Stainless steel welded by remote scanner laser: welding behavior and corrosion resistant

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Enhancing stainless steel corrosion properties in chloride environment are one of the most promising topics for industry such as oil and gas refining, marine environment, pollution control equipment and many other applications. As known, in most applications welding is necessary; in our case two types of stainless steels were studied D.S.S. (1.4462) and A.S.S. (1.4539). The welding was carried out by remote scanner laser, for comparison un-welded samples were used for investigation.

The microstructure has been investigated and analyzed using optical, scanning electron microscopes (SEM) and energy dispersive X-ray. The microstructure examination showed type A solidification in austenitic stainless steel (A.S.S) and extensive grain growth and primary ferrite phase was observed, while in duplex stainless steel (D.S.S.) no precipitation on the grain boundaries or changes in composition of iron or chromium was present. Vicker's hardness measurements reflected higher hardness value towards the center of the weld. To improve the corrosion resistant six inhibitors were selected for this study; sodium chromate, sodium phosphate, sodium molybdate, potassium bromate, sodium oxalate and sodium nitrate. The corrosion behavior was investigated by open circuit potential (OCP) and potential cyclic voltammetery (PCV) measurements. These electrochemical tests reflected more positive potential in weld samples than that of un-welded one; this case was in D.S.S while lower potential was recorded for welded A.S.S. sample. The OCP of the un-welded sample in both D.S.S. and A.S.S. in the presence of inhibitor (bromate) was recorded more positive potential than the other inhibitors. For welded samples of D.S.S. and A.S.S. higher positive potential were recorded in the presence of phosphate and oxalate, respectively. The pitting potential was estimated from the PCV curves for welded and un-welded in the presence and absence of inhibitors, higher pitting resistance was obtained for un-welded samples compared to welded ones. Certain inhibitors have increased the pitting resistance for welded and un-welded sample such as phosphate and molybdate.