

IIIe40-005

Corrosion resistance of lean duplex stainless steel 2101 welded by the gas tungsten arc welding double fusion (GTAW-DF) process for use in the citrus juice industry

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Tanks for storage of products in the food industry are usually made of stainless steel, as they must present hygiene and safety standards to ensure product quality. These stainless steels are finding increasing demand due to their good combination of mechanical properties, weldability and corrosion resistance. However, they are susceptible to localized corrosion when exposed to high temperatures, as during the welding process. In this study, welding of the 2101 lean duplex stainless steel (LDSS) was carried out by gas tungsten arc welding double fusion (GTAW-DF) process using ER 2209 weld consumable. This work aims to investigate the influence of optimized welding parameters on the corrosion performance of the 2101LDSS. The correlation between microstructure and electrochemical behavior of the fusion line (FL) and heat-affected zone (HAZ) has been investigated. In the study, six welded samples were manufactured with various welding parameters, specifically the welding current, travel speed and heat input. The microstructure of the welding zone was characterized by scanning electron microscopy (SEM) and its mechanical properties were evaluated by microhardness test. A mini-cell and Syringe Cell were used to characterize the electrochemical behavior of the different welded zones by means of the double loop electrochemical potentiokinetic reactivation test (DL-EPR) and potentiodynamic polarization tests. The results showed that the welding parameters tested in this study significantly affected the corrosion resistance of the 2101LDSS. The heat-affected zone (HAZ) was the zone most susceptible to localized corrosion and the specific region most affected by corrosion process was that of the 2101LDSS adjacent to the FL. The steel used as filler alloy (ER 2209) is significantly more resistant to corrosion than the 2101LDSS, and the galvanic coupling between the 2101 LDSS and the ER 2209 promoted galvanic corrosion in the 2101 adjacent to the ER 2209.