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RESEARCH ARTICLE

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A Study on effects of pulse parameters on the bead geometry of welded Aluminium Alloy 7039

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ABSTRACT

The pulsed-current Gas Tungsten Arc (GTA) Welding process is employed for a high rate of current rise, decay and a high pulse repetitive rate, widely used in the joining of precision parts. The main aim of pulsing is to achieve maximum penetration without excessive heat built-up. The use of high current pulses is to penetrate deeply and allow the weld pool to dissipate some of the heat during a proportionately of longer arc period at a lower current. Aluminium Alloy 7039 is employed in aircraft, automobiles, high-speed trains and high-speed ships due to their low density, high specific strength and excellent corrosion resistance. The present paper depicts the application of Pulsed GTA welding for AA7039 using pure argon gas as a shielding gas with sinusoidal AC wave. In this investigation, the bead geometry and metallographic study of welded (AA7039) aluminium alloy have been carried out at various pulse currents, secondary currents, pulse frequencies and duty cycles.

Key words : Pulsed GTA Welding, Aluminum Alloy 7039, Bead Geometry, Microstructure

INTRODUCTION

The GTAW process is one of the most well established processes, which can weld all metals of industrial use and also give the best quality welds among the arc welding processes. The basic requirements of all GTAW processes are similar, *i.e.* a power source, a hand or machine manipulated torch, a pressurized supply of a suitable inert gas or gas mixtures from cylinders and cables of correct size to conduct welding current from the power source to the torch and tungsten electrode. Zeytsev in1953 developed the pulsed GTAW process in the Soviet Union. GTAW is the best preferred welding process for high strength aluminium alloys due to easier adaptability and better economy. Pure tungsten electrodes, zirconiated tungsten electrodes, thoriated tungsten electrodes, ceriated tungsten electrodes, lanthanated tungsten electrodes and other tungsten alloy electrodes are used in the TIG welding process. Argon, helium, argon-helium, argon-hydrogen, helium-hydrogen, and nitrogen are used in this process as shielding gases.

A demand for lighter and stronger aluminium armour for protection against high explosive shell fragments in the early 1960s led to the introduction of AA7039. It is a heat treatable and weldable aluminium alloy having 4.5% zinc and 2.5% magnesium. Magnesium is added for improving the mechanical properties, corrosion resistance and machinability. Zinc is usually added to improve the mechanical properties through formation of the hard intermetallic phases, such as Mg_2Zn. Heat treatable aluminium alloys are widely used in aircraft structural applications and are susceptible to localized corrosion in chloride environments, such as pitting, crevice corrosion, intergranular corrosion, exfoliation corrosion and stress corrosion cracking.

AA7039 is employed in aircrafts, automobiles, high-speed trains, lightweight transportable bridges, armour plate, military vehicles, road tankers, railway transport systems and high-speed marine applications due to their low density, high specific strength and excellent corrosion resistance. It was used in the armoured hulls of M551 light tanks and XN723 IFV in USA. AA7039-T64 exhibits better performance against ball and armour piercing than AA5083.

Welding of aluminium and its alloys presets some peculiarities in contrast to ferrous materials, due to the physical and chemical properties of aluminium like passive oxide layer, high thermal and electrical conductivity, low fusion temperature, heat coefficient of thermal expansion, solidification shrinkage and high solubility of hydrogen and other gases in molten state. Further problems can rise when attention is focused on heat-treatable alloys, since

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