

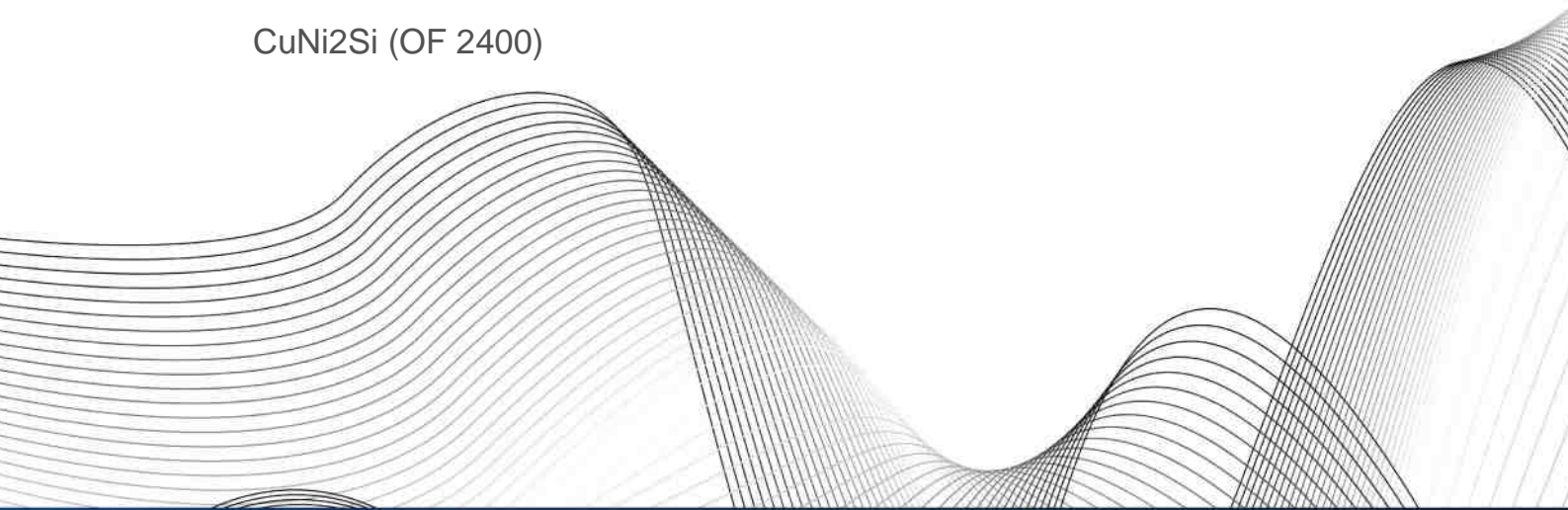


OTTO FUCHS  
Dülken GmbH & Co. KG



Copper and Copper Alloys

CuNi2Si (OF 2400)



|      | Cu   | Zn | Pb   | Sn | Fe  | Mn  | Ni  | Al | Si  | As | Co | Cr | Others |
|------|------|----|------|----|-----|-----|-----|----|-----|----|----|----|--------|
| Min. | Rem. | -  | -    | -  | -   | -   | 1.6 | -  | 0.4 | -  | -  | -  | -      |
| Max. | -    | -  | 0.02 | -  | 0.2 | 0.1 | 2.5 | -  | 0.8 | -  | -  | -  | 0.3    |

## Applications

CuNi2Si is highly suitable for friction and wear applications. Parts which combine high static strength and fatigue strength even at elevated temperatures, e.g. in electronics or overhead traction line with reasonable electric and thermal conductivity are also made of CuNi2Si. CuNi2Si can be used for diamagnetic and paramagnetic applications. Another field of application is the use of parts made of CuNi2Si in corrosive environments.

CuNi2Si is enlisted as an antimicrobial alloy at U.S. EPA.

Examples of application:

- Electronics, e.g. connectors
- Overhead traction lines: clamps, screw nuts and screws
- Electric parts for use in corrosive environment
- Bushings
- Sliding and friction applications
- Diamagnetic and paramagnetic applications
- Antimicrobial applications
- Maritime applications

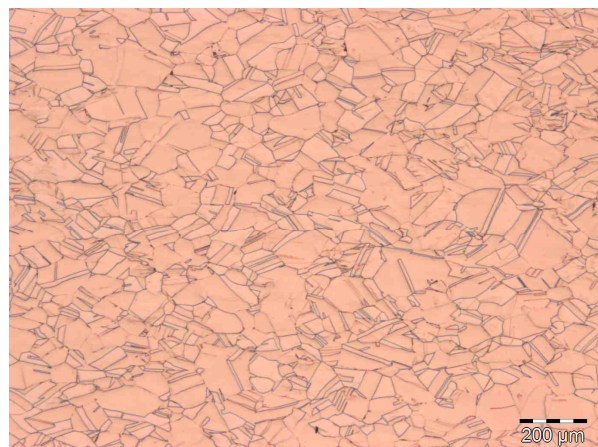
## Physical properties

At room temperature

|                                  |                    |                     |
|----------------------------------|--------------------|---------------------|
| Density                          | 8.8                | g/cm <sup>3</sup>   |
| Electrical conductivity          | ≥ 17 (hardened)    | MS/m                |
|                                  | ≥ 29.3 (hardened)  | % I.A.C.S           |
| Heat conductivity                | 150-250 (hardened) | W/(m*K)             |
| Heat capacity                    | 377                | J/(kg*K)            |
| Coefficient of thermal expansion | 17                 | 10 <sup>-6</sup> /K |
| Young's modulus                  | 140-155 (hardened) | GPa                 |
| Melting range                    | 1040-1060          | °C                  |

