# COATING SELECTION GUIDE

PVD - voestalpine eifeler Coatings - Properties and Applications

<table>
<thead>
<tr>
<th>Coating Material</th>
<th>TiN</th>
<th>TiCN</th>
<th>ZrN</th>
<th>CrN</th>
<th>EXTRAL® plus</th>
<th>EXTRAL® blue</th>
<th>CROSAL® -plus</th>
</tr>
</thead>
<tbody>
<tr>
<td>TiN</td>
<td>Titanium Nitride</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TiCN (ML)</td>
<td>Titanium Carbo-Nitride</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ZrN</td>
<td>Zirconium Nitride</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CrN</td>
<td>Chromium Nitride</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ATIN (stacked)</td>
<td>Aluminum Titanium Nitride</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ATIN (nanostructured)</td>
<td>Aluminum Chromium Nitride</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Color of the Coating</td>
<td>gold</td>
<td>blue gray</td>
<td>pale yellow</td>
<td>silver-gray</td>
<td>anthracite</td>
<td>blue-violet</td>
<td>slate-gray</td>
</tr>
<tr>
<td>Microhardness HV&lt;sub&gt;0.05&lt;/sub&gt;</td>
<td>2300±300</td>
<td>3500±500</td>
<td>3500±300</td>
<td>5300±100</td>
<td>3500±500</td>
<td>3200±500</td>
<td></td>
</tr>
<tr>
<td>Friction Coefficient Against Steel (Dry)</td>
<td>0.6</td>
<td>0.2</td>
<td>0.5</td>
<td>0.3 - 0.4</td>
<td>0.7</td>
<td>0.7</td>
<td>0.45</td>
</tr>
<tr>
<td>Thermal Threshold °C/F</td>
<td>500°C/900°F</td>
<td>400°C/750°F</td>
<td>600°C/1100°F</td>
<td>600°C/1100°F</td>
<td>800°C/1470°F</td>
<td>900°C/1650°F</td>
<td>1100°C/2012°F</td>
</tr>
<tr>
<td>Key Characteristics</td>
<td>standard, all-purpose coating</td>
<td>high hardness, excellent abrasive wear resistance, enhanced toughness</td>
<td>decorative color, good wear and corrosion resistance</td>
<td>low stress/good adhesion, high toughness and corrosion resistance</td>
<td>high hardness, very good oxidation resistance</td>
<td>extreme wear resistance at high temperature, excellent oxidation resistance</td>
<td>extreme high hardness, high oxidation resistance and high adhesive strength</td>
</tr>
<tr>
<td>Key Applications</td>
<td>Cutting/Punching/Forming/Medical</td>
<td>Cutting/Punching/Forming/Medical</td>
<td>Cutting/Punching/Forming/Medical</td>
<td>Forming</td>
<td>Cutting</td>
<td>Cutting</td>
<td>Cutting/Punching/Forming</td>
</tr>
<tr>
<td>Ultratine Duplex</td>
<td>ultratine Available</td>
<td>ultratine Available</td>
<td>Biocompatible</td>
<td>Biocompatible</td>
<td>Duplex Available</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Biocompatible</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Primary Applications</td>
<td>Machining/cutting of iron based materials</td>
<td>Machining of difficult-to-machine alloy steels</td>
<td>High performance cutting where moderate temperatures are generated at the cutting edge</td>
<td>Excellent for metal forming (stainless steel)</td>
<td>Machining of aluminium and generally non-ferrous materials machining</td>
<td>Machining of fiberglass, nylon and most polymer materials</td>
<td>Machining and forming</td>
</tr>
</tbody>
</table>

1) depends on size of tools, for micro tools also smaller thicknesses necessary.

