BALINIT® coatings: designed for winners in motorsport
To the pole position with Oerlikon Balzers

BALINIT® high-performance coatings are the key to success. They provide optimised protection for highly stressed components in engines, powertrains, steering assemblies, or chassis against wear and scuffing. Friction losses are reduced to a minimum. The result: measurably improved power output and reliability! Even under extreme conditions, BALINIT®-coated components live substantially longer.

In the production of existing components or newly designed ones, Oerlikon Balzers high-precision coatings are applied as a final step, and the coated components are ready for use without further machining. A noteworthy design aspect is the use of BALINIT® coatings allowing more compact designs, tighter tolerances and the use of alternative alloys. Weight and fuel consumption are reduced, performance and dependability are enhanced!

BALINIT® high-performance coatings are applied in plasma-assisted processes under vacuum with an accuracy in the µm range. This advanced coating technology contributes to enhanced performance and lifetime at the highest competitive levels. Improvements with the coatings are often straightforward because often no significant design changes are necessary.

Powerful. Fast. Reliable. These are qualities you can always rely on when you work with Oerlikon Balzers. As the global market leader in the field of vacuum coating and a long-time partner of the motor sports industry, we can offer the decisive edge in know-how and support in motorsport surface technologies.

**BALINIT® improves longevity**

BALINIT® high-performance coatings are up to 5 times harder than hardened steel. They provide highly stressed components with excellent protection against wear and thus increase their service lives.

**BALINIT® improves performance**

The friction coefficient of the BALINIT® high-performance coatings is up to 8 times lower than that of steel. Heat generation in components and lubricants is reduced and power delivery is significantly enhanced.

### Friction coefficient

<table>
<thead>
<tr>
<th>Speed [rpm]</th>
<th>Power output [HP]</th>
<th>Torque [Nm]</th>
</tr>
</thead>
<tbody>
<tr>
<td>8,000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10,000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12,000</td>
<td></td>
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</tbody>
</table>

**BALINIT**-coated standard valvetrain and transmission components in a Kawasaki racing motorcycle improve performance and torque at lower speeds and smoothen power delivery characteristics across the entire speed range.

Tappets of a Kawasaki racing motorcycle. Left: Uncoated after approx. 250 km; heavy wear requires replacement. Right: BALINIT® DLC-coated after approx. 1,000 km; almost no wear, still in operation.
Whether the goal is boosting performance in motor sports or optimising standard automobile engines by tuning, Oerlikon Balzers offers solutions that lead to success.
As a partner of factory teams and private drivers, manufacturers, and suppliers, among others in Formula 1, IRL, DTM, NASCAR, rally or truck sports, motorcycle, motorcross, or motor boat sports. World-wide.
**BALINIT® high-performance coatings:**
The key to success

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**Valvetrain**
The valvetrain is one of the most highly stressed friction-pair assemblies. BALINIT® high-performance coatings reduce friction and wear. They resist the extremely high surface pressures as well as thrust and shear forces that occur across the entire engine speed range.

BALINIT®-coated components
- enable higher speeds
- increase engine performance
- reduce fuel consumption
- are more stress-resistant and attain substantially longer service lives

Applications: camshafts, tappets, cam followers, rocker arms, lifters, pushrods, shafts, gear wheels, and bearings.

**Valves**
Wear, deformation, and material deposits on valves and valve seats compromise fitting accuracy and flow behaviour and thus reduce engine performance.

BALINIT®-coated components
- prevent performance losses caused by wear-induced dimensional changes and deformation
- prevent hot-gas oxidation, improve flow behaviour, and enhance engine efficiency
- enable more slender and more stable designs because undercutting of the valve stem is no longer necessary

Applications: intake valves, exhaust valves, spring retainers, locks, lash caps.

**Piston assembly**
High speeds, high injection and combustion pressures, high temperatures, as well as demanding lubrication conditions expose the piston assembly to extreme loads.

BALINIT®-coated components
- live longer and operate more reliably—even when lubrication is reduced
- eliminate the need for bronze bushes and enable a lighter and stiffer design of the connecting rods
- exhibit greater thermal stability
- increase engine performance and reduce fuel consumption

Applications: wrist pins, piston rings, connecting rods, crank shafts.
**Powertrain**

Ever smaller transmissions are expected to transmit ever greater engine power. High torques and surface pressures, high operating temperatures, and adverse lubrication conditions quickly push drive components to their stress limits, especially in motor sports (risk of scuffing and pitting).

BALINIT®-coated components
- increase power-to-track by reducing friction losses
- reduce thermal loads and enable the use of lower-viscosity oils
- reduce fuel consumption
- support precise, faster gear shifting
- improve power delivery characteristics and handling
- enhance reliability

Applications: gear wheels, pinions, selector forks, sliding shafts, ball and roller bearings, housings, washer discs.

**An unlimited range of applications**

The full spectrum of advantages of BALINIT® high-performance coatings can also be harnessed for many other vehicle components whose functionality, performance, or design is influenced by friction and wear. Examples include hydraulic and pneumatic systems such as pumps and actuators, brakes, or structural parts such as link fittings and shock absorbers, to name only a few. But BALINIT® high-performance coatings are also high-quality style elements that set new and attractive colour accents.

Viewed as an overall system, BALINIT® high-performance coatings enable decisive enhancements in performance and reliability while saving costs and maintenance time. Even without any component design modifications, power delivery and responsiveness are perceptibly improved.

Winners rely on BALINIT® high-performance coatings!
The right coating for any requirement

BALINIT® high-performance coatings are only a few thousandths of a millimetre thin but harder than steel and extremely wear-resistant, and have exceptionally low friction coefficients. Edge sharpness and narrow manufacturing tolerances are not affected, the integrity of super finished surfaces remains intact.

