

Effect of rotational speed and copper interlayer on the mechanical and fracture behaviour of friction stir spot welds of 5754 aluminium alloy

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Abstract: The application of joining processes requires advanced mechanical tests to control the joints quality. Generally, welded sheets are verified using tensile shear tests. However, few studies also recommend conducting tension peel and cross-tension tests. The present work evaluates the mechanical behaviour of 5754 aluminium sheets jointed by friction stir spot welding (FSSW). The influence of the rotational speed on joint strength was first compared to riveted assemblies. Then, sheets welded with pure copper interlayers were compared to the precedents. The results indicated that, without an interlayer, lower and intermediate rotational speeds lead to higher mechanical strength under tensile shear tests compared to riveted assembly. However, it performed worse under tension peel and cross-tension tests at all studied rotational speeds. By adding copper, the strength of welded sheets is globally improved under tensile shear tests. Nevertheless, under tension peel and cross-tension tests, it performed worse, although a slight improvement was observed for increasing rotational speeds. Two different failure morphologies and four fracture modes were observed regarding the different tested samples. Microhardness tests were also conducted, to relate the influence of the studied parameters on the joint s strength.

Keywords : 5754 aluminium alloy, Failure and fracture modes, Friction stir spot welding, Mechanical testing, Microhardness