.5	
80 µm vertical	1 700	2 010	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.

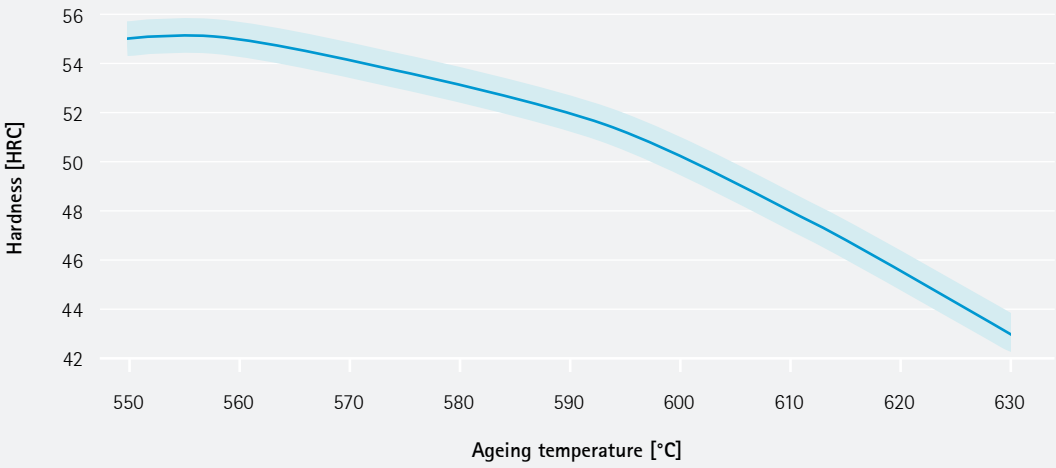
1. Hardening

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.

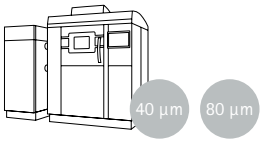
Hardness and Aging Temperature



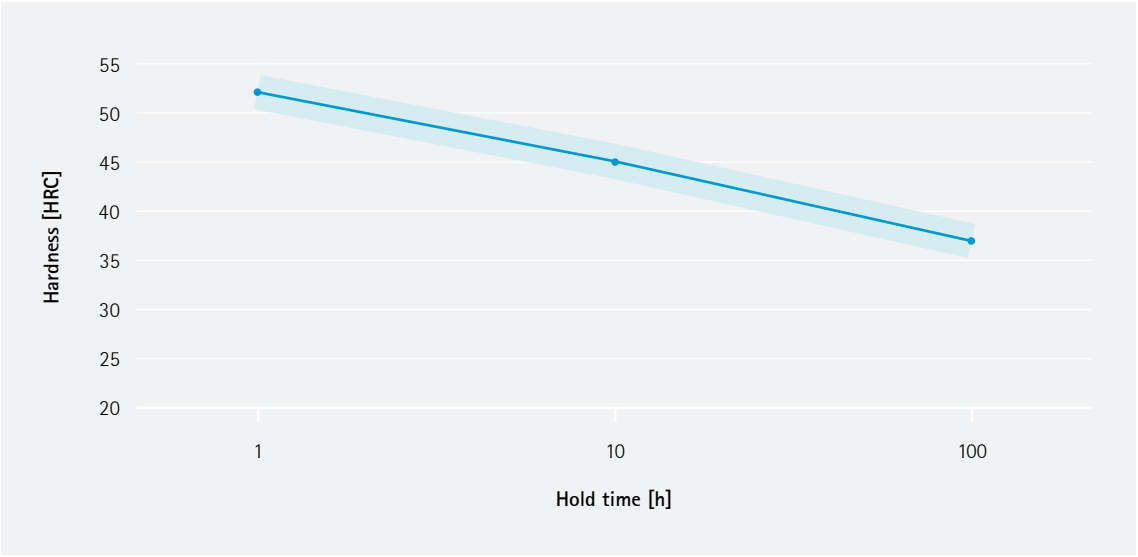
Additional Data

Impact toughness

Heat treated to 55 HRC		
Typical impact toughness [J]	5	Testing according to ISO 148-1, V-notch at room temperature.



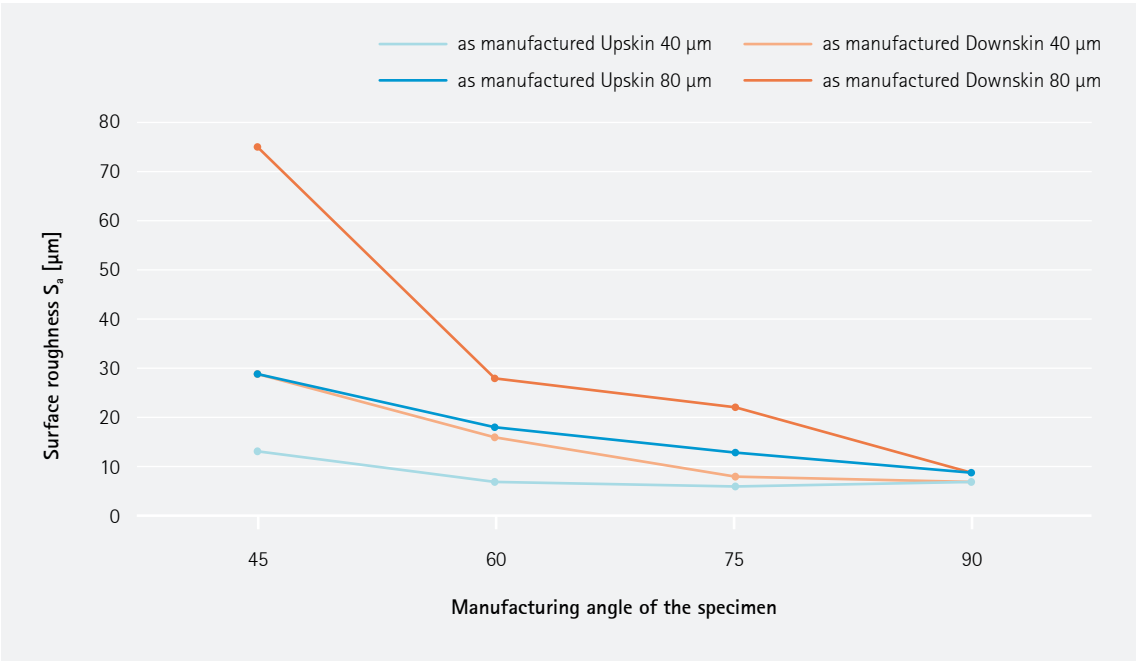
Temper resistance, 600 °C



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	$10.6*10^{-6}$/K	$11.5*10^{-6}$/K	$12.0*10^{-6}$/K	$12.4*10^{-6}$/K	$12.7*10^{-6}$/K	$13.2*10^{-6}$/K

Surface Roughness



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
EOSGmbH
#ShapingFuture
#ResponsibleManufacturing

Further Offices

EOS France
Phone +33 437 497 676

EOS Greater China
Phone +86 21 602 307 00

EOS India
Phone +91 443 964 8000

EOS Italy
Phone +39 023 340 1659

EOS Japan
Phone +81 45 670 0250

EOS Korea
Phone +82 2 6330 5800

EOS Nordic & Baltic
Phone +46 31 760 4640

EOS North America
Phone +1 877 388 7916

EOS Singapore
Phone +65 6430 0463

EOS UK
Phone +44 1926 675 110

Status 05/2022

Cover: This image shows a possible application.