

REPLACEMENT OF HARD CHROME PLATING BY S³P

DIFFUSION HARDENING INSTEAD
OF COATING

WEAR AND CORROSION PROTECTION

AVOID FLAKING AND DELAMINATION

NO CHROME (VI) EXPOSURE

EU-REACH REGULATION



Superior alternative technology with legal conformity

For many years hard chrome plating was an standard industrial process for wear and corrosion protection, but due to the European REACH regulations the application of hard chrome plating has been highly regulated since 2017. Apart from desirable properties such as wear resistance, medium corrosion resistance and galling resistance, the use of hard chrome is limited by reduced fatigue strength and flaking-off of the coating. S³P surface-hardening of corrosion resistant materials is an efficient alternative, which is superior to a coating in many applications thanks to its technological properties.

Corrosion resistant, hard yet ductile

Bodycote S³P, featuring Kolsterising® offers processes that produce a very hard yet ductile diffusion zone with a surface hardness of more than 1000 HV 'microhardness' on the surface of corrosion resistant steels, nickel-based and cobalt-chromium alloys. Benefits of the processes include considerably enhanced wear resistance, which is superior to hard chrome plating in many areas, see Fig. 1.

Unlike coatings, the bending fatigue strength can also be significantly improved, which allows a more efficient design of components. Further, no flaking off occurs on the hard outer surface. In particular in applications where food is in contact with, hard chromium can be safety-critical when it flakes off, Fig. 2.

Low processing temperatures (< 500 °C), which prevent the formation of carbide and nitride precipitations, are essential for the S³P hardening process. These precipitations would significantly reduce the corrosion resistance and impact mechanical characteristics. A further advantage of the low processing temperatures is that no dimensional changes can occur on finished components, and thus no reworking is required. Another disadvantage of platings such as hard chrome is that complex structures cannot be coated uniformly, while internal contours, indentations and even the smallest boreholes can be treated with S³P.

Benefits of S³P

- Avoids Cr⁶⁺ in manufacturing¹
- No flaking off possible in diffusion-based processes
- Eliminates galling
- Retains corrosion resistance
- Increases fatigue resistance
- Improves wear resistance

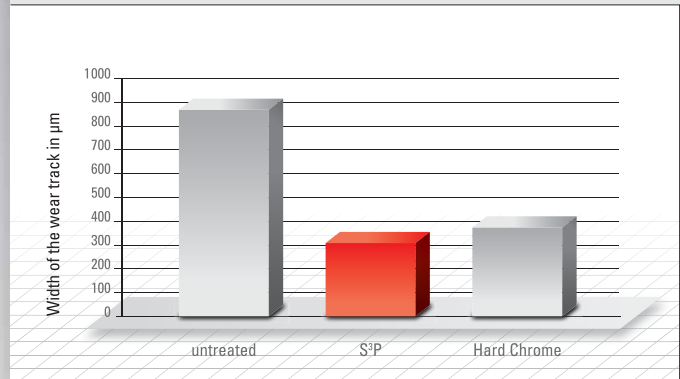


Fig. 1 Wear width in pin-and-disc tribometer (Al₂O₃ ball Grade 25 according to DIN 5402:2012), contact pressure: 100 N, sliding speed: 66 mm/s, sliding distance: 5 m, base material: 1.4404; the S³P-treated component exhibits the strongest resistance against abrasion.



Fig. 2 Hard chrome-plated cylinder with flaking off due to dynamic stress; this problem does not exist with S³P-treated surfaces.

¹ Galvanic baths for chrome plating consist of chromic acid, sulphuric acid and other additives. But the chromic acids in particular pose a problem. Harmful Cr⁶⁺, which occurs during the galvanic process, has triggered a reconsideration in the European Union. From 2017 the REACH Regulation (Registration, Evaluation, Authorisation and Restriction of Chemicals) will enforce considerably stricter regulations for the use of chromium trioxide. The substance is classified as carcinogenic and mutagenic.

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