

Effect of microstructure and precipitation phenomena on the mechanical behavior of AA6061-T6 aluminum alloy weld.

M. Hakem, S. Lebaili, S. Mathieu, D. Miroud, A. LEBAILI, B. Cheniti

Abstract: In the present study, the effect of microstructure and precipitation phenomena on the micro hardness, tensile strength, impact toughness, and electrochemical behavior of tungsten inert gas (TIG)-welded AA6061-T6 aluminum alloy are investigated. The microstructure features showed mainly the grains of aluminum solid solution with the presence of some precipitates at the grain boundaries. Scanning electron microscope micrographs exhibited the presence of Fe-based intermetallic and B-equilibrium precipitates throughout α -Al grains. In the heat-affected zone (HAZ), the dissolution, over-aged, and coalescence of precipitates are observed; their hardening effects disappear and a decrease in strength and hardness are noticed. The fracture toughness values of each zone at different temperatures using Charpy V-notch test remained constant where the HAZ presents the highest absorbed energy. However, the temperature did not have a significant effect on the absorbed energy for each zone. In addition, the fracture surface of base metal (BM) and HAZ are characterized by dimple-like structure and they are larger in the HAZ. The electrochemical behavior of each zone of the weld evaluated in NaCl + H₂O₂ solution revealed that the corrosion current density of BM and HAZ is lower than that of molten zone (MZ), which displays high corrosion current density in this electrolyte and would be fastest to corrode.

Keywords : Aluminum alloys, TIG welding, precipitates, microstructure, Fractography, Electrochemical behavior