Carl Schreiber GmbH
Neunkirchen

Molds for Continuous Casting
Long term experience and state of the art production enable CSN to offer all types of molds for slab, bloom and beam blank casters.
CSN can offer any required alloy; rolled or forged.

• Common and exotic Mold alloys
  - Work hardening alloys (CuAg)
  - Precipitation hardening alloys
    - CuCrZr
    - CuNiBe
    - CuCoNiBe
• Hot and cold rolling
• Forging
• Heat treatment
  - Solution annealing
  - Precipitation (age) hardening
  - Stress relieving
CSN can provide the best alloy for each application.

### Desired Properties

- High thermal conductivity
- High strength and hardness
  - Wear resistance
  - Creep resistance
  - Fatigue resistance
  - Cracking resistance
- High softening temperature (Maintaining desired properties at high temperatures)

### Brief Comparison

<table>
<thead>
<tr>
<th>Material</th>
<th>Thermal Conductivity</th>
<th>Strength/Hardness</th>
<th>Softening Temperature</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>CuAg</td>
<td>Very High</td>
<td>Medium</td>
<td>Medium</td>
<td>Low</td>
</tr>
<tr>
<td>CuCrZr</td>
<td>High</td>
<td>High</td>
<td>Very High</td>
<td>Medium</td>
</tr>
<tr>
<td>CuNiBe</td>
<td>Medium</td>
<td>Very High</td>
<td>Very High</td>
<td>High</td>
</tr>
<tr>
<td>DHP Cu</td>
<td>High</td>
<td>Medium</td>
<td>Medium</td>
<td>Very Low</td>
</tr>
</tbody>
</table>
CSN offers machining to the most demanding specifications.

- State of the art milling, drilling, …
- CNC machines (4-/5-axis) capable of producing any required shape
- Quality assured by latest measurement systems (e.g. 5-axis CMM)
Coating prolongs mold life.

- Main reasons for coating:
  - Prolonging Mold life (better wear resistance)
  - Improving slab quality (avoiding star cracks)
- Side effects of coating:
  - Reduced heat transfer (approx. 1.5%/mm Ni)
  - Higher wall temperatures (approx. 15°C/mm Ni)
Coating is designed according to specific customer requirements.

### Comparison of selected Coating Materials

<table>
<thead>
<tr>
<th>Material</th>
<th>Thermal Conductivity</th>
<th>Hardness (Virgin)</th>
<th>Britteness</th>
<th>Lifetime</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ni</td>
<td>High</td>
<td>Medium</td>
<td>Low</td>
<td>Medium</td>
<td>Low</td>
</tr>
<tr>
<td>NiCo</td>
<td>High</td>
<td>High(^1)</td>
<td>Low</td>
<td>High</td>
<td>High</td>
</tr>
<tr>
<td>NiCo special</td>
<td>High</td>
<td>High(^1)</td>
<td>Low</td>
<td>High</td>
<td>High</td>
</tr>
<tr>
<td>Cr</td>
<td>Medium</td>
<td>Very High</td>
<td>High</td>
<td>Very High(^2)</td>
<td>High</td>
</tr>
<tr>
<td>Ceramic</td>
<td>Medium</td>
<td>Extremely High</td>
<td>Very High</td>
<td>Very High</td>
<td>Very High</td>
</tr>
<tr>
<td>Uncoated</td>
<td>Extremely High</td>
<td>Low</td>
<td>Extremely Low</td>
<td>Low</td>
<td>-</td>
</tr>
</tbody>
</table>

1) Alloys maintain hardness through many heats
2) Thin layer used to preserve against initial wear during start-up
CSN offers multiple coating materials and shapes.

