

Mechanical and structural evaluation of friction stir welded 6061 aluminium alloy lap joints at different welding speeds

ABSTRACT

Lap joints of 6061-T6 aluminium alloy were produced by friction stir welding, and the influence of welding speed on their weld quality was investigated in terms of welding defects, micro- and macrostructures, hardness distribution, and tensile properties as well as effective plate thickness (EPT) by applying the welding speed in the range 20–60 mm min⁻¹ at constant rotation speed of 1000 rpm. The results showed that although tensile shear strength, joint efficiency, and microhardness of the weld nugget zone (WNZ) rather than the heat affected zone (HAZ), and the EPT increased with an increase in welding speed, the average grain size in the WNZ rather than the HAZ decreased. Due to increasing welding speed, the hooking and thinning defects were gradually restricted from the WNZ to the WNZ/TMAZ interface. The fracture mode within the highest tensile shear strength joints was denoted as plate separation along the hook throughout the stir zone.

Keyword: Friction stir welding; 6061 aluminium alloy; Mechanical properties; Microstructure; Welding speed