

# Resist

With innovative PVD coating solutions for high-performance precision components



**General Engineering**



# Oerlikon Balzers' BALINIT coatings boost performance

Mechanical engineering components frequently operate under extreme conditions: high loads, high sliding speeds or poor lubricating conditions can lead to wear or excessive friction and thus reduced lifetime and/or efficiency.

Trust BALINIT® wear protective coatings from Oerlikon Balzers – a global technology leader in hard coatings. BALINIT® coatings provide a wide range of matchless advantages that push components to peak performance and unmatched reliability.



## Equipment for low-friction and wear resistant coatings with Oerlikon Balzers' RS50 coating system

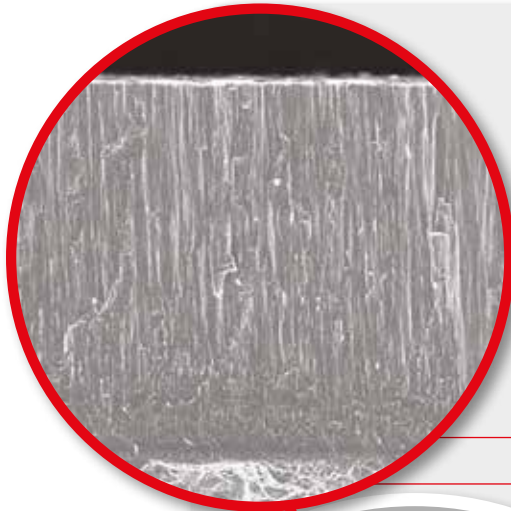


### BALINIT COATINGS

#### GOOD TO KNOW!

From planning, through installation and applications-specific training to your own production, you profit from the decades of our coating equipment experience.

# Highest level wear protection



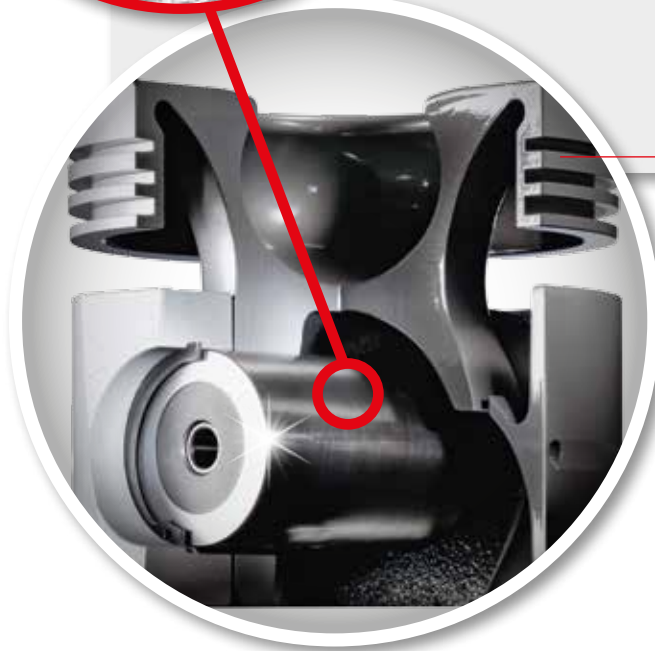
## BALINIT® for tribosystem

**Environment:** Lubricant, temperature, atmosphere

**Coating:** PVD and DLC coatings

**Surface:** Surface preparation

**Substrate:** Material advice



## Counterpart:

Surface recommendation

To find a proper solution, our Oerlikon Balzers surface engineers are starting with an analysis of the whole tribosystem: the parts and their materials, hardnesses and surface finish, the environment and wear mechanism.

The analysis results enable Balzers surface engineers to select the appropriate coatings. Experienced job coating centers apply well proven, standardized procedures which are moreover ISO, and in many cases also QS 9000 or NADCAP certified. Sophisticated after-test analyses complete the solution.



## Oerlikon Surface Solutions

Oerlikon Balzers not only offers PVD- and DLC thin coatings, but also special nitriding solutions. Oerlikon Balzers has e.g. the worlds largest plasma nitriding equipment for parts up to 40 t weight, 10 m in length and 3 m in diameter.

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balzers**

Oerlikon Metco, also part of the Oerlikon Surface Solutions segment, is also a leading supplier of thermal spray materials, equipment and job coating service for thick abrasion and erosion resistant coatings such as WC-Cobalt or oxides e.g. for turbine blades.

