Effect of Activating Fluxes to the Microstructure and Mechanical Properties on 2304 Duplex Stainless Steel Welds

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ABSTRACT

Duplex stainless steel possesses many other superior mechanical properties than traditional austenitic stainless steel, which is due to exist the advantages on both austenitic and ferritic phases. Furthermore, the capability of corrosion resistance of duplex stainless steel is splendid than austenitic stainless steel, especially under the chloric ion or sulfoxide compound environments. Therefore, duplex stainless steels were widely utilized in the facility of storage tank, transportation vehicle, heat exchanger, petroleum decomposing and sea-water desalination equipments. The welding methods commonly used in industries were satisfied in duplex stainless steel welding. To avoid affecting the phase equilibrium between austenite and ferrite phases, the heat input still need to be controlled as low as possible during welding.

This study aims to investigate the effect of activating flux on the characteristics in stainless steel welds. Autogenous TIG welding process through a layer of the flux was applied on the 304 and 2304 stainless steels to produce a bead-on-plate welded joint. Oxide and NiCO3 powders were used as the activating fluxes. The experimental results indicate that activating fluxes can be sure to increase penetration and narrow the welds on 304 stainless steels, and enhanced the depth to width ratio. Then completely weld the 3 mm thickness 2304 duplex stainless steels plate as the standard. To investigate the influence of activating fluxes by observing the morphology of welds, microstructure, grain size, mechanical properties, content of ferrite phase and fracture surface.

From experimental results shown that the activating fluxes can decrease heat input for a completely weld which will result in grain refinement and increase mechanical properties. Especially for the TiO2 flux, it can increase the toughness almost double. Therefore, using the TiO2 flux can bring large benefits in terms of productivity, cost and achieve practical applications.

Keywords : Duplex Stainless Steel、Austenitic Stainless Steel、Activating Flux、Heat Input、Depth to Width Ratio

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