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FRICTION STIR SPOT WELDED CHARACTERIZATION OF ALUMINIUM ALLOY 5052-H112 AND PREDICTION MODEL USING ARTIFICIAL NEURAL NETWORK

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ABSTRACT

As a solid-state joining technique, the friction stir spot welding facing the issues of decreasing the mechanical property of the spot weld which mainly occurs due to improper settings of parameters. The desire to eliminate insufficient parameter setting that impacted the imperfect welding process together to enhance cost efficiency of experiments and tests was the main motivations of this dissertation. The main influence of friction stir spot weld parameters on the mechanical properties of friction stir spot weld Aluminium alloy 5052-H112 with 2 mm thick was investigated. Based on investigation via ANOVA, it was shown that spindle speed had 45% contributions to the tensile shear load. Meanwhile, the tool dwell time had 53% contribution to the fatigue endurance cycles. In the failure mode investigation, complex failure mode with complex failure mechanisms in the large bonded region with large nugget composition show hard shear fracture called Nugget-Upper-Sheet-Fracture (NUSF) mode. Furthermore, by employing a higher level * parameter configuration, the characteristic of friction stir spot weld improved significantly where formed equiaxed fine grain structures with minimum grain size approximately 10/xm, increased Hardness-Value up to 77 HV, and uniform temperature distribution across the welding zones with a maximum temperature of 541°C in the vicinity of the keyhole. Finally, the study is continued with development of the prediction model for the output performance of tensile shear load using Artificial Neural network. The artificial neural network was achieved the Normalize Root Mean Squared Deviation (NRMSD) of 15.7% deviation of error for all patterns. The results show a good correlation between the actual value from the experimental tensile shear load test and artificial neural network prediction model. This was in good to acceptable justification.

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