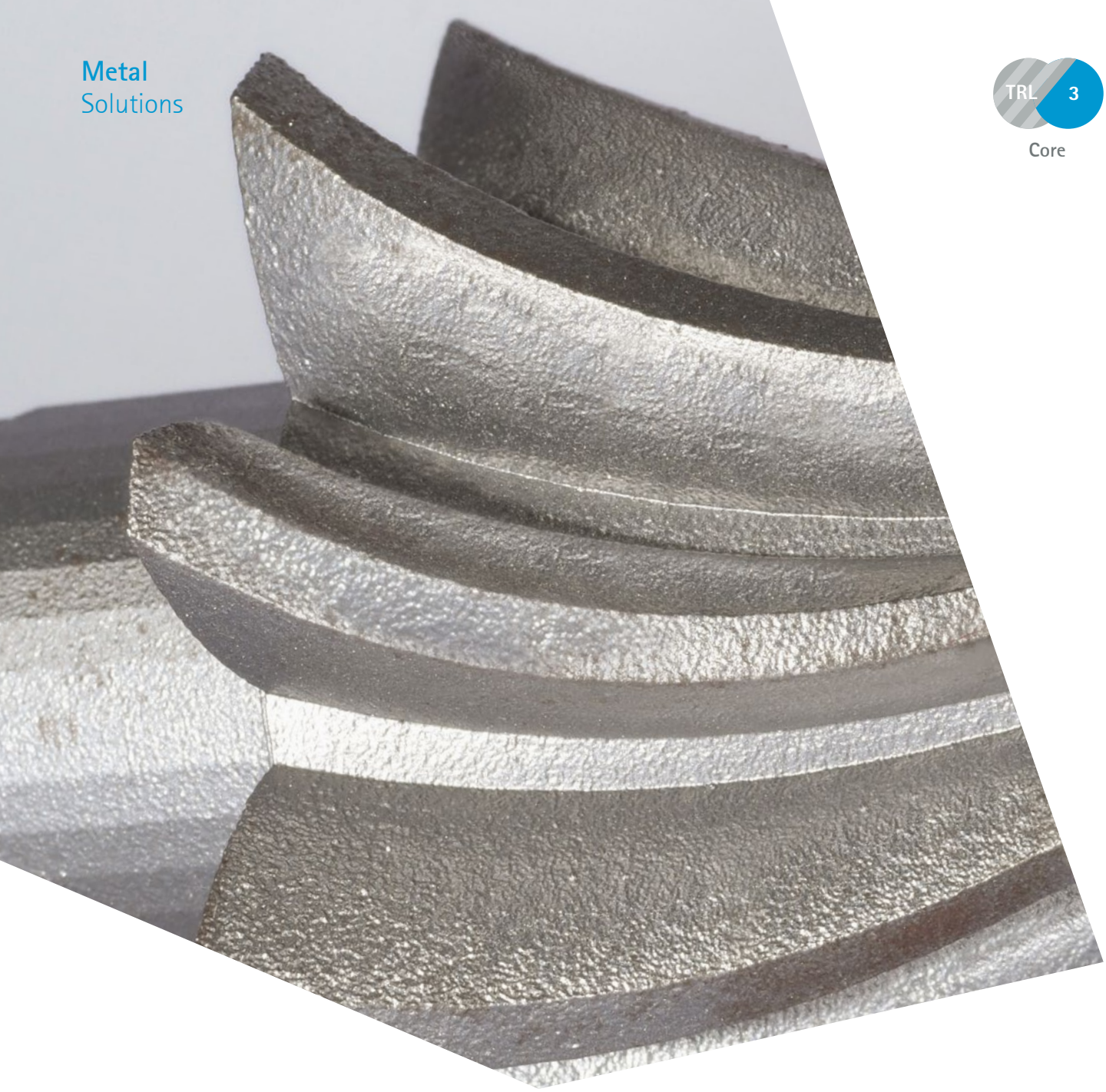
Metal
Solutions

TRL 3
Core



# EOS CaseHardeningSteel 20MnCr5
## Material Data Sheet

# EOS CaseHardeningSteel 20MnCr5

Case hardening steel with good hardenability reaching good wear resistance due to high surface hardness after heat treatment.

