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An Experimental Study on Mechanical Behaviour of Pulsed Current Welding on Aluminum Alloy Joints

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Abstract: Aluminum alloys (Al–Si–Mg alloys) have gathered wide acceptance in the fabrication of light weight structures requiring high strength-to weight ratio, such as transportable bridge girders. An improvised method is Pulsed current tungsten inert gas (PCTIG) welding (Developed in 1950s). The pulse current is more frequently used in manual welding because it has a lot of advantages in comparison to direct current. The main advantages are improved bead contour, greater tolerance to heat sink variations, lower heat input requirements, reduced residual stresses and distortion. In the present work to study the effect of PCTIG welding over continuous current TIG welding, work plates of 6 mm thickness have been used as the base material for preparing single pass welded joints. Single V butt joint configuration has been prepared for joining the plates. The filler metal used for joining the plates is AA 5356 (Al–5Mg (wt%)) grade aluminum alloy The preferred welding processes of moderately high strength aluminum alloy are frequently tungsten inert gas welding (TIGW) process. Two different welding techniques are used to fabricate the joints and they are: (i) continuous current TIG welding (CCGTAW) (ii) pulse current TIG welding (PCGTAW) processes. Argon (99.99% pure) has to use as the shielding gas. This report presents the effect of pulsed current TIG welding on mechanical behavior of high strength aluminum alloy joints, and studying about the grain refinement of weld bead, conducting the mechanical tests such as tensile test, impact test, and hardness test. Pulsed current welded joints have given superior mechanical properties comparative to continue current welded joints. PCTIG welded joints given high tensile strength, hardness and impact strength values. Current pulsing leads to relatively finer structure.

Introduction

Medium strength aluminum alloys (Al-Mg-Si alloy) have gathered wide acceptance in the fabrication of light weight structures requiring a high strength-to weight ratio. Such as military vehicles, road tankers and railway transport systems. The preferred welding process for aluminum alloy is frequently TIG (tungsten inert gas) welding due to its comparatively easier applicability and better economy. In the case of single pass TIG welding of thinner section of this alloy, the pulsed current has been found beneficial due to its advantages over the conventional continuous current process. The use of pulsed current has been found to improve the mechanical properties of the welds compared to those of continuous current welds of this alloy due to grain refinement occurring in the fusion zone. Weld fusion zones typically exhibit coarse columnar grains because of the prevailing thermal conditions during weld metal solidification. This often results in inferior weld mechanical properties and poor resistance to hot cracking. It is thus highly desirable to control solidification structure in welds and such a control is often very difficult because of higher temperatures and higher thermal gradients in welds in relation to castings and the epitaxial nature of the growth process.

Literature Survey

V.Balasubramanian, *et al*. [1] presents in this paper an attempt has been made to refine the fusion zone grains by applying pulsed current welding technique of high strength alumimunm alloy (AA7075), Single V butt joint configuration has been prepared for joining the plates. The filler