Other application specific coatings available upon request. For further information and contact details please check our website: www.eifeler.com/northamerica

This information is based upon our present state of knowledge and is intended to provide general notes on products and their uses. It should not, therefore, be construed as a warranty of specific properties of the products described, or, as a warranty of suitability for a particular purpose. Rev_5 March 27/2020.
**ADDITIONAL COATING SERVICES**

voestalpine eifeler Coatings can service all coating requirements from new tooling programs to the refurbishment and recoating of existing tools. Our capabilities include:

- Mechanical and Chemical Coating Removal
- Polishing
- Micro-Blasting
- PVD Coating of Small to Large Tooling
- Pick-up and delivery

<table>
<thead>
<tr>
<th>SISTRAL®</th>
<th>TIGRAL®</th>
<th>VARIANTA®</th>
<th>VARIANTIC®</th>
<th>VARIANTIC®-1000</th>
<th>MOLDADUR®-P</th>
<th>DLC: SUGASLIDE®</th>
<th>DLC: CARBON-X®</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aluminum Titanium Nitride (with additives)</td>
<td>Aluminum Chromium Titanium Nitride</td>
<td>Titanium Aluminium TiAlN (nanostructured)</td>
<td>Titanium Aluminium Carbo-Nitride</td>
<td>Titanium Aluminium Carbo-Nitride</td>
<td>Special Plasma Coating</td>
<td>DLC Coating</td>
<td>a-C: H Based DLC Coating</td>
</tr>
<tr>
<td>AITiN</td>
<td>AICrTiN</td>
<td>TiAIN (ML)</td>
<td>TiAlCN (ML)</td>
<td></td>
<td></td>
<td>a-C:Cr</td>
<td>a-C:Cr</td>
</tr>
<tr>
<td>3500±500</td>
<td>3300±500</td>
<td>3500±500</td>
<td>4000±200 HV</td>
<td>4000±200 HV</td>
<td>1800±200</td>
<td>2400±400</td>
<td></td>
</tr>
<tr>
<td>0.7</td>
<td>0.6</td>
<td>0.7</td>
<td>0.2</td>
<td>0.2</td>
<td>0.05-0.10</td>
<td>0.05-0.15</td>
<td></td>
</tr>
<tr>
<td>1-3</td>
<td>3-5</td>
<td>2-4</td>
<td>2-4</td>
<td>approx. 9-11 μm</td>
<td>approx. 9 μm</td>
<td>1.5-2</td>
<td>1.5-2.5</td>
</tr>
<tr>
<td>Anthracite</td>
<td>Anthracite</td>
<td>Old rose</td>
<td>Dark reddish gold</td>
<td>Pink</td>
<td>Black</td>
<td>Dark gray</td>
<td></td>
</tr>
<tr>
<td>extreme wear resistance at high temperature, excellent oxidation resistance</td>
<td>high oxidation resistance, high protection against abrasive wear</td>
<td>high hardness, very good oxidation resistance</td>
<td>low friction, high oxidation resistance</td>
<td>low friction, thick high layer adhesion and excellent protection against abrasive wear</td>
<td>high layer adhesion and excellent protection against abrasive wear</td>
<td>good adhesive strength, very hard, low friction coefficient, very dense and smooth coating structure. Biocompatible</td>
<td>outstanding wear resistance due to high hardness, low friction and reduced sticking of workpiece material, enhanced tool performance and longer lifetime</td>
</tr>
<tr>
<td>Cutting, Punching, Forming</td>
<td>Cutting, Forming</td>
<td>Cutting, Forming/Forming</td>
<td>Cutting, Forming/Forming</td>
<td>Stamping and forming</td>
<td>Plastic Injection</td>
<td>Cutting and forming tools, injection moulds, precision components, motor and gear parts, paper knives, industrial blades, components of food-, vacuum- and cooling technology</td>
<td>Cutting of non-ferrous metals, blanking/piercing of non-ferrous metals, cold work, injection molding tools, components</td>
</tr>
<tr>
<td>ultratine Available</td>
<td>Duplex Available</td>
<td>Biocompatible</td>
<td>Duplex Available</td>
<td>Duplex Available</td>
<td>Biocompatible</td>
<td>N/A</td>
<td>N/A</td>
</tr>
</tbody>
</table>

- excellent choice for cutting under extreme conditions (hard, abrasive materials, high speed, dry cutting)
- machining under dry conditions
- hot forming sheet metals
- die casting
- coating for a wide range of carbide, cement and high speed steel tooling
- machining of cast iron and nickel based high temperature alloys
- High speed operations, semi dry or dry machining
- drawing, pressing and forming tools for the working of high-strength steels
- HSLA material for deep draw
- suit for low-tempered steels, tools and precision components
- applications where high abrasive wear occurs and softer tribological coatings reach their limits.
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