

In the SPOTLIGHT:

S³P – PROVIDING A HARD AND DUCTILE SURFACE

Different solutions exist for stainless steel application that require corrosion resistance AND wear resistance, the most common being diffusion processes and coatings. Coatings can be very hard, but are prone to cracking and delamination what can lead to contamination of the surrounding environment. Specialty stainless steel processes (S³P) – low temperature diffusion – are an excellent solution for these applications providing a ductile case-hardened surface that increases the wear resistance of corrosion resistant metallic alloys. During the S³P process, high compressive stresses are generated in the diffusion zone, which leads to a significant increase in hardness and tribological properties. The surface hardness exceeds 1000 HV_{0.05} while the hardened diffusion zone remains ductile.



Coatings

Chipping, flaking, and peeling are common failure modes of many coating technologies. These types of delamination failures are caused by insufficient bonding with the base material or brittle fracture due to deformation of the surface (See fig. 1). In industries such as food and beverage or medical, this type of failure is unacceptable as the risk of contamination is substantial. This risk should be strictly avoided, and Bodycote S³P provides an excellent solution.

S³P

S³P was developed to increase surface hardness and wear resistance of corrosion resistant metallic alloys. By means of a low temperature process, nitrogen and/or carbon diffuses into the surface without formation of deleterious phases like chromium carbides. Thus the corrosion resistance of the material can be maintained. S³P processes can combine typically conflicting properties: Hardness, ductility, corrosion resistance. The carbon S-Phase stays very ductile when loaded rapidly, fig. 2. Interstitially solved carbon in a ductile base structure still allows deformation. Further, the gradually rising carbon content leads to a smooth hardness increase to the surface what provides outstanding fatigue properties.

Advantages

- Homogenous and reproducible diffusion zone
- High surface hardness > 1000 HV_{0.05}
- Eliminates galling and fretting
- Maintains corrosion resistance
- Increases fatigue resistance
- Diffusion based process, no chipping or flaking possible
- High ductility of carbon S-Phase
- Excellent wear resistance

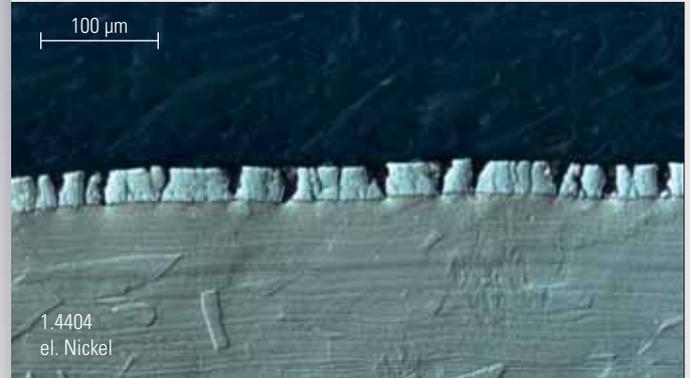


Fig. 1 Cracks in electroless nickel plating on AISI316L after slight bending.



Fig. 2 No cracks visible in heavily deformed carbon S-Phase after hammer & nail test of S³P treated AISI 316L.



Fig. 3 Application example in the food and beverage industry. Bodycote S³P provides excellent wear and galling resistance while contamination due to delamination is eliminated.