

EFFECT OF RUTHENIUM ADDITIONS ON THE CORROSION AND MECHANICAL PROPERTIES OF THE WELD METAL OF 316L AUSTENITIC AND LDX 2101 DUPLEX STAINLESS STEELS

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Austenitic stainless steels (ASSs) and duplex stainless steels (DSSs) are widely used in high performance pressure vessels, nuclear, chemical, process and medical industry due to their very good corrosion resistance and superior mechanical properties. Welding is a common technique used to join 316L ASS or LDX 2101. 316L is a molybdenum bearing ASS, while LDX 2101 is a duplex stainless steel that was patented by Outokumpu in 2013. This work validated the potential benefit that Ru additions would have on the corrosion resistance of the weld metal based on microstructural and mechanical properties. The microstructures of all 316L gas tungsten arc welding (GTAW) button samples in Figure 1 exhibited γ -austenite phases with δ -ferrite at the dendritic boundaries. The ferrite-austenite (FA) solidification mode suggested that an incomplete solid-state transformation had occurred due to the melting of the 316L in water cooled conical shaped copper mould. The hardness results revealed that 316L ASS (Figure 1) and LDX 2101 (Figure 2) had an increase in hardness as Ru additions were increased due to grain refining nature of Ru). The potentiodynamic polarization test indicated that as Ru addition increased there was an increase in corrosion resistance for both 316L and LDX 2101. Overall, it was concluded that the addition of Ru exhibited no detrimental effect of the solid state transformation but rather strengthens the alloy as Ru increases. Ruthenium additions in the stainless steels not only improve the weld metal mechanical properties but can improve the corrosion resistance of the weld metal.

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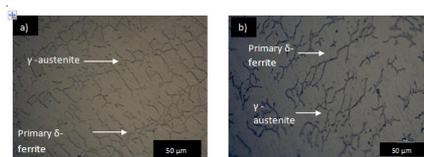


Figure 1: (a) 0.1 wt% Ru (b) 2 wt% Ru to 316L ASS after GTAW.

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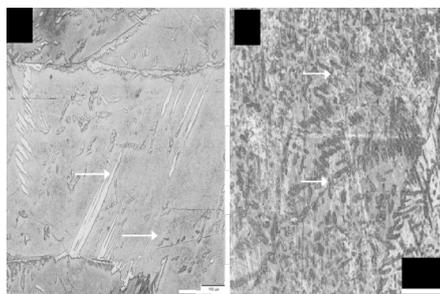


Figure 2: (a) 0.1 wt % Ru (b) 2 wt % Ru to LDX 2101 ASS after GTAW