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

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

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