With BALINIT and BALITHERM, efficiency and productivity are in top form

Optimal wear protection solutions for your punching and forming tools
Upgrade your tools to a new quality level – with BALINIT and BALITHERM

In production, stamping and forming tools are exposed to extreme forces and, consequently, subject to wear. You can minimise the wear of your tools, however, with BALINIT® hard coatings and BALITHERM® plasma-diffusion treatment by Oerlikon Balzers. As a global technology leader in surface solutions, we can offer you significant advantages with our coating solutions and diffusion processes that will boost the efficiency, cost-effectiveness, and ecological soundness of your applications.

**Extreme coating hardness**
- Protection against abrasive wear
- No dimensional changes of functional surfaces

**Low coefficient of friction, high thermal stability**
- Prevention of adhesive wear
- No cold welding
- No heat checking
- Reduced lubricant consumption

**High wear resistance, very good sliding properties**
- Improved forming
- Greater dimensional accuracy across longer runs
- Fewer drawing passes

**Improved surface and cut quality**
- No micro-welding, scoring, and rough sheared edges
- Better dimensional stability despite tighter manufacturing tolerances

**Lower tool costs due to extended service life**

**Improved ecological footprint due to environmentally friendly reduced lubricant use**

**Reduced production costs due to less machine downtime and higher cycle frequencies**

**Perceptibly less aftermachining due to higher workpiece quality**

BALINIT® and BALITHERM® for punching and forming: Greater productivity, efficiency, and process reliability with an optimised ecobalance.
Save up to 86% of costs in production

When forming stainless steel, untreated tools quickly approach their limits. The series production of heat shields, for instance, will stop at about 2000 produced parts due to cracks in the tool surface. However, with BALINIT® ALCRONA PRO and BALINIT® C, you can extend the life of the forming tool as much as tenfold, which saves up to 86% of costs.

<table>
<thead>
<tr>
<th>Production of Heat shields</th>
<th>Untreated</th>
<th>BALINIT® ALCRONA PRO</th>
<th>BALINIT® C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tool costs (EUR)</td>
<td>10,000</td>
<td>11,080</td>
<td></td>
</tr>
<tr>
<td>Tool life (Number of formed parts)</td>
<td>2,000</td>
<td>20,000</td>
<td></td>
</tr>
<tr>
<td>Tool cost per produced part (EUR)</td>
<td>5.00</td>
<td>0.55</td>
<td>0.20</td>
</tr>
<tr>
<td>Production per minute (No. of parts per min.)</td>
<td>20</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td>Production costs per minute (EUR/min.)</td>
<td>4</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>Production costs per part (EUR)</td>
<td>0.20</td>
<td>0.20</td>
<td>0.00</td>
</tr>
<tr>
<td>Costs of machinery downtime</td>
<td>0.02</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Subsequent machining costs (EUR)</td>
<td>0.02</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Extra cost per part (EUR)</td>
<td>0.04</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Total production costs per part (EUR)</td>
<td>5.24</td>
<td>0.75</td>
<td>86% cost savings</td>
</tr>
</tbody>
</table>

The bars merely illustrate the correlations among the individual cost factors and do not relate directly to the bottom-line sum.
**Rely on outstanding performance**

**BALINIT® FORMERA**
Deep drawing of automotive structural part

**Tool**
Draw die segment DIN 1.2379 (~ AISI D2)

**Workpiece**
Longitudinal beam UHSS (960 MPa) Tailor welded blanks 1.6 mm + 2 mm

**Challenge**
Short tool life due to wear Large reject rate after 100,000 strokes with CVD coated die

**Benefit:**
- Tool life significantly improved
- Cleaning intervals and effort reduced

**Graph:**
- No. of parts [pcs]
  - 0
  - 5,000
  - 10,000
  - 15,000
  - 20,000
  - 25,000
  - 30,000

**BALINIT® ALCRONA PRO**
Fineblanking of refrigerator hinge

**Tool**
Fine Blanking die HSS

**Workpiece**
Refrigerator hinge SCP1 - Cold rolled carbon steel 4.5 mm

**Challenge**
Tool life not satisfying

**Solution:**
- Tool life increased by 140% - Product quality improved

**Graph:**
- No. of parts [pcs]
  - 0
  - 200
  - 400
  - 600
  - 800
  - 1,000
  - 1,200

**BALINIT® TRITON STAR**
Aluminium trimming and flanging

**Tool**
Trimming and flanging steels DIN 1.2333 / DIN 1.2358

**Workpiece**
Fender / bonnet / door / trunk lid AlMg and AlMgSi alloys

**Challenge**
Aluminium sticking and high scrap rate

**Solution:**
- Aluminium sticking and scrap rate significantly decreased
- Maintenance time per shift cut to one third

**Graph:**
- Maintenance time/shift [min]
  - 0
  - 20
  - 40
  - 60
  - 80
  - 100
  - 120
  - 140
  - 160
  - 180
  - 200
Coating properties at a glance

