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Study the impaction tool speed on the friction stir welding of magnesium alloys plates

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Abstract

Reduction of materials weight is an innovative process in the current materials engineering works which causes lesser fuel consumption in any automotive. Magnesium alloys (Mg) is one of the most preferable lightweight structural material and it provide both potential and economical aspects in terms of rich material properties. In this study, dissimilar Mg alloys of AZ80A - T5 and AZ91C – T6 plates joined by the Friction Stir Welding (FSW) method by using tapered cylindrical tools with three different speeds of 500, 750 and 1000rpm are used for the study. The optimum rotational speed was suggested for the FSW welded magnesium alloy plates based on the macrostructure and SEM images.

Introduction

The conventional welding styles have some limitations for joining magnesium blends due to their high cracking vulnerability, high-energy conditions, and high erosion of magnesium to the bobby electrode [1]. Magnesium Alloy has an abundant material supply, the unique characteristic properties of Mg alloys like high specific strength, excellent damping capability, low density, good modulus of elasticity, preferable specific rigidity, high stiffness, good heat conductivity, easy machinability, cast-ability, high strength to weight ratio, etc. Welding of Mg alloys by fusion welding techniques like laser beam welding, electron beam welding, etc has not resulted in high-quality joints due to the reasons like the formation of brittle intermetallic, higher distortion & oxidation, and partial melting, formation of defects like hot cracks, porosity, etc. At high temperatures, Mg alloys are readily oxidized due to their strong affinity for oxygen chemical reactivity nature and pure shielding gases should be employed to avoid contamination in weldments. Furthermore, because solidification and melting play a significant role in determining microstructural characteristics, they cause problems such as residual stresses to arise during these welding processes. Mg Alloys are lighter in weight when compare to aluminium. Hence, the usage of Mg alloys for the transportation industries requires the identification of a reliable, suitable & inexpensive welding process [2].

Section snippets

Literature review

The FSW offers a wide range of advantages, it could be seen from our literature review that, only very few investigations have been done concerning FSW of Mg alloys [3]. At the same time, when compared to other high-strength alloys such as aluminium, the number of published research articles and experimental papers on friction stir welding of Mg alloys is lower. Friction stir welding is a solid-state process, it does not require the use of flux or filler metal. Furthermore, the majority of the…

Friction stir welding (FSW) machine

The FSW work is carried out of AZ80A - T5 and AZ91C – T6 magnesium plates were joined under a standard feed rate of 75 mm/min under standard FSW technique parameter conditions. Tapered Cylindrical specially designed FSW tool is used with a desk length of 810×four hundred mm and a spindle speed starting from 500 rpm, 750 rpm and 1000 rpm were used. The spindle motor in this system produces a three-ton mechanical direct axial pressure in the perpendicular route. Likewise, the device has 510 mm…

Weld surface and macrostructure examination

Weld shells and macrostructural pix attained at the point, device rotational speed starting from 500, 750 and 1000 rpm are proven in desk three. Blights similar to perforations and lair blights have been found in weld shells fabricated at device rotational pets of 500–750 rpm because of inadequate heat technology and above 1000 rpm because of indecorous and fats influx of plasticized essence because of inordinate warmth generation, in line. Fig. 3 shows Defect-free joints: Proper flow of…

Conclusion

This experimental exploration study of dissimilar Mg alloys of AZ80A - T5 and AZ91C – T6 plates joined by Friction Stir Welding (FSW) method by using tapered cylindrical tools with three different speeds of 500, 750 and 1000 rpm. The results reveal that the rotational velocity has a great effect on joining the materials the macroscopic and SEM microstructural images are also evidenced that the welded joints. In this work, 75 mm/min used the constant feed rate value of the taper cylindrical pin…

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.…

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