**Main Characteristics:**

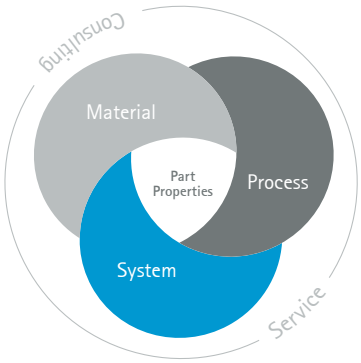
- Good wear resistance
- Excellent surface hardness after carburizing
- Material according to EN-10084 alloy number 1.7147
- Carburizable to achieve surface hardness of 60 HRC

**Typical Applications:**

- Automotive and general engineering applications
- Gears, mechanical part

**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

EOS CaseHardeningSteel 20MnCr5 powder material is in accordance with EN-10084 alloy number 1.7147.

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

| Element | Min. | Max. |
|---|---|---|
| Fe | Balance | |
| Mn | 1.10 | 1.40 |
| Cr | 1.00 | 1.30 |
| C | 0.17 | 0.22 |
| Si | - | 0.40 |
| S | - | 0.035 |

**Powder particle size**

| | |
|---|---|
| Generic particle size distribution | 15-55 µm |

TRL 3

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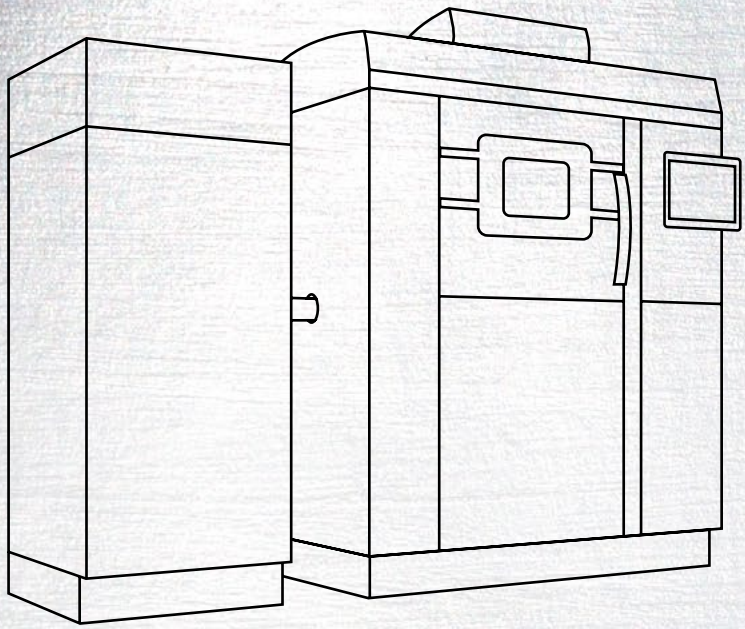


# EOS CaseHardeningSteel 20MnCr5
# **for EOS M 290 | 40 µm**

Process Information
Physical Part Properties
Heat Treatment
Additional Data

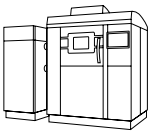
# EOS CaseHardeningSteel 20MnCr5 for EOS M 290 | 40 µm

