In the SPOTLIGHT:

S³P AGAINST CAVITATION EROSION

There is a risk of cavitation erosion wherever liquids under unfavorable flow conditions come into contact with a metal surface, in particular stainless steels. Whether it affects hydraulic machines such as pumps or high-pressure injection systems for fuels, cavitation erosion greatly reduces the service life of components. This erosion phenomenon not only impacts the efficiency of the system, but can also lead to component failure. S³P processes offer a solution for corrosion resistant alloys that significantly improves the performance when battling cavitation all while maintaining the corrosion properties of the material.

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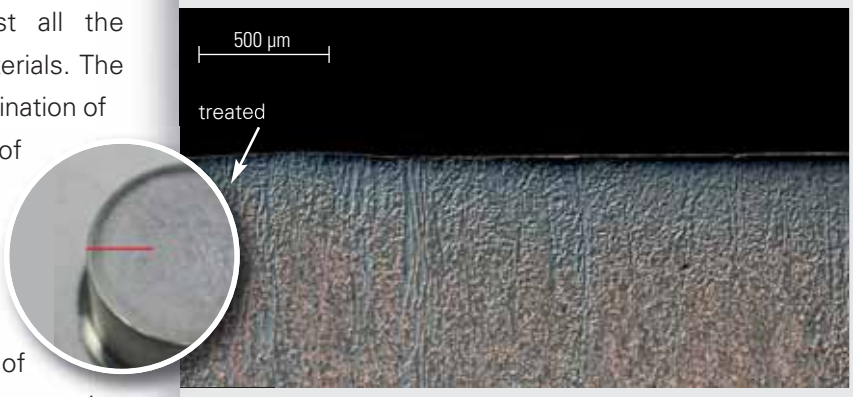
S³P – Specialty Stainless Steel Processes
Cavitation

S³P processes can be applied to almost all the corrosion-resistant Fe-, Ni- and Co-based materials. The interstitial supersaturation of carbon or a combination of carbon/nitrogen leads to the formation of expanded austenite, which is characterized by high hardness (> 1000 $HV_{0.05}$) and wear resistance. Due to the high ductility in combination with very high compressive stresses, the impact of void implosions – typical of cavitation – can be strongly decreased. Cavitation erosion is thus greatly reduced or even completely avoided for many applications and materials. The excellent ductility of the hardened boundary is created from the gradual compressive stress gradient within this diffusion zone. As a result flaking and delamination, a common issue affecting coatings, does not occur. In addition, S³P processes preserve the corrosion resistance of the base material, since chromium carbide/nitride precipitates can be effectively suppressed.

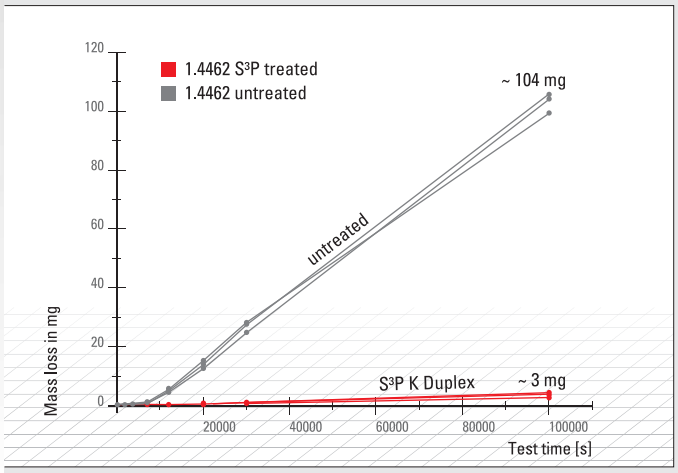


S³P-treated Duplex2205 (1.4462) after cavitation testing in accordance with ASTM G32-10 (27h).

Untreated Duplex2205 (1.4462) after cavitation testing in accordance with ASTM G32-10 (27h).

Advantages

- Improve cavitation erosion resistance
- High surface hardness >1000 $HV_{0.05}$
- Improve wear resistance
- Homogeneous diffusion layer
- Increase fatigue resistance
- Diffusion-based processes, no flaking or peeling off is possible
- Maintain corrosion resistance
- Eliminate fretting and galling



Mass loss curve in demineralised water with a maximum test time of 100,000 s. Material Duplex2205 (1.4462) in untreated (grey curve) and S³P-treated state (red curve).

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