The coating processes developed by Oerlikon Balzers guarantee highly adherent coatings that are always reproducible on the basis of defined compositions and specified properties. Standardised and documented analysis and test procedures assure that reliable and comparable data on the quality and operating behaviour of the coatings can be provided.

The coating portfolio of Oerlikon Balzers meets the most diverse requirements and stress situations to which motor-sports components are subjected. We respond to new challenges with customised developments.

BALINIT® high-performance coating features:
- greater performance
- smaller dimensions and less weight
- longer service life
- greater functional reliability
- exotic materials may be replaced by more conventional alloys
- less wear and friction under all lubrication conditions
- emergency running properties in case of starved lubrication
- reduced thermal loads
- components ready for use after coating without subsequent machining

BALINIT® high-performance coatings are applied in plasma-assisted processes under high vacuum at temperatures between 160 and 500 °C. Most steels and non-ferrous metals used in motorsports are amenable to coating without restriction. Note that the temperature of the last heat treatment must be greater than the coating temperature.

<table>
<thead>
<tr>
<th>Coating material</th>
<th>a-C:H:W</th>
<th>a-C:H</th>
<th>CrN</th>
<th>TiN</th>
<th>TiAlN</th>
<th>AlCrN</th>
</tr>
</thead>
<tbody>
<tr>
<td>Metal-containing carbon coating:</td>
<td>Tungsten diamond-like carbon (WC/C)</td>
<td>Diamond-like carbon (DLC)</td>
<td>Chromium nitride</td>
<td>Titanium nitride</td>
<td>Titanium aluminum nitride</td>
<td>Aluminium chromium nitride</td>
</tr>
<tr>
<td>Typical microhardness (HK 0.01)</td>
<td>&gt; 1,000</td>
<td>&gt; 2,000</td>
<td>1,750</td>
<td>2,300</td>
<td>3,300</td>
<td>3,200</td>
</tr>
<tr>
<td>Coefficient of friction against steel (dry)</td>
<td>0.1 - 0.2</td>
<td>0.1 - 0.2</td>
<td>0.5</td>
<td>0.4</td>
<td>(post-treated)</td>
<td>0.35</td>
</tr>
<tr>
<td>Typical coating thicknesses (µm)</td>
<td>1 - 4</td>
<td>0.5 - 3</td>
<td>1 - 4</td>
<td>1 - 4</td>
<td>1 - 4</td>
<td>1 - 4</td>
</tr>
<tr>
<td>Maximum service temperature (°C)</td>
<td>300</td>
<td>350</td>
<td>700</td>
<td>600</td>
<td>900</td>
<td>1,100</td>
</tr>
<tr>
<td>Coating colour</td>
<td>anthracite</td>
<td>black</td>
<td>silver-grey</td>
<td>gold-yellow</td>
<td>violet-grey</td>
<td>blue-grey</td>
</tr>
<tr>
<td>Key characteristics</td>
<td>Outstanding protection against scuffing and excellent running in behaviour</td>
<td>Maximum dry sliding wear capacity and abrasive wear resistance</td>
<td>High toughness and exceptional wear resistance with minor lubrication</td>
<td>High abrasion resistance and decorative function</td>
<td>High impact and wear resistance, high temperature resistance</td>
<td>Extreme impact and wear resistance, maximum temperature resistance</td>
</tr>
<tr>
<td>Primary applications</td>
<td>Gears, bearings, engine components, hydraulics</td>
<td>High loaded engine components, seals, sprockets, bearings</td>
<td>Engine components with thermal load, structural parts</td>
<td>Structural parts, fittings, pistons, hydraulics</td>
<td>Engine components with high thermal load, structural parts</td>
<td>Engine component subjected to high loads and high speeds</td>
</tr>
</tbody>
</table>

The diamond-like carbon coatings from Oerlikon Balzers (BALINIT® C and BALINIT® DLC) are also available as:Version STAR for maximum wear resistance under highest loads.

* depending on application and test conditions
We do everything for your success

Oerlikon Balzers is the world’s leading supplier of performance-enhancing high-tech coatings for precision components and machine tools. We have a global presence through a dense, dynamically growing network of more than 70 coating centres in all key industrial regions in Europe, America, and Asia. This guarantees fast turnaround times, efficient procedures, and competent advice by our experts.

Consistent quality and reliability are crucial requirements in motor sports. With Oerlikon Balzers, you can always count on the same equipment and processes being used at all locations. Standardised manufacturing processes and documented coating processes warrant for reproducible quality at the highest level and at any time – whether individual components or large batches are involved. And of course, all our coating facilities are certified. Moreover, you benefit immediately from the latest developments in surface and coating technology. If you involve us in the design phase, we can implement customised solutions even faster.

Discover Oerlikon Balzers as a competent, trustworthy partner who can achieve your objectives more quickly:
- technology innovator and global market leader in PVD and PACVD coatings
- many years of experience in motor sports
- coating technology, coating systems, and coatings are developed in-house
- customer-oriented coating service

with over 70 centres and about 2,000 employees in Europe, America, and Asia
- all coating centres are certified and comply with QA standards
- state-of-the-art analysis and test facilities
- application lab for the development of customised solutions

Oerlikon Balzers offers innovative solutions that take you further. Not only in motor sports. Our customers include leading manufacturers and suppliers in the automotive, aerospace, machine and tool industries as well as in many other sectors.

Oerlikon Balzers uses PVD (Physical Vapour Deposition) and PACVD (Plasma Assisted Chemical Vapour Deposition) processes to coat components.
We are at your service. World-wide.

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Rock Hill/SC, Wixom/MI,

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