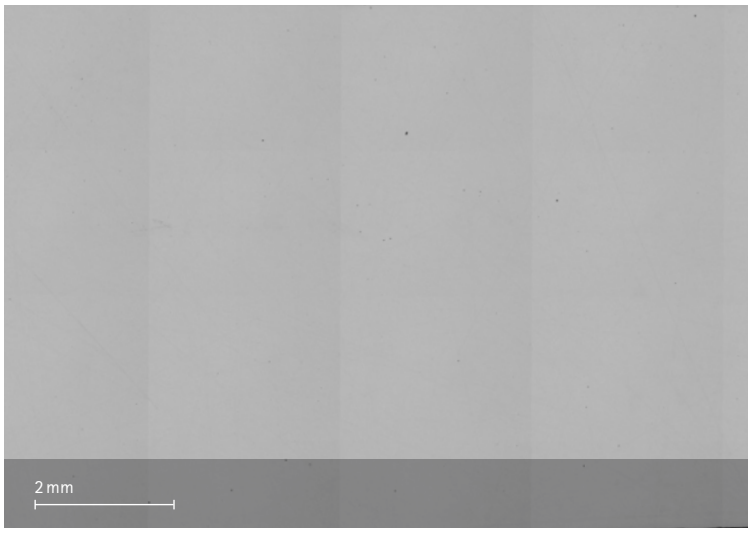
## Process Information

| System set-up | EOS M 290 |
|---|---|
| EOS ParameterSet | 20MnCr5_040_CoreM291 1.X |
| EOSPAR name | 20MnCr5_040_CoreM291_100.eospar |
| Software requirements | EOSPRINT 2.7 or newer<br>EOSYSTEM 2.11 or newer |
| Powder part no. | 9030-0004 |
| Recoater blade | EOS ceramic blade |
| Nozzle | EOS grid nozzle |
| Inert gas | Nitrogen |
| Sieve | 75 µm |

| Additional information | |
|---|---|
| Layer thickness | 40 µm |
| Volume rate | 3.84 $mm^3/s$ |

# Chemical and Physical Properties of Parts





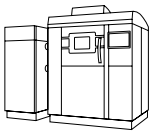

Micrograph of polished surface

| Defects | Result |
|---|---|
| Porosity | < 0.5 % |

**Typical part properties**

| | Yield strength $R_{p0.2}$ [MPa] | Tensile strength $R_m$ [MPa] | Elongation at break A [%] |
|---|---|---|---|
| Heat treated horizontal | 1 265 | 1 480 | 9 |
| Heat treated vertical | 1 265 | 1 480 | 9 |

## Heat Treatment



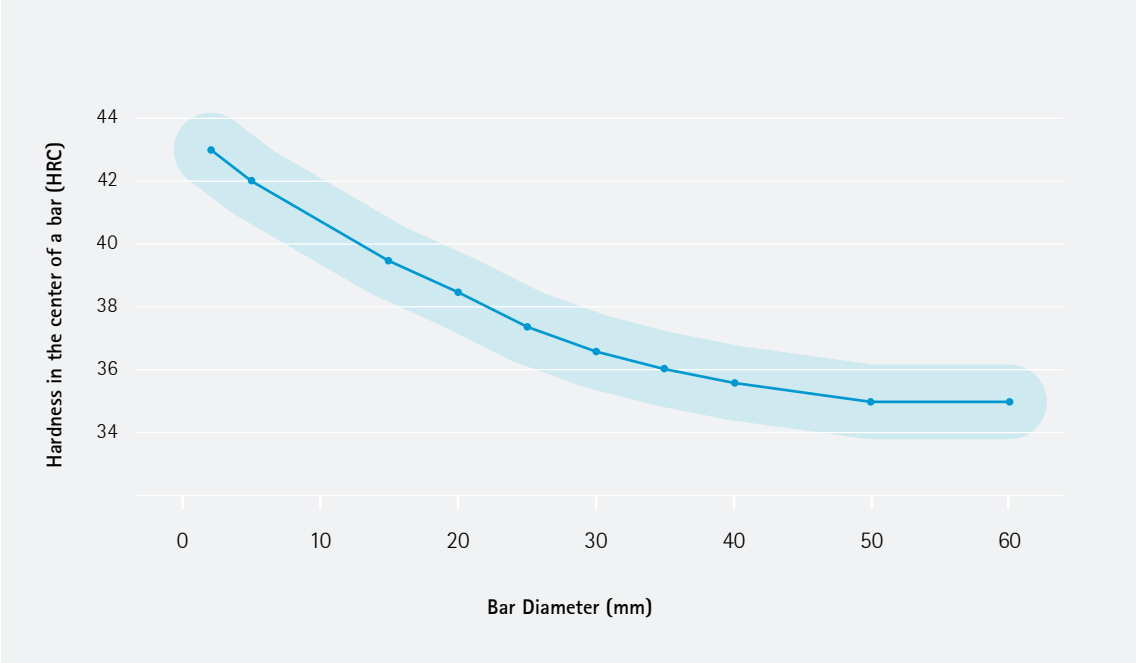
**Hardening:**
840 - 870 °C, hold time 30 min when thoroughly heated, water or oil quenching