<table>
<thead>
<tr>
<th></th>
<th>Single-Layer</th>
<th>Multi-layer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Straight</td>
<td><img src="image1.png" alt="Image" /></td>
<td><img src="image2.png" alt="Image" /></td>
</tr>
<tr>
<td>Tapered</td>
<td><img src="image3.png" alt="Image" /></td>
<td><img src="image4.png" alt="Image" /></td>
</tr>
<tr>
<td>Step</td>
<td><img src="image5.png" alt="Image" /></td>
<td><img src="image6.png" alt="Image" /></td>
</tr>
</tbody>
</table>

- **Copper Plate**
- **Nickel/Nickel alloys**
- **Chrome**
- **Ceramics**
CSN mold plates are used by major steel mills all over the world.

<table>
<thead>
<tr>
<th>OEMs/ Maintenance Companies</th>
<th>Steel Plants</th>
<th></th>
<th>Americas</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>EMEA</td>
<td>Asia</td>
<td></td>
</tr>
<tr>
<td>• SMS-Siemag (D)</td>
<td>ArcelorMittal (F, BE,</td>
<td>Tata Steel (IN)</td>
<td>ArcelorMittal (KZ)</td>
</tr>
<tr>
<td>• Siemens VAI (A, D, UK, F)</td>
<td>ROM)</td>
<td>Bhushan (IN)</td>
<td>DOFASCO (CAN)</td>
</tr>
<tr>
<td>• Danieli (I)</td>
<td>TATA Corus (NL, UK)</td>
<td>Essar Steel (IN)</td>
<td>ESSAR Steel Algoma</td>
</tr>
<tr>
<td>• Comcast (CH)</td>
<td>Voest-Alpine Stahl (A)</td>
<td>Bhilai (IN)</td>
<td>(CAN)</td>
</tr>
<tr>
<td>• SMS-Millcraft (USA)</td>
<td>SSAB (S)</td>
<td>JSL (IN)</td>
<td>Nucor Corp (USA)</td>
</tr>
<tr>
<td>• Hertwich (A)</td>
<td>Erdemir (TK)</td>
<td>JSPL (IN)</td>
<td>Nucor Yamato (USA)</td>
</tr>
<tr>
<td>• Ormeto Yumz (RUS)</td>
<td>US Steel (SK)</td>
<td>JSW (IN)</td>
<td>Gallatin Steel (USA)</td>
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<tr>
<td>• Metaprom (RUS)</td>
<td>Rautaruukki (SF)</td>
<td>ISPAT Dolvi (IN)</td>
<td>AK Steel (USA)</td>
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<tr>
<td>•</td>
<td>Columbus (RSA)</td>
<td>Visakhapatnam (IN)</td>
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<td>Hadeed (KSA)</td>
<td>China Steel (TW)</td>
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<td>Dragon Steel (TW)</td>
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<td>Severstal (RUS)</td>
<td>Baoshan (CN)</td>
<td>AHMSA (MEX)</td>
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<td>Azovstal (UKR)</td>
<td>Maanshan (CN)</td>
<td>Hylsa (MEX)</td>
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<tr>
<td>•</td>
<td>NKMZ (UKR)</td>
<td></td>
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<td>•</td>
<td>...</td>
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<td></td>
</tr>
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CSN has supplied hundreds of molds for billets and beam blanks.
CSN supports the entire life cycle of mold plates.

- **Original equipment or replacement**
  - New Plates
  - Revamped plates
  - Used plates
  - Worn plates

**Usage**
- of mold plates in steel plant

- **Manufacturing of mold plates**
- **Revamping of mold plates**
- **Recycling of mold plates**

**Removing (Machining) of used coating**
- Nickel chips
- Copper chips

**Coating**
- Preparation
- Galvanic Coating

**Finishing**
- Nickel pellets
- Nickel chips

CSN
CSN offers technical assistance as well as mold plates tailored to your specific needs.

**How can we optimize the lifetime of your molds?**

*Parameters to be considered*

- Chemistry of cast steel
- Mold flux
- Casting speed
- Mold taper
- Wall thickness
- Cooling conditions (water quality, flow rate, velocity)
- Adjustment of strand guide
- Adjustment of oscillating unit
- Width changes
- ...

Therefore, we have to carefully look at each individual case for fine tuning.
Please contact us for an offer!

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