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# Friction Stir Lap Welding of Light Alloys

Z.W. CHEN※ and S. YAZDANIAN※

※School of Engineering, AUT University, St Paul Street, Auckland 1010, New Zealand
*E-mail : zhan.chen@aut.ac.nz*

Friction stir welding (FSW) has been widely applied and studied intensively in recent times. The majority of FSW studies have been based on butt joint configuration. Joining with lap configuration is also widely used in rail, automotive and aerospace industries. Thus, various FS material flow related joint features and deformation and fracture behaviours of the joints under loading need to be better understood for FSLW to be more widely applied particularly for light weight structure applications. In this paper, features of hooking formed during FSLW of Al-to-Al and Mg-to-Mg will be quantified. These features are the results of two sequential material flows during FS which, as will be shown, are speeds dependent and alloy deformation behaviour dependent. Strength values of the welds will be presented and it has been found that hooking affects Al and Mg FSL welds very differently, due to the different modes of local plastic deformation. FSLW study has been extended to Al-to-Ti alloy, for which we will show that under a well controlled FSLW condition a thin and continuous interface intermetallic layer forms and this layer can bear a high shear load. As a result, the strength of the lap weld is very high.

***Key Words*** : Hooking, Stress concentration, Fracture