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metco**

# Main applications of wear-resistant and low-friction BALINIT coatings



Engines



Motorcycles



Racing



Gears



Roller bearings



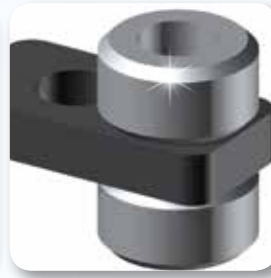
Food processing



Hydraulics



Compressors



Sub sea valves



Water- and steam-turbines



Machine tools



Linear guides and ball screw drives



Textile spinning and weaving



Printing



Packaging

## Further applications



Leisure and domestic appliances



Ceramic discs for faucets



Medical instruments



Medical devices

## More decorative coatings & heat treatment by Oerlikon Balzers

### BALTONE

As well as hard and wear resistant coatings, Oerlikon Balzers also offers decorative BALTONE™ coatings in a broad range of colours which are applied using specialized coating machines for very economic decorative treatment.



### BALITHERM IONIT

The low temperature heat treatment process creates a wear resistant and durable surface on large components. No harmful chemicals or gases are used in the IONIT process. This means that IONIT is the environmentally-friendly and efficient alternative to conventional nitriding methods.



# Coating properties at a glance

	Coating material	Process technology	Coating hardness $H_{IT}$ (GPa)	Typical coating thicknesses ( $\mu\text{m}$ )	Friction against steel, dry running	Coating temperature ( $^{\circ}\text{C}$ )	Max. service temperature ( $^{\circ}\text{C}$ )	Max. treatable dimensions [mm] D x L
<b>BALINIT® C</b>	WC/C	Sputter	8 - 12 / 12 - 15	1 - 4	0.1 - 0.2	< 250	300	250 x 1,000
<b>BALINIT® DLC</b>	a-C:H	PACVD	~15 - 25	1 - 3	0.1 - 0.2	< 250	300	250 x 1,000
<b>BALINIT® DLC STAR</b>	CrN/a-C:H	PACVD	~15 - 25	2 - 5	0.1 - 0.2	< 250	300	250 x 1,000
<b>BALINIT® CAVIDUR</b>	a-C:H	PACVD	~25 - 35	2 - 4	0.1 - 0.2	250 - 350	350	320 x 665
<b>BALINIT® CNI</b>	CrN	Sputter	18 +/- 3	1 - 20	0.5	< 250	700	250 x 1000
<b>BALINIT® CROMA PLUS</b>	CrN	Arc	25 +/- 3	4 - 10	0.3 - 0.5	250 / 400	700	700 x 1,450 600 x 4,500 1,200 x 1,200
<b>BALINIT® A</b>	TiN	Arc	30 +/- 3	1 - 4	0.4	250 / 400	600	700 x 1,450
<b>BALINIT® ALCRONA PRO</b>	AlCrN	Arc	36 +/- 3	2 - 6	0.35	< 500	1000	700 x 1,450
<b>BALINIT® DYLYN</b>	a-C:H:Si	PACVD	~20 - 25	1 - 3	0.1 - 0.2	180 - 220	300	330 x 900
<b>BALINIT® DYLYN PLUS</b>	a-C:H:Si	PACVD	~17 - 23	1 - 3	0.05 - 0.1	180 - 220	350	330 x 900
<b>BALINIT® DYLYN PRO</b>	a-C:H:Si	PACVD	~15 - 20	1 - 3	0.05 - 0.1	180 - 220	350	330 x 900

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

## Coating description and recommended applications

**BALINIT® C:** The standard coating for sliding and rolling elements under poor lubricating conditions, counteracts seizure and galling (e.g. roller bearings, gears).

**BALINIT® DLC:** Harder than BALINIT® C and therefore used to withstand higher levels of abrasive wear and high sliding speeds. Standard for diesel injection, engine valve train and piston pins.

**BALINIT® DLC STAR:** Tribological performance like DLC, but enhanced with a very ductile CrN base layer for additional high loads.

**BALINIT® CAVIDUR:** Very hard and smooth DLC coating. The standard for highly loaded racing parts such as camshafts and finger followers.

**BALINIT® CNI:** Chromium nitride is very ductile and highly oxidation resistant and is therefore used in high temperature applications requiring high wear resistance (e.g. piston rings, exhaust valves).

