# In the SPOTLIGHT:

## LASER WELDING OF S³P-TREATED COMPONENTS

Due to easy automation and excellent seam quality, laser welding is a popular joining process also for corrosion resistant steels. The process offers an efficient solution particularly for mass production. The comparably low energy input reduces warpage, despite the high welding penetration depths, and makes mechanical straightening unnecessary. With regards to the surface-hardening processes of Bodycote S³P, laser welding is one of the preferred joining processes. By following certain rules, an optimum welding result can be achieved even for components whose surface has already been hardened.

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# S³P – Specialty Stainless Steel Processes
# Laser Welding

In almost all cases corrosion resistant components joined by laser welding can be easily finished using S³P processes. The welding seam behaves in a similar manner to the base material when subjected to low temperature diffusion processes. However, it is often necessary to subsequently join hardened components.

Low-temperature processes based on nitrogen or a combination of nitrogen and carbon are not recommended. The recombination of nitrogen triggers the formation of gas bubbles in the weld pool, which solidify into pores and significantly reduce the strength; see fig. 1 c. In the heat-affected zone nitrogen is prone to cause nitride precipitations even where the energy input is minimal.

Purely carbon-based diffusion procedures, on the other hand, allow a homogeneous, pore-free weld; see fig. 1 b. Furthermore, carbon possesses a comparably low carbide-forming tendency, which results in an almost precipitation-free weld seam. A corrosion resistance of surface hardened and subsequently welded components, which can be compared to that of untreated base material is achievable by additional mechanical procedures, pickling and/or passivation. Fig. 2 and fig. 3. Bodycote S³P would be happy to support on the selection of suitable parameters.

## Design rules

- Weld first, then S³P
- Carbon S-phase instead of nitrogen S-phase
- Minimum energy input
- Grinding, pickling and passivating are beneficial

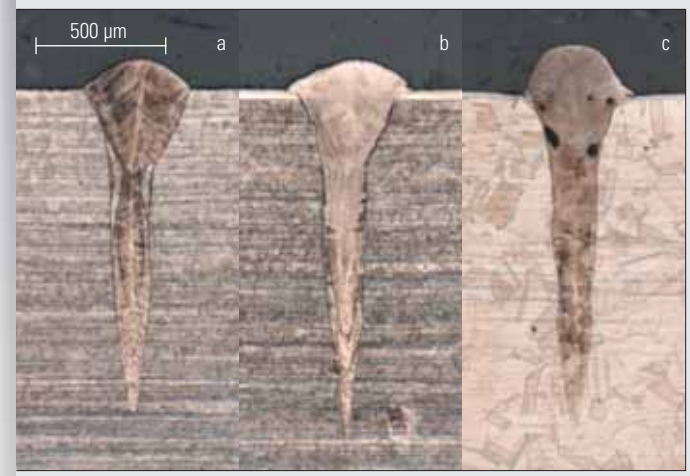


*Fig. 1 Cross section of single mode fiber laser weldments on AISI 316L stainless steel (P: 500 W; v: 100 mms$^{-1}$); a: non-hardened sheet; pore-free weldment; b: S³P surface hardened sheet; pore-free weldment; c: solution annealed and low temperature nitrocarburized sheet; porous weldment with nitride precipitations in the heat affected zone.*

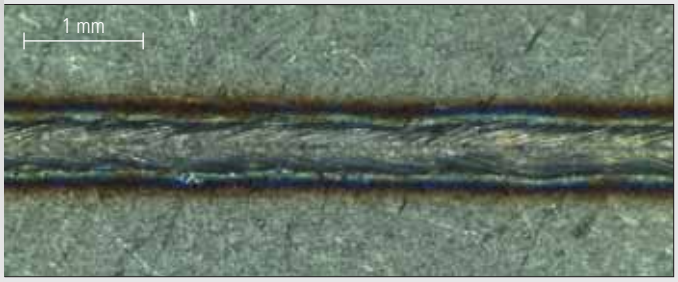


*Fig. 2 As welded surface of low temperature carburized stainless steel; massively lowered corrosion resistance mainly due to heat tint.*

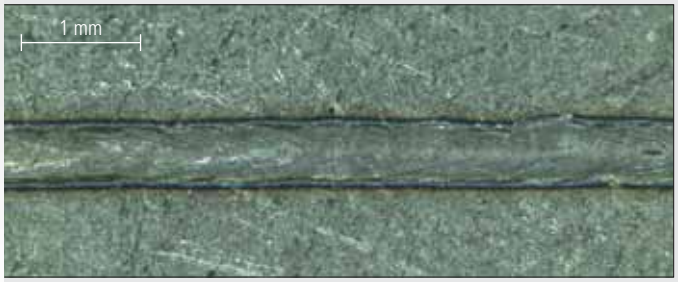


*Fig. 3 Weld track of low temperature carburized stainless steel after pickling and passivation; the corrosion resistance was measured to be on the same level as the base material.*



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