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Joining of Dissimilar Material in MIG Welding – A Review

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ABSTRACT

Joining of dissimilar metals has found its extensive use in nuclear reactors, power generation, electronic, petrochemical and chemical industries because of environmental concerns, high performance, cost saving, energy saving and other factors. However efficient welding of dissimilar metals has posed a major challenge due to difference in thermal, mechanical and chemical properties of the materials to be joined under common welding condition. A variety of problems arises in welding dissimilar materials like cracking, causing stress concentration on one side of the weld due to migration of atoms during welding, large weld residual stresses, tensile and compressive stresses, cracking, etc.

Keywords: MIG, GMAW, MAG, Dissimilar Material

I. INTRODUCTION

MAG (Metal Active Gas) welding, also known as MIG (Metal Inert Gas) and GMAW (Gas Metal Arc Welding), is a widely used process for welding a variety of materials. Presently, in every large or small industry, welding is used for fabrication process. Welding is a process of joining similar or dissimilar material by application of heat with or without application of pressure and addition of filler material. An arc is produced between work and continuous wire feed. The selection of technique for welding depends on cost, precision required, size and shape of component, material availability. Our main focus is on tensile strength of welded joint.

II. LITERATURE REVIEW

Amit Kumar et al. [1], have carried out research work in optimization of MIG welding parameters using Artificial Neural Network (ANN) and Genetic Algorithm (GA). For prediction of welding parameters such as welding speed, welding current and welding voltage and ultimate tensile stress they have used the ANN method for development of mathematical model for dissimilar material like stainless steel of grade 316 and 304. Full factorial method and argon gas as shielding gas have been used in experiment. Genetic Algorithm (GA) was used to optimize the parameter. From this experiment, they concluded that maximum ultimate tensile strength was achieved at 18 V welding voltage, 43.2362cm/min travel speed and 110 A welding current. Also, Artificial Neural Network (ANN) was successfully integrated as another regression model.

Ajit Hooda et al. [2], developed a response surface model to predict the tensile strength of Gas Metal Arc welding joint of AISI 1040 medium carbon steel. The input parameters such as wire speed, voltage , gas flow rate, and welding voltage were chosen. From this experiment they inferred that for current value of 190A and 210A yield strength for both transverse and longitudinal remains same at wire speed 2.4 m/min, gas flow rate 12 l/min and welding voltage 22.5 V.

M. Aghakhani et al. [3], did research work on parameter such as increased productivity and quality of weldmet. They have tried optimize process parameter in gas metal arc welding. They used shielding gas as mixture of 20% CO2 and 80% of argon gas and material of ST-37 steel as plate. To increase productivity and quality of weldmet parameters, input parameters such as gas flow rate (G), nozzle to plate distance (N), feed rate (W), welding speed (S) and welding voltage (V) were taken and weld dilution as output parameter. For weld dilution they have developed mathematical model whose

analysis was carried out by ANOVA method and Taguchi's L25 orthogonal array was used. They concluded that weld dilution had no effect on gas flow rate while wire feed rate showed the most significant effect on weld dilution.

Abdul Wahab H. Khuder et al. [4], have studied the effect of welding joints between dissimilar metals by varying process parameter in MIG welding. Austenitic stainless steel-type AISI 316L and carbon steel were selected as base material for the research. CO2 was used as shielding gas and E80S-G as filler metal for joining those dissimilar metals. In this experiment input parameters were taken as weld current, feed of wire and time of feed. Here, the change in diameter and shear force was predicted using these parameters. Through this experiment they concluded a decrease in shear force with increase in weld time and an increase in shear force with increase in welding current. Also with increase in welding time and welding current, the weld zone diameter would increase and shear force would decrease.

Monika K. et al. [5], have analysed the effect of heat input on the mechanical properties of dissimilar joints through MIG welding. Heat input was determined through speed of wire, welding voltage and current. They have taken material IS 45 C8, IS 103Crl and IS 2062, wire of copper coated mild steel having 1.2mm diameter for filler. At both the joints (IS 103 Cr1& IS2062) and (IS 45 C8&IS 2062), for decrease in heat input there was increase in hardness value and for increase in heat input there was increase in tensile strength.

Rajkumar Duhan et al. [6], developed a response surface model to predict the tensile strength of Metal inert gas welding. They have taken EN 31(AISI 50110) high carbon steel material for welding, input parameters as welding current and voltage. To predict the tensile strength mathematical model was developed and ANOVA method was used for analysis of welding parameter. They have analyzed that the tensile strength was greatly affected by welding voltage.

Pradip D. Chaudhari et al. [7], have studied the effect of tensile strength on SS 3Cr12 steel material by varying process parameter in Metal Inert Gas (MIG). They have taken input parameter as gas flow rate, welding voltage, welding speed and wire feed rate. Analysis was done in Minitab-17 software and central composite design matrix was designed for this research work. From this experiment they concluded that with decreasing the value of welding voltage and wire feed rate, and increasing the value of gas flow rate and welding speed, the tensile strength is increased.

III. CONCLUSION

In MIG welding process, there are several important parameters need to concern. These parameters are arc voltage, amperage, travel speed, welding current, flow rate of gas, wire feed speed, welding direction, free wire length ,torch angle, nozzle distance, electrode extension, and the welding position. However, wire electrode composition and its diameter, type of protective gas are the defined parameters which are kept unchanged during the process. During the study we have seen that many difficulties have been arise.

Mechanical properties, weld-bead geometry define the quality of weld bead. All processes used having aim of obtaining weld bead and weld joint with the desired parameters to achieve good quality surface and excellent mechanical properties. Implementation of Design of Experiment through ANN method to develop mathematical relationship between input parameters and output parameters.

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