**BALINIT® CROMA PLUS:** Similar to CNI with higher hardness and a special top layer for reduced friction.

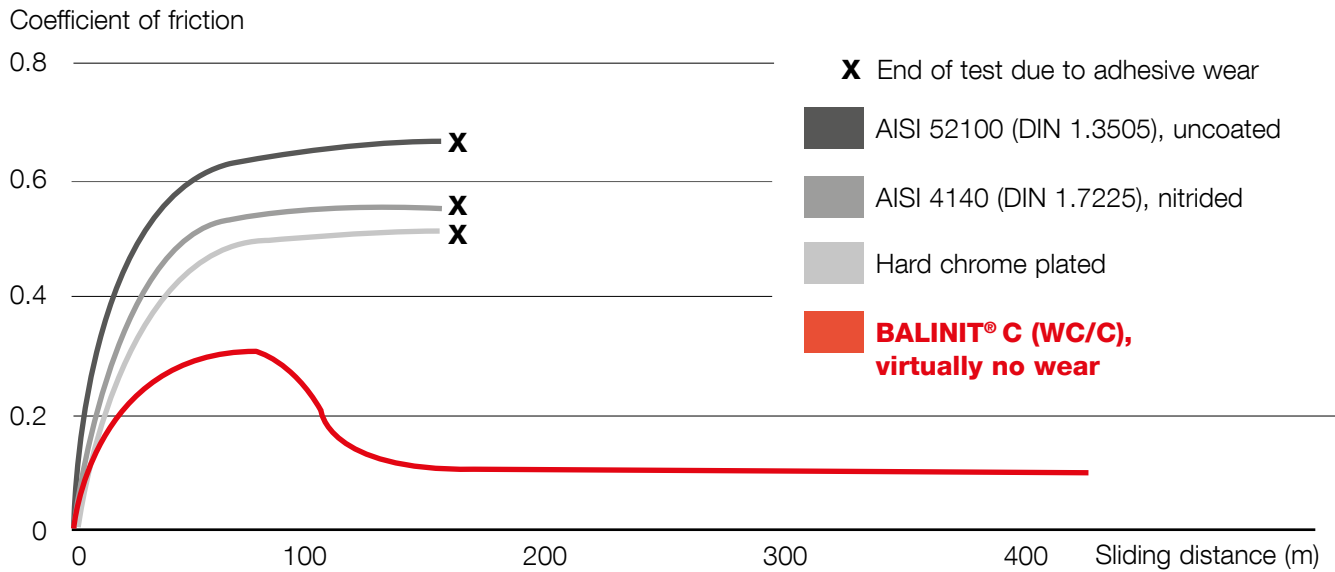
**BALINIT® A:** The historical first coating for tools and components, impressive golden color. Used therefore in long-lasting specification industries such as aerospace or for colouring and designation purposes.

**BALINIT® ALCRONA PRO:** Extremely oxidation resistant and therefore used in high temperature and abrasive environments (e.g. for turbocharger parts or exhaust valves).

**BALINIT® DYLYN:** Silicon-enriched DLC coatings for lower friction, higher corrosion resistance and good release properties (e.g. plastic moulds).

# Harness the main advantages of carbon-based coatings: low friction and low sliding wear

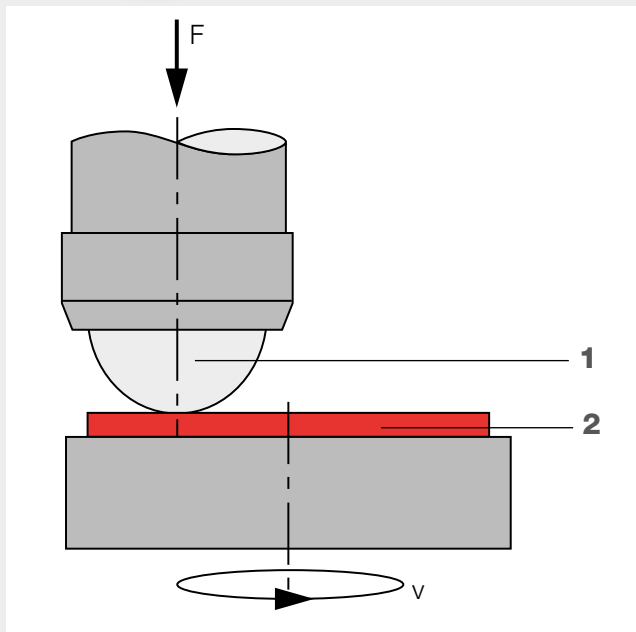
## Pin-on-disc test to compare friction and wear of materials



