Effect of intermetallic precipitations on pitting corrosion resistance of a 2205 duplex stainless steel

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Phase transformation taking place during welding in a heat affected zone (HAZ) has a great influence on steel properties. Investigation of a corrosion susceptibility of the weld metal by use of ferrie chloride solution (Standard Test Methods ASTM G48-97) showed that the pitting corrosion in HAZ takes place.

The series of aging treatments at the temperature range of 700-1000 ºC for one hour after solution treatment at 1100 ºC were carried out. The microstructure of aged specimens were characterized using transmission electron microscopes JEM 200CX and analytical JEM-2010 ARP using thin foils. The specimen after corrosion in ferrie chloride solution was investigated using light microscope.

The results of corrosion tests show that the corrosion starts at the γ/δ interface. In the specimens aged at 700 and 1000ºC, corrosion occurs in the austenite phase, while after aging at 800 and 900ºC this phase have a better corrosion resistance.

Steel microstructure investigations revealed that ageing at 700ºC caused the precipitation of Mo-rich χ particles, which were located preferentially at γ/δ interface and within δ-ferrite. Very fine secondary $M_{23}C_6$ and Cr_2N were also observed in this steel.
After ageing at 800 and 900ºC, the eutectoid transformation of δ-ferrite to sigma phase and γ_2 austenite took place. A coral-like morphology of sigma phase was observed. The sigma phase was enriched with Cr and Mo and γ_2 austenite was more depleted of these elements than a primary austenitic phase. No intermetallic precipitates after aging at 1000 ºC was found.
The results of microstructure findings are correlated with steel corrosion properties.