Coating Technology

Hard material coatings

PVD - coatings
PACVD - coatings
**PVD**

(Physical Vapour Deposition)

is the physical deposition of thin layers through the vapour phase. This process creates coatings with a high proportion of covalent bonds of the layer atoms.

**PACVD**

(Plasma Assisted Chemical Vapour Deposition)

method is a further development of the CVD technique and combines the benefits of the PVD and the CVD methods. In the PACVD process, a physical vapour deposition takes place by a chemical reaction through the gas phase at temperatures below 180°C with specific plasma assistance.

PVD coating of high-precision tools and high-quality components increases properties such as hardness and thermal and chemical stability. At the same time, properties such as friction coefficient, cold welding tendency, bonding and adhesive tendency, corrosion tendency and oxidation tendency are significantly lowered.

Our **H-O-T** high-tech coatings have been used in all sectors of industry since 1988.

We have satisfied customers in the

- Automotive industry
- Medical technology
- Aerospace industry
- Electrical industry
- Textile industry
- Machine-building industry
- Tool industry
Our **PVD coatings** offer the following benefits in plastics technology:

- High level of wear protection of structured tools, also protection against damage to polished surfaces
- Improved ejectability
- Faster filling => shorter cycle time
- Less cleaning effort through reduced plastic coats on the mould
- Increased production reliability
- Improved surface finish of the plastic parts
- Reduced warping of plastic parts

We recommend the following coatings for your various plastic applications:

- **TiN** (Titanium nitride)  
  e.g. for polyamide
- **Cr₂N** (Chromium nitride)  
  e.g. for polysulphone
- **TiCN** (Titanium carbonitride)  
  e.g. for plastic masses with > 30 % glass fibre
- **TT⁺-DLC** (amorphous materials)  
  e.g. slides and ejectors
Forming and Punching

Our PVD coatings offer the following benefits in forming and punching technology:

- Low cold welding tendency
- Considerably longer tool life
- No adhesion and cold welding
- Optimized flow behaviour
- Clean cuts, thus reducing re-works of the components
- Reduced friction co-efficiency, thus lower punching and retraction forces

We recommend the following coatings for your various forming and punching applications:

- **CrN** (Chromium nitride) e.g. for copper alloys and aluminium alloys
- **TiN** (Titanium nitride) e.g. for unalloyed steels
- **TiCN** (Titanium carbonitride) e.g. for medium and high-alloy steels
- **Calida®F** (aluminium-chrome nitride) as an alternative to CVD coatings
For the use in chip removal our range of applications of PVD coatings show the following advantages:

- Considerably longer tool life
- No material accumulation on the cutting surface
- Temperature dissipation into the chips
- Higher cutting parameters
- Dry machining possible
- HSC machining possible

We recommend the following coatings for your cutting tools:

- **UniPlus® DC** (TiAlN)  
e.g. for dry work and high-speed machining operations
- **Calida® PD** (AlTiN)  
e.g. for drilling
- **Calida® T** (AlTiN)  
e.g. for heavy duty chip removal
- **UniCut®** (TiAlCN)  
e.g. for machining of titanium alloys

Hardening technology - Nitriding technology - Coating technology with HIGH-TECH KNOW-HOW in application system
We offer the much preferred application of TT*-WCC® and TT*-DLC coatings for tool making, mould and die production and aluminium chip removal.

**TT*-WCC®** is a wolfram-doped, amorphous, diamond-like carbon coating and shows itself to be quite different, particularly resulting in lower amounts of friction, and a good elastic behaviour throughout. As a result of the lower coating temperature (<180°C), also components with a low annealing temperature can be coated without the base material being affected.

**TT*-DLC** is a metal-free diamond-like carbon coating, with lower temperatures through the isolated PACVD-process. TT*-DLC is an ideal surface finishing for tribological heavy-duty components and tools due to the combination of high wear resistance and outstanding friction and non-stick properties.

<table>
<thead>
<tr>
<th>Coating system</th>
<th>Colour</th>
<th>Manufacturing process</th>
<th>Microhardness (HV 0.05)</th>
<th>Coefficient of friction on steel towards 100°C <em>R</em></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>TT</strong> - WCC®</td>
<td>black-grey</td>
<td>magnetron sputtering</td>
<td>1,500</td>
<td>0.20</td>
</tr>
<tr>
<td><strong>TT</strong> - DLC</td>
<td>black-grey</td>
<td>PACVD</td>
<td>2,000-3,500</td>
<td>&lt; 0.15</td>
</tr>
<tr>
<td>MoS - glide®</td>
<td>black-grey</td>
<td>magnetron sputtering</td>
<td>300</td>
<td>&lt; 0.05</td>
</tr>
</tbody>
</table>

* Measured with pin-on-disc tribometer (DIN 50324)

Test parameter: non-lubricated, T= 23 ± 1°C, r.F = 80 ± 5 % (steel against steel: \( \mu = 0.6-0.9 \))
We guarantee your success - not only through our daily achievements in hardening and surface technology, but also through our wide range of services:

- Pick-up service through our own \( H \cdot O \cdot T \) fleet
- State-of-the-art laboratory equipment
- Material analysis
- Structural analysis
- Hardness testing acc. to Rockwell, Vickers and Brinell
- Coating analysis
  - Coating thickness measurement through calotte grinding and X-ray fluorescence
  - Coating adhesion acc. to VDI guideline 3198
  - Micro hardness measurement
  - Roughness measurement

Appropriate are hardened tool steels or steels that have been plasma-nitrided by \( H \cdot O \cdot T \) with annealing temperatures above 500 °C, as well as hard metals. Please ensure that the tools have been given preliminary heat treatment suitable for coating in order to prevent changes in structure, in hardness and in dimensions. Coating processes below 200 °C are available on request.
### Hardening technology
- Vacuum hardening
- Induction hardening
- Controlled atmosphere hardening

### Nitriding technology
- Plasma-nitriding
- Gas-nitriding
  - in gas
  - in plasma

### Coating technology
- PVD/PACVD coating
- High-performance coating systems
- Tribological coating systems
  - UniTwin® - combination systems
- Oxidizing

### Service
- Laboratory (analyses, sample tests)
- Consulting (materials, layouts)
- Pick-up Service (with own feet)