ABSTRACT

According to Aerospace Material Specifications, which the hardness value of SAE 4130 with a cross section thickness greater than 12.7mm (0.5in) should be limited after heat treatment. When manufacturing a precise containers requires a welding process after thermal refinement and circumferential GTAW and before final welding in order to relieve stress in SAE 4130 weldment. This study simulated SAE 4130 multilayer weldment after thermal refining to evaluate how the reduced stress affected its microstructures and mechanical properties. The ASTW and ASTWR achieved the minimum hardness value in the TZHAZ. Because, the peak temperature is only slightly lower than A1 and apparently causes no residual stress. Hardness was substantially reduced between welding beads but was still higher than the minimum value at TZHAZ. Tensile tests showed that the joint efficiency of ASTW was about 85.9%, and elongation was only 61.4% of that observed before welding. The joint efficiency of ASTWR slightly decreased to 80.8%. The elongation recovered to 66.1%. Stress relief after welding did not significantly improve tensile strength. In terms of fracture toughness, it improved the HAZ impact value of ASTWR. The impact value reached 306.0% of AST. The experimental results showed that HAZ is more likely broken first in terms of failure positions on HAZ and base material with stable stress. However, breakage in the base material is most likely to result from instant stress.

Keywords: Cr-Mo steel, SAE 4130, GTAW, mechanical property

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