

Influence of Machine Variables and Tool Profile on the Tensile Strength of Dissimilar AA7075-AA6061 Friction Stir Welds

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ABSTRACT

Friction stir welding (FSW) of dissimilar alloys and

materials is becoming progressively essential as it permits to take the benefits of both materials. Tensile strength is a measure of the weld quality, which mainly depends on machine variables and tool design. In this paper, FSW of dissimilar AA7075-AA6061 aluminium alloys was studied with respect to the welding speeds (rotational and axial), tool tilt angle and tool geometry by the response surface methodology (RSM) with central composite design (CCD). A reduced secondorder polynomial equation was successfully developed and validated to adequately fit the observed results of the ultimate tensile strength (UTS). Respectable fitness and well agreement between the experimental and calculated values with an elevated regression coefficient and low deviation were detected for this model within the range of the operating variables. Five tools with concave shoulders and different probe profiles (cylindrical and tapered, smooth and threaded, flatted and non-flatted) and a self-designed backing plate and clamping system were fabricated for this study. It was found that the welding tool with a threaded truncated cone pin and single flat results in a sound weld with higher tensile strength, wide nugget area and smooth surface finish.

KEYWORDS:

Aluminium alloys; Friction stir welding; Statistical analysis; Tensile strength

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