Wear track (30x) of nitrided ring, exhibits heavy galling after 150 m sliding distance



Wear track (30x) of BALINIT® C coated ring exhibits only slight running in (wear depth approx 0.2  $\mu$ m) after 2000 m sliding distance



### Experimental method

1. Ball, non-rotating  
diameter 3mm  
AISI 52100, DIN 1.3505 100Cr6  
60 HRC
2. Test ring  
AISI 52100, DIN 1.3505 100Cr6  
60 HRC  
Abrasive-blasted  
or polished  
Coated

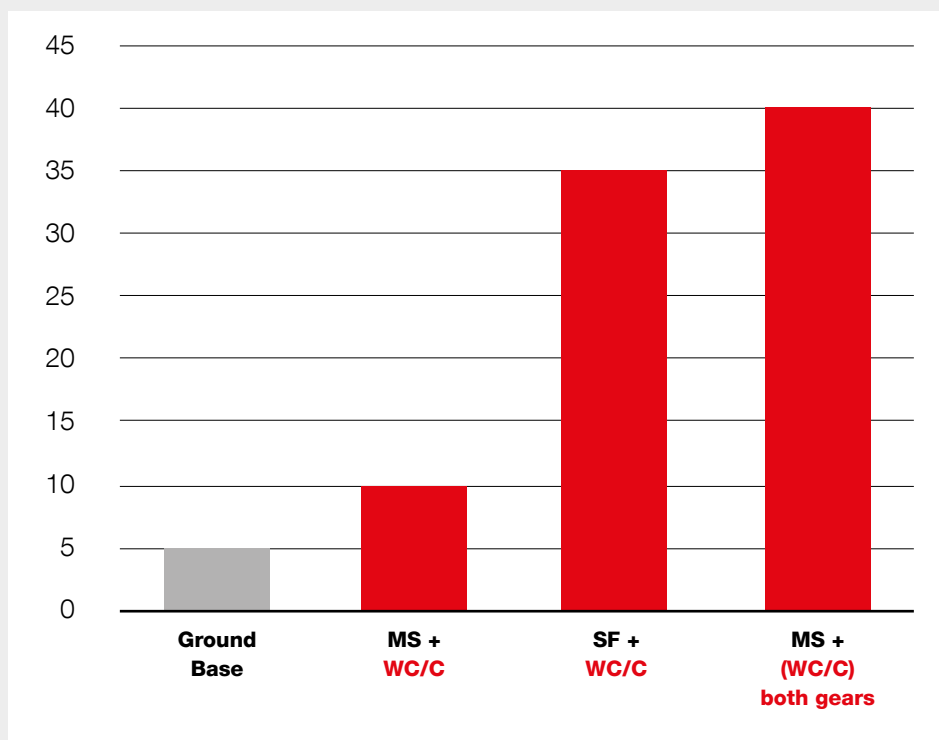
### Test conditions

$F = 30$  N  
 $v = 0.3$  m/s  
 Dry contact

# The coating as a design element – Increased service life due to higher wear resistance

BALINIT® hard coatings are frequently only employed after completion of product development when it is discovered that there is too much wear (acute problem solving). However, the coating itself is more and more playing a role as a design element during development to achieve improved performance. A recent example of this is the use of the BALINIT®C coating in combination with special pre-treatments designed to increase the load capacity of gears.

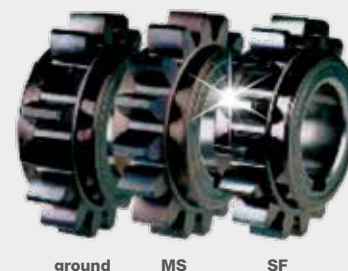
## Cycles x10<sup>8</sup> to pitting failure



**800%**  
increased  
pitting  
life

BALINIT®C (WC/C) coating, micro-blasting or superfinish increase pitting life. Maximum lifetime is achieved with a combination of superfinish and BALINIT®C on one gear, or microblasting and BALINIT®C when both gears are coated.

**MS** Microblasting  
**SF** Super Finish  
**WC/C** **BALINIT®C coating**



**Benefit from high-performance BALINIT coatings**  
**Contact us now!**

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