Corrosion Behavior of Austenitic Stainless Steel Welds Prepared by Dual Protection GTAW Process in 0.5 M H₂SO₄ and 3.5%wt. NaCl

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The GTAW process is largely employed in the industry for welding metal alloys and is generally considered to generate high quality welds with relatively low penetration in comparison to other arc-welding processes. In the present study, a modified GTAW dual shielding torch operating with an inner flow of pure Ar gas and an outer flow of mixed Ar-CO₂ gas was employed for producing autogenous AISI 316L stainless steel bead-on-plate welds. The performance of the proposed torch was assessed by numerical simulation of the gas flow in the nozzle, microstructure characterization and corrosion resistance analysis. To this end, a number of welds were produced with different levels of CO₂ concentration in the outer gas layer (0, 1, 2.5, 4, 8, 15, 25, 50 and 100%) and the samples were analyzed in terms of optical microscopy and X-ray Diffraction. When using the modified nozzle with a 2.5%CO₂ concentration in the outer gas flow, an increase of 2.5 times in the weld depth/width ratio could be obtained in relation to the pure Ar shielding condition. With the proposed configuration, no significant changes in phase composition or microstructure were noticed relative to the standard 100%Ar welding condition, and the samples were also found to exhibit similar corrosion behavior.

Keywords: GTAW, dual shielding, active gas, stainless steel, weld penetration.

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