<table>
<thead>
<tr>
<th>Coating material</th>
<th>BALINIT® ALCRONA PRO</th>
<th>BALINIT® FORMERA</th>
<th>BALINIT® FUTURA NANO</th>
<th>BALINIT® LUMENA</th>
<th>BALINIT® B</th>
<th>BALINIT® C</th>
<th>BALINIT® D</th>
<th>BALINIT® TRITON</th>
<th>BALINIT® HARD CARBON</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coating hardness $H_{TV}$ [GPa]</td>
<td>36 +/- 3</td>
<td>28 +/- 2</td>
<td>33 +/- 3</td>
<td>33 +/- 3</td>
<td>37 +/- 3</td>
<td>12 - 15</td>
<td>18 +/- 3</td>
<td>-15 - 25</td>
<td>40 - 50</td>
</tr>
<tr>
<td>Coefficient of friction (dry) vs. steel</td>
<td>0.35</td>
<td>0.35</td>
<td>0.3 - 0.35</td>
<td>0.3 - 0.35</td>
<td>0.4</td>
<td>0.1 - 0.2</td>
<td>-0.5</td>
<td>0.1 - 0.2</td>
<td>&lt; 0.15</td>
</tr>
<tr>
<td>Typical coating thickness [µm]</td>
<td>2 - 6</td>
<td>6 - 12</td>
<td>3 - 4</td>
<td>8 - 12</td>
<td>2 - 4</td>
<td>1 - 4</td>
<td>2 - 4</td>
<td>1 - 3</td>
<td>0.5 - 3</td>
</tr>
<tr>
<td>Intrinsic stress [GPa]</td>
<td>-3 +/- 1</td>
<td>-2 +/- 0.5</td>
<td>-2 +/- 1</td>
<td>-2 +/- 1</td>
<td>-3 +/- 1</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Max. service temp. (°C)</td>
<td>1,100</td>
<td>900+</td>
<td>900</td>
<td>900</td>
<td>400</td>
<td>300</td>
<td>700</td>
<td>300</td>
<td>500</td>
</tr>
<tr>
<td>Coating temp. (°C)</td>
<td>&lt; 500</td>
<td>480</td>
<td>200 - 450</td>
<td>450</td>
<td>450</td>
<td>&lt; 250</td>
<td>200 - 450</td>
<td>&lt; 250</td>
<td>&lt; 150</td>
</tr>
<tr>
<td>Coating colour</td>
<td>bright grey</td>
<td>silver-light grey</td>
<td>violet-grey</td>
<td>violet-grey</td>
<td>blue-grey</td>
<td>anthracite</td>
<td>silver-grey</td>
<td>black</td>
<td>black</td>
</tr>
<tr>
<td>Coating structure</td>
<td>monolayer</td>
<td>multilayer</td>
<td>nanolayer</td>
<td>nanolayer</td>
<td>multilayer</td>
<td>nanolayer</td>
<td>monolayer</td>
<td>monolayer</td>
<td>monolayer</td>
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<tr>
<td>Available as STAR version*</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Available in BALINIT® DUPLEX Series**</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
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<tr>
<td>Available in BALINIT® ADVANCED Series***</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
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</tr>
</tbody>
</table>

* The STAR version delivers better load-bearing capabilities.
** The DUPLEX Series includes a nitriding process with the possibility of higher nitriding depths.
*** The ADVANCED Series includes a one step in process diffusion.

All given data are approximate values, they depend on application, environment and test condition.

Application recommendations

<table>
<thead>
<tr>
<th>DRAWING</th>
<th>FLERRING</th>
<th>HOT FORMING</th>
<th>CAST IRON TOOLING</th>
<th>PIERRING / TRIMMING</th>
<th>FINE BLANKING</th>
</tr>
</thead>
<tbody>
<tr>
<td>Forming Flanging Punching</td>
<td>Cold / Hot Forging</td>
<td>Hot Forming</td>
<td>Cast Iron Tooling</td>
<td>Piercing / Trimming</td>
<td>Fine blanking</td>
</tr>
<tr>
<td>Non-alloyed steel</td>
<td>FN / LU</td>
<td>LU / AP</td>
<td>Δ</td>
<td>PPD</td>
<td>FN / AP</td>
</tr>
<tr>
<td>Steel &lt; 250 Mpa</td>
<td>LU</td>
<td></td>
<td>Δ</td>
<td>PPD</td>
<td>AP / B</td>
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<tr>
<td>Steel &lt; 400 Mpa</td>
<td>FO / LU</td>
<td></td>
<td>Δ</td>
<td>PPD</td>
<td>FN / AP</td>
</tr>
<tr>
<td>Steel &gt; 400 Mpa</td>
<td>FO</td>
<td></td>
<td>Δ</td>
<td>PPD</td>
<td>FN / AP</td>
</tr>
<tr>
<td>Aluminium*</td>
<td>T Star / HC</td>
<td>AP</td>
<td>Δ</td>
<td>PPD</td>
<td>T / HC</td>
</tr>
<tr>
<td>Stainless steels*</td>
<td>FO / AP</td>
<td>FO / AP</td>
<td></td>
<td>PPD</td>
<td>AP / B</td>
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<tr>
<td>Titanium alloys</td>
<td>LU</td>
<td>LU</td>
<td></td>
<td>PPD</td>
<td>FN</td>
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<tr>
<td>Brass, bronze*</td>
<td>FN / AP</td>
<td>AP</td>
<td></td>
<td>PPD</td>
<td>FN / AP</td>
</tr>
<tr>
<td>Copper</td>
<td>T Star / D</td>
<td>AP</td>
<td></td>
<td>PPD</td>
<td>AP / D</td>
</tr>
</tbody>
</table>

* Additional layer of BALINIT® C can aid with release and sticking of these materials.
The decisive advantage for more efficiency: BALITHERM PPD for large stamping dies

Our future-oriented plasma-based diffusion process PPD (Pulsed-Plasma Diffusion) is applied in our INAURA systems. They provide a loading capacity of 10 x 3 metres and 40 tonnes. The fully automated process ensures a stable and controlled wear-protection coating procedure. The combination of hydrogen, nitrogen and electricity means that INAURA operates entirely without the use of poisonous gases and chemicals.

Benefit from optimised wear-protection solutions for punching and forming tools. Contact us now!