Study of the corrosion resistance of duplex and lean duplex steels welded by the gas tungsten arc welding double fusion (GTAW-DF) applied in the construction of tanks

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Duplex stainless steels has great technological importance due to the combination of high mechanical strength, high toughness and excellent corrosion resistance. New methods of joining these materials have been investigated and updated, with better cost-benefit. In this work, joints welded by the TIG process with root pass by the double-fusion method (GTAW-DF), typically applied in the construction of tanks for the citrus juice and biotechnology industry were investigated. The welding process of steels changes in its microstructures forming of deleterious precipitates which decrease the corrosion resistance. Thus, the aim of this work was to evaluate and compare the corrosion resistance after welding by the GTAW-DF process of similar joints of lean duplex 2101 steel and dissimilar joints of 2205 and 2304 steels, duplex and lean duplex respectively, both used in the citrus juice industry. Samples were made using optimized welding parameters under corrosion resistance criteria. Microstructural characterization was performed by metallographic etching and observation by optical microscopy (OM) and by scanning electron microscopy (SEM). Mechanical properties were evaluated by microhardness test. Corrosion resistance was evaluated by electrochemical tests by the double loop electrochemical potentiokinetic reactivation test (DL-EPR) and potentiodynamic polarization test. The results showed that the welding process caused microstructural changes in the materials, and that after welding the most susceptible regions to corrosion were in the fusion line and in the thermally affected zone. When analyzing the two welding conditions, it was observed that the welded samples with higher heat input showed lower tendencies to intergranular corrosion.