## Microstructures

CuNi2Si provides a homogeneous microstructure with a matrix of  $\alpha$ -brass. In solution treated condition the matrix is oversaturated with Ni and Si. After hardening at elevated temperatures fine Ni-silicides are present.





## Consignment and measurements

### Strength conditions

| Spec./<br>DIN EN                      | Condition | Yield strength<br>R <sub>p0.2</sub> [MPa] | Tensile<br>strength R <sub>m</sub><br>[MPa] | Elongation<br>A [%] | Brinell-<br>Hardness<br>HBW 2.5/62.5 |
|---------------------------------------|-----------|---|---|---------------------|--------------------------------------|
| 12163/12165/<br>12167/12420/<br>12449 | M         | **  | **  | **                  | **                                   |
| 12449                                 | R260      | ≥60                                       | ≥260  | ≥30                 | /                                    |
| 12449                                 | R380      | ≥260                                      | ≥380  | ≥6                  | /                                    |
| 12449                                 | R460      | ≥300                                      | ≥460  | ≥12                 | /                                    |
| 12163/12167                           | R550      | ≥430                                      | ≥550  | ≥15                 | /                                    |
| 12163/12167                           | R600      | ≥520                                      | ≥600  | ≥10                 | /                                    |
| 12449                                 |           | ≥480                                      | ≥600  | ≥8                  | /                                    |
| 12163                                 | R640      | ≥590                                      | ≥640  | ≥10                 | /                                    |
| 12167                                 |           | ≥590                                      | ≥640  | ≥8                  | /                                    |
| 12165                                 | H060      | /   | /   | /                   | 60-220                               |
| 12449                                 | H065      | /   | /   | /                   | 60-80                                |
| 12449                                 | H130      | /   | /   | /                   | 120-160                              |
| 12420                                 | H140      | (≥320)                                    | (≥470)                                      | (≥12)               | ≥140                                 |
| 12163/12167                           | H150      | /   | /   | /                   | 150-190                              |
| 12420                                 |           | (≥340)                                    | (≥490)                                      | (≥12)               | ≥150                                 |
| 12449                                 |           | /   | /   | /                   | 140-180                              |
| 12163/12167                           | H165      | /   | /   | /                   | 165-210                              |
| 12163/12167                           | H180      | /   | /   | /                   | 180-230                              |
| 12449                                 | H190      | /   | /   | /                   | ≥180                                 |

DIN EN 12163:  
Bars, general purpose

DIN EN 12165:  
Pre-material for forgings

DIN EN 12167:  
Profiles, rectangular bars

DIN EN 12420:  
Forgings

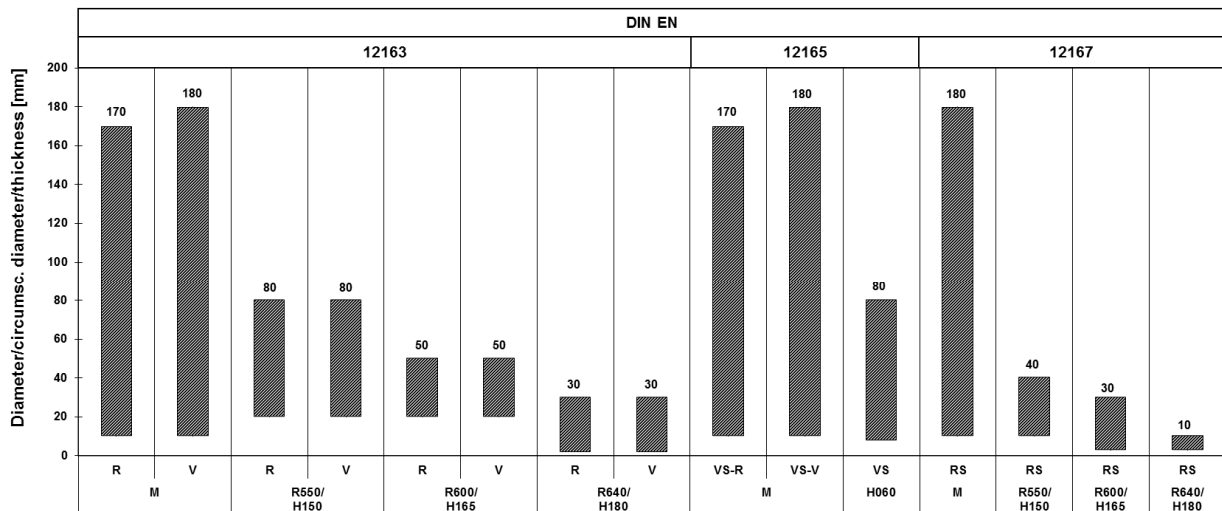
DIN EN 12449:  
Seamless tubes

\*\* Condition M = without specified properties - as manufactured

/ No requirements in standard or not applicable

( ) The numbers are not requirements of the standard - they are for information only