**Tempering:**
160 - 200 °C, hold time 2 h when thoroughly heated, air cooling

**Optional softening treatment:**
Normalizing 870 °C, hold time 1 h when thoroughly heated, air cooling

## Additional Data

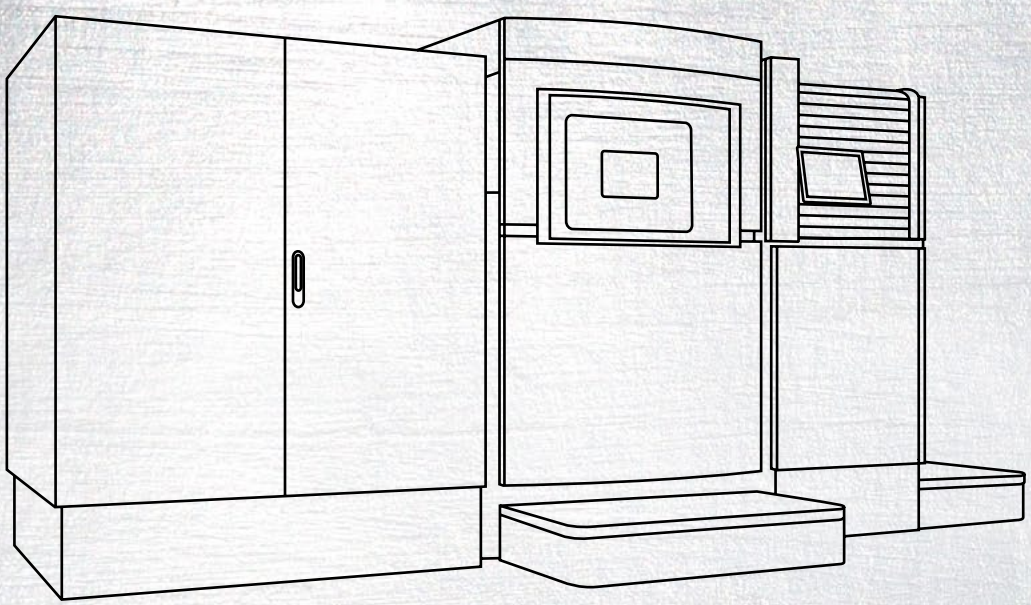
### Hardness




Hardness in the center of a bar as a function of its diameter

TRL 3

Core



# EOS CaseHardeningSteel 20MnCr5
# for EOS M 400-4 | 40 µm

Process Information Physical

Part Properties

Heat Treatment

Additional Data

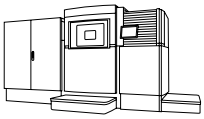
# EOS CaseHardeningSteel 20MnCr5 for EOS M 400-4 | 40 µm

