

The influence of post weld heat treatment precipitation on duplex stainless steels weld overlay towards pitting corrosion

ABSTRACT

Duplex stainless steels (DSSs) are complex materials and they have been widely used in the marine environment and gas industries, primarily offering a better resistance of pitting corrosion and good mechanical properties. In the present work, the effects of heat treatment on duplex stainless steel (DSS) weld overlay samples that were heat treated at three different temperatures, namely 350 °C, 650 °C, and 1050 °C, and followed by air cooling and water quenching were studied. Stress relief temperature at 650 °C had induced sigma phase precipitation in between delta ferrite and austenite (δ/γ) grain boundaries, resulting in the loss of corrosion resistance in the weld metal. Interestingly, post weld heat treatment (PWHT) test samples that were reheated to solution annealing temperature had shown no weight loss. The ferrite count determination in the region of weld metal overlay increased at hydrogen relief and decreased at stress relief temperatures due to slow cooling, which is more favorable to austenite formation. The amount of ferrite in the weld metals was significantly reduced with the increment of solution anneal temperature to 1050 °C because of sufficient time for the formation of austenite and giving optimum equilibrium fraction in the welds.

Keyword : Duplex stainless steel; PWHT; Dilution; Weld overlay; Solution annealing; Pitting corrosion and ferrite count