

Hybrid Laser-Gas Metal Arc Welding of ASTM A106-B Steel Pipes

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Abstract : The Oil and Gas industries are vigorously looking for new ways to increase the efficiency of their pipeline constructions. Besides the other approaches, implementing of new welding methods for joining pipes can be the best candidate on this regard. Hybrid Laser Arc Welding (HLAW) with the capabilities of high welding speed, deep penetration, and excellent gap bridging ability can be a possible alternative method in pipeline girth welding. This paper investigates the feasibility of applying the HLAW to join ASTM A106-B as the mostly used piping material for transporting high-temperature and high-pressure fluids and gases. The experiments were carried out on six-inch diameter pipes with the wall thickness of 10mm. AWS ER 70 S6 filler wire with diameter of 1.2mm was employed. Relating to this welding procedure, characterization of welded samples such as hardness, tensile testing and Charpy V-notch testing were performed and the results will be reported in this paper. In order to have better understanding about the thermal history and the microstructural alterations caused by the welding heat cycle, a comprehensive Finite Element (FE) model was also conducted. The obtained results have shown that the Gas Metal Arc Welding (GMAW) procedure with the minimum number of 5 passes to complete the wall thickness, was reduced to only single pass by using the HLAW process with the welding time less than 15s.

Keywords : finite element modeling, high-temperature service, hybrid laser/arc welding, welding pipes

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