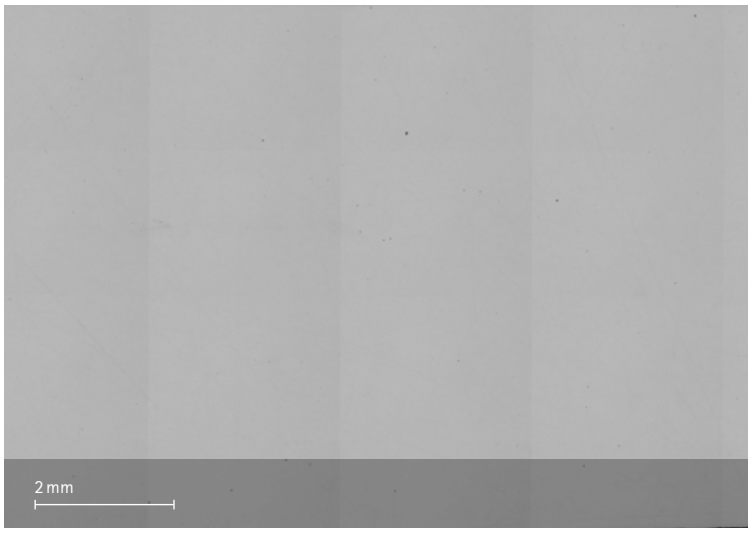
## Process Information

| System set-up | EOS M 400-4 |
|---|---|
| EOS ParameterSet | 20MnCr5_040_Core M404 1.X |
| EOSPAR name | 20MnCr5_040_CoreM404_100.eospar |
| Software requirements | EOSPRINT 2.7 or newer<br>EOSYSTEM 2.11 or newer |
| Powder part no. | 9030-0004 |
| Recoater blade | EOS ceramic blade |
| Inert gas | Nitrogen |
| Sieve | 75 µm |

| Additional information | |
|---|---|
| Layer thickness | 40 µm |
| Volume rate | 4 x 3.84 $mm^3/s$ |

# Chemical and Physical Properties of Parts






Micrograph of polished surface

| Defects | Result |
|---|---|
| Porosity | < 0.5 % |

**Typical part properties**

| | Yield strength $R_{p0.2}$ [MPa] | Tensile strength $R_m$ [MPa] | Elongation at break A [%] |
|---|---|---|---|
| Heat treated horizontal | 1 265 | 1 480 | 9 |
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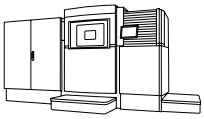
## Heat Treatment



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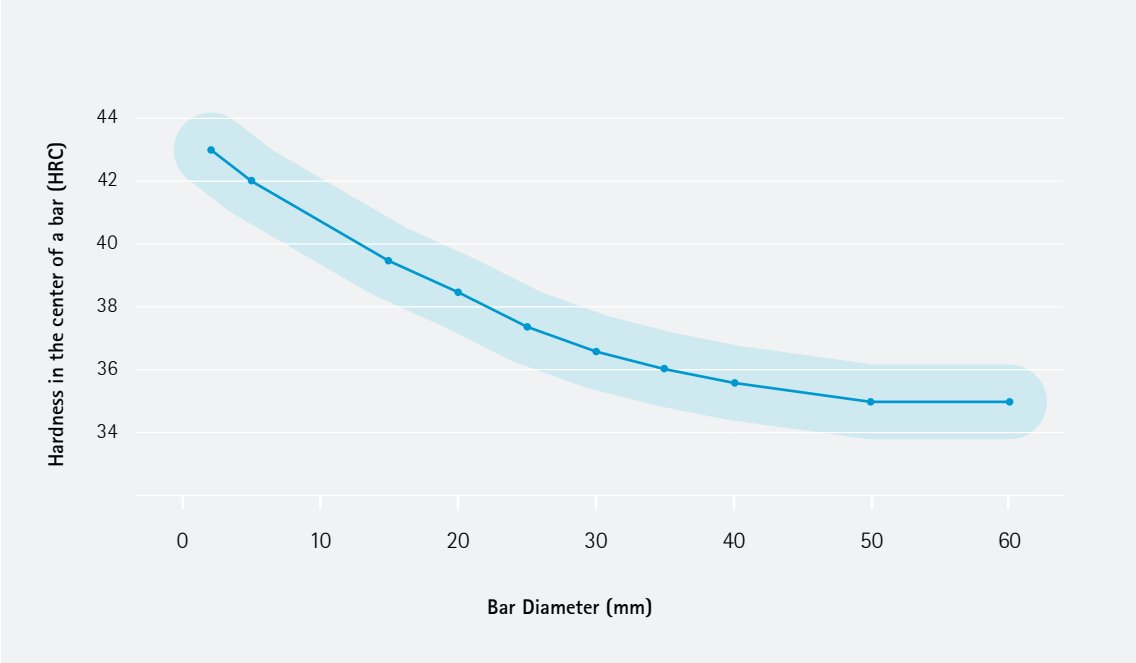
**Optional softening treatment:**
Normalizing 870 °C, hold time 1 h when thoroughly heated, air cooling

## Additional Data

### Hardness




Hardness in the center of a bar as a function of its diameter

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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.