IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

ANALYSIS OF DISSIMILAR JOINING OF STAINLESS STEEL AND MILD STEEL USING MIG WELDING

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Abstract-This paper investigates the effectiveness of Metal Inert Gas (MIG) welding in joining dissimilar metals, specifically stainless steel and mild steel. The study explores the challenges associated with welding two different metals and the effect of welding parameters on the quality of the joint. The experiments were conducted by varying welding parameters such as welding current, voltage, and welding speed. The weld quality was evaluated by examining the hardness and weld width of the joint. The results indicated that the welding parameters significantly influenced the quality of the joint. It was observed that the welding current and voltage had a significant impact on the joint hardness. Overall, the study provides valuable insights into the welding of dissimilar metals and offers a guideline for selecting appropriate welding parameters to achieve a high-quality joint.

Keywords: **Metal inert gas welding; Weld width; Response surface methodology; Optimization.**

1. INTRODUCTION

Dissimilar metal welding is a process that involves joining two metals with different chemical compositions and properties. One of the most common dissimilar metal combinations is stainless steel and mild steel. This combination is widely used in the manufacturing of various products, such as pipes, tanks, and automotive parts. MIG welding is a widely used welding process for joining dissimilar metals due to its high welding speed, ease of use, and low cost. However, MIG welding of dissimilar metals can be challenging due to the difference in their properties, which can lead to the formation of brittle intermetallic compounds and poor weld quality. The MIG welding of dissimilar metals, specifically stainless steel and mild steel, with the aim of identifying the optimal welding conditions for producing sound welds with adequate mechanical properties. The study focused on the effects of process parameters, such as welding current, voltage, and travel speed, on the weld quality and microstructure. The experiment needed a commercial MIG welding machine and a range of filler wires with varying compositions and also a MIG welding machine and mild steel has been used as filler wire. The outcome can be useful for selecting the appropriate welding parameters for MIG welding of dissimilar metals, specifically stainless steel and mild steel. The findings can also help to improve the understanding of the mechanisms of formation of intermetallic compounds and their effects on the properties of the weld.

Literature Review -Rajendra singh & Dr. SS Dhami [1] - discussed the parametric optimization of Metal Inert Gas (MIG) welding of stainless steel (316) and mild steel using the Taguchi technique. The study focuses on identifying key process parameters that influence the quality of the weld joint and developing an optimal combination of these parameters for enhanced weld quality. The study highlights the potential of the Taguchi technique as an effective method for process optimization in MIG welding of dissimilar metals. J. P. Ganjigattiet al. [2] – focussed on regression analysis to establish input-output relationships of the MIG welding process. Both linear and nonlinear regression techniques are employed to analyse the effects of welding parameters. Results are compared and some concluding remarks made, adding to the literature on statistical methods for modelling MIG welding. Kumar Rahul Anand & Vijay Mittal [3]- Carried out the optimization of TIG welding parameters for a joint of AISI 316 stainless steel and mild steel using the Taguchi method. He carried out the experiment on parametric optimization of CO2 welding. The study found that arc current, voltage, and gas flow ratio significantly influenced the joint's mechanical properties. The optimized parameters for maximum tensile strength and hardness were identified. Vishal Chaudhari et al. [4] - investigated the use of TIG welding to join stainless steel 304 and mild steel materials. The Taguchi method was employed to optimize the welding parameters, including current, voltage, and gas flow rate, which significantly influenced the joint's tensile strength and hardness. The study also used Taguchi's orthogonal array and analysis of variance to investigate welding characteristics. Abhishek Prakash et al. [5] - investigated the Tungsten inert gas welding process on ASTM A29, with welding current having the greatest influence on tensile strength and hardness. Optimal conditions were determined for both properties using welding current, voltage, and wire speed. Mrugesh Solanki & Ketan Shah [6] - aimed to optimize the Tungsten Inert Gas (TIG) welding process for dissimilar metals by using the Response Surface Methodology (RSM). The results showed that welding current had the greatest impact on ultimate tensile strength and microhardness. The formation of steel and copper globules in the fusion zone was also observed. N. Murugan & R.S. Parmar [7] – found that voltage affects with weld width. Compared to other parameters, voltage has a stronger influence on the width, as the width remains constant at 31 and 34 volts regardless of the speed and wire