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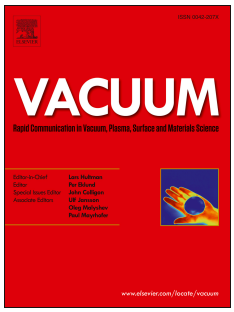

High mechanical performance of similar Al joints produced by a novel spot friction welding technique

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High mechanical performance of similar Al joints produced by a novel spot friction welding technique

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Abstract

In this study, the protrusion friction stir spot welding (PFSSW) was introduced in this study while a specially designed back plate (anvil) with a protrusion on its surface and a pinless tool were used. The effects of the tool dwell time (6, 12, 18 s) were investigated on the microstructure and mechanical properties of samples. Surface appearance of the welding zone showed that the keyhole was not formed and the appearance of weld was relatively smooth. Microstructure and mechanical results indicated that the welding zone with uniform and refine structure due to dynamic recrystallization presents higher hardness and strength than base metal while can be affected by dwell time. The tool penetration depth, the stir zone (SZ) depth and the bonding area at the interface of two sheets increased with increasing dwell time. Fracture surfaces of the failed specimens present the shear fracture at dwell times of 6 and 12 s and the interfacial fracture at 18 s. The proper dwell time of tools in this process was obtained 12 s. Considerable hardness (220 HV) and maximum failure load (6000 N) were obtained in present work compared to other welding methods.

Keywords: Al2024 sheet; Friction stir spot welding; Microstructure; Mechanical properties.