HIGH CYCLE FATIGUE BEHAVIOUR OF FRICTION STIR LAP WELDED 6061 ALUMINIUM ALLOY TO COATED STEEL SHEET JOINT

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Abstract

Multi-material fabrication such as joining of steel and aluminium has become prominence now a days in automotive industries. Friction Stir Welding (FSW), a novel solid state welding process, has already established good joint strength between steel and aluminium; but joint fatigue strength of such dissimilar material has not yet been explored. In the present study, the friction stir lap welding has been performed at each rotation speeds of 500, 1000, 1500 rpm for two different travel speed i.e. 50 and 100 mm min-1 at a constant probe depth 2.5 mm. Among the different joints, two joints: one achieved of maximum load (5 kN) and other achieved of minimum load (2 kN) have been exclusively characterized by high cycle fatigue at R=0.1. Furthermore, R ratio has been varied from +0.5, +0.3 to -0.5, -0.3 at endurance limit (106 cycles). The experimental results show that fatigue strength at 106 cycles for both the FS welded lap joint is about 20% of their respective failure load. Thus better fatigue strength is associated with the lap joint performed with the joint of maximum load. The fatigue behaviour of two FS joints has been correlated with the thickness of intermetallic compound evaluated by SEM image and accumulation of dislocations observed by TEM.

STUDIES ON THE MICROSTRUCTURE AND TOUGHNESS OF SIMULATED HEAT AFFECTED ZONE IN A MODIFIED 9CR-1MO STEEL

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Abstract

The impact toughness of various regions of heat-affected zone (HAZ) of modified 9Cr-1Mo steel has been carried out on physically simulated specimens. For this, modified 9Cr-1Mo steel specimens were subjected to simulated thermal cycles in a Gleeble thermo-mechanical simulator at four different peak temperatures, viz. 860°C and 900°C for the inter-critical HAZ (ICHAZ), at 975°C for the fine grain HAZ (FGHAZ), and at 1200°C for the coarse grain HAZ (CGHAZ). HAZ simulated specimens were subjected to simulated post weld heat treatment (PWHT) at 760°C for 4h. Charpy V-notch impact toughness, hardness measurement and microstructure studies were carried out in the as-simulated and after simulated PWHT. Impact toughness after PWHT for all the four different peak temperatures is comparable to base material toughness. Microhardness measured across the simulated specimen showed substantial reduction in hardness after PWHT and hence recovery of ductility and toughness. This paper presents and discusses the results of this experiment investigation on the microstructure, hardness distribution and impact toughness of different regions of HAZ in modified 9Cr-1Mo steel.