### Specified dimensions for bars, pre-material for forging and forgings



Condition and product

R/V Rod/polygonal bar

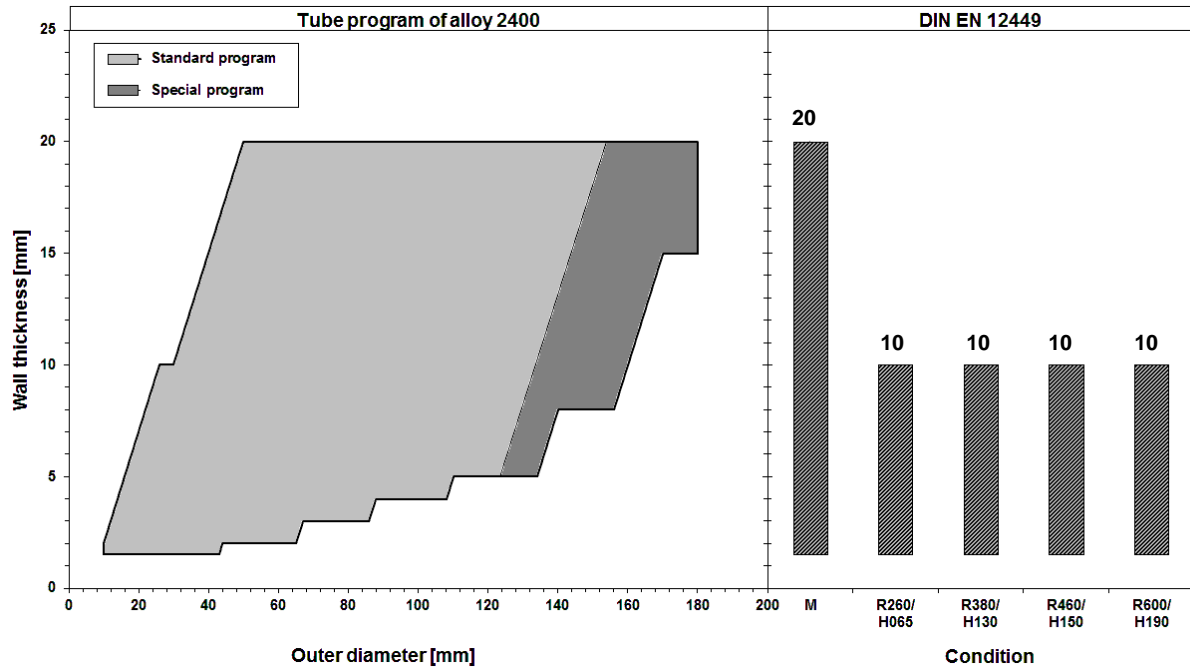
VS-R/V Pre-material for forging round/polygonal

RS Rectangular bar

Profiles and rectangular bars can be delivered up to 180 mm in extruded and up to 130 mm in cold drawn condition. Pre-material for forging and forgings is dependent upon each individual case.



## Specified dimensions for hollow bars and round tubes



Further dimensions for hollow bars and round tubes are available on request.

## Other consignments

Rods and tubes in other strength and hardness conditions, and dimensions are available on request.

| Processing                                   |           | Heat treatment  |           |
|--|-----------|---|-----------|
| Shaping                                      |           | Solution annealing  | 750-850°C |
| Machinability (hardened)<br>(CuZn39Pb3=100%) | poor (30) | Soft annealing  | 650-725°C |
| Cold working<br>(solution treated)           | good      | Hardening   | 425-490°C |
| Hot working                                  | good      | <b>Special notes and remarks</b>  |           |
| Hot working temperature                      | 800-950°C | CuNi2Si provides good corrosion resistance in natural environment. Under atmospheric conditions CuNi2Si forms a protective oxide layer having a dark colouring. |           |
| Connecting                                   |           | CuNi2Si in fully hardened condition has a reasonable persistence against stress corrosion cracking (SCC, in particular ammoniac atmosphere).                    |           |
| Resistance welding                           | good      | There is a risk of corrosion cracking (SCC) in the presence of oxidising acids or wet sulphur.  |           |
| Shielded welding                             | average   |   |           |
| Brazing                                      | average   |   |           |
| Soldering                                    | good      |   |           |
| Surface treatment                            |           |   |           |
| Mechanical polishing                         | good      |   |           |
| Electrolytic polishing                       | good      |   |           |
| Galvanisation                                | good      |   |           |
| Tin coating                                  | good      |   |           |

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