Abstract

Mechanical properties change has been studied which are tensile properties and hardness properties on tensile samples of austenitic stainless steel, alloy 403, alloy 316L welded using TIG technology and MMAW technology. The corrosion was then studied which happen in an atmosphere of chlorine-containing mineral salts as FeCl3, MgCl2, and CaCl2 in the rate of 6% for three continuous hours on the AUTOLAB device, for welded and non-welded metal joints without exposed stress. On the other hand, corrosion was also studied when there was constant stress due to bending of the metal, so that the welding area is a central area that only undergoes corrosion test in a saline atmosphere containing 5% NaCl chlorine for three continuous hours on the PARSTAT 4000. In both tests-with and without stress - corrosion action was determined by TAFEL polarization analysis. For U welded and non-welded joints, they were tested for bending before corrosion testing in two ways, one from the weld side (face bend) and the other from the opposite side (Root bend) in order to demonstrate the best way to bend the welded metal in the corrosive environment. The experimental study on welded joints showed that there were changes in the hardness and tensile properties of both types due to a number of reasons related to the direction of cutting the metal (longitudinal or transverse), as well as the presence of defects in the metal (due to operating conditions or defects in the crystal) and also the type of technology used in welding. All of which have an effect on the mechanical properties, some of which have increased and some of them have been reduced compared to the original joints that are not subject to any kind of changes. Scanning electron microscopy (SEM) showed that both metals were subjected to severe pitting corrosion in corrosive operating environments, and when the erosion drill was studied, there was also transgranular corrosion on the crystalline boundary and intergranular corrosion between the grains themselves. The results of the electronic images on the metal joints U showed greater elongation of the drilling when compared with the non-stress samples, and the images showed several cases of metal fatigue associated with pitting corrosion, there is also a significant impact by bending the welded joint on the shape and dimensions of the corrosion drill in weld metal region and heat affected zone. The results of the spectroscopic analysis by EDX (Energy Dispersive X-ray) device of the metal surfaces showed a difference in the relative content of the mineral materials, especially when studying three areas besides the erosion drill (limits of the drill, drill zone, and outside the drill) , and this is evidence of the migration of some mineral elements to the limits of the drill or vice versa.This work provides a scientific basis for making recommendations of both types and which is best to use especially when constructing fixed and mobile metal structures in corrosive saline conditions, it also shows the best method of operation of the joints in terms of direction and type of welding used in the operations that include Compression, drag, tensile and Forging. As well as the operating environment, which is subject to constant stresses and needs good hardness and good tensile properties, all in order to mitigate the risk of corrosion. This work also addresses the use of welded joints, especially in the long-term storage of chemicals without operating conditions, as well as the action of the metal in such conditions