International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 09 Issue: 07 | July 2022 www.irjet.net p-ISSN: 2395-0072

# "EXPERIMENTAL INVESTIGATION OF MIG WELDING PARAMETERS FOR HARDNESS AND WELD-BEAD QUALITY"

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**Abstract -** ***I****n the modern era, in metal joining industries, the requirement of the metal joining is to manufacture better surface hardness and good quality welds. The MIG welding machine is specialized in joining complex shapes with better surface quality as compare to other conventional welding processes. The present study on MIG welding machine performed on bright Mild Steel AISI1025 is conducted to found the affect of various factors like welding current(A), welding voltage(V) and weld speed(mm/sec) on hardness and surface quality. In this research I used to perform welding over various specimens and check their hardness using Rockwell hardness tester and surface quality using the SEM.*

## 1. INTRODUCTION

The process of MIG welding works on the principle of developing a joint due to melting faying layers of the work-piece metal by utilizing the heat created by an arc of welding generated between work-piece specimen and a consumable electrode. To defendthe arc of welding and weld-pool shielding dormant gas (inert gas) is used which comes outside from the nozzle and make a cover in circular manner through out the arc produced and weld pool. Metal Inert Gas Idle Gas welding isn't considered as spotless as 'Tungsten Inert Gas' welding becase of the variety in adequacy of protecting gas to secure the weld pool.The arc produced in 'MIG' welding is relatively longer in length and has less stability as compared to TIG welding arc. The stability is different for 'MIG and TIG' arcs as in MIG, the arc is formed between 'parent metal or work metal and the consumable electrode while in the case of TIG welding, arc is creaated between work metal and "non-consumable tungsten electrode". Dependability of 'arc'is diminished due to the proper utilization of the anode amid welding and consequently we accomplish less compelling protecting of the weld-pool for MIG welding than TIG welding. MIG welding procedure and TIG welding are like each other aside from that MIG uses a consequently bolstered consumable anode henceforth it offers high statement rate and beside these lines it is reasonable for first-class quality weld-bead joints that are required in mechanical creation

## LITERATURE REVIEW

Rakesh Kumaret al. [1]Investigation of mechanical properties in mild steel utilizing metal idle gas welding. The point of the present investigation is to demonstrate the impact of various information parameters, for example, welding current(A), circular arc voltage(v) and root hole on the mechanical properties amid the Metal Inert Gas Welding (MIG) of gentle steel 1018 review. He utilized tagauchi improvement technique. As per his analysis arc voltage(V) has the more prominent effect on the hardness of the weldpool. through their examination found that the most astounding elasticity was accomplished at 180 A current, 35 V voltage and 4 mm root hole while the greatest hardness was seen at a welding current of 180 amp, circular segment voltage of 40 volt and root hole of 3 mm.

Yugang Miao et al.[2] Impact of Heat Input on Microstructural and Mechanical Properties of weld-Joints Made by Bypass-Current MIG Welding-Brazing of Magneseum Alloy to coated-Galvanized Steel.

K. Abbasi[3] in their investigation found that when speed is taken as factor parameters, infiltration profundity increments with increment in speed upto an ideal estimation of 1450 mm/min, past that speed entrance begins diminishing. These specialists additionally found that when the warmth input is viewed as, the profundity of infiltration will increment with warm contribution till 109 J/min. Past this esteem, the entrance insight will diminish.

Sanjay A.Patil et al. [4] amid the examination while finding the impact of welding current(A), welding voltage(V), welding on a definitive rigidity (UTS) of AISI 1030 mellow steel material amid welding process utilized Taguchi strategy for planning the investigations and investigation of difference was utilized for concentrate the welding qualities of material and upgrade the welding parameters.

Chandresh N. Patel et al. [5] in the researchs of plan of trial strategies received the dark social examination (GRA) improvement system, where the info parameters for MIG welding chose were welding current, wire wideness and wire encourage rate and the execution measure was hardness. Another examination conveyed by.

Ajit Hooda et al. [4], they built up a RSM demonstrate for foreseeing rigidity of idle gas metal MIG welded AISI 1040 medium carbon steel. Welding voltage(V), current(A), and wire speed(mm/sec) and gas stream rate were picked as the parameters of the machine. RSM procedure was connected

for streamlining the MIG welding process parameters in order to achieve the most extreme yield quality of the joint.

S.Utkarsh et al. [5] in their examination considered the impact of information parameter, for example, welding current(A), welding voltage(V), gas stream rate in l/min and welding speed in mm/sec in order to ponder the "Ultimate Tensile Strength"(UTS) of 'ST—37' low amalgam mild steel material in MIG Welding (GMAW). Tests were done by utilizing L9 orthogonal cluster.

Sudesh Verma et al. [6] examined the advancement of information parameters of metal inactive gas welding by utilizing Taguchi Method of investigation outline for dab width and dot tallness. They found that every parameter has effect on the yield parameters.

Srivani Valluru et al[7] in their research they reveals that Weld-bead Area Hardness is more than the 'parent metal hardness' and less than the Hardness of Heat affected zone(HAZ).

Sindiri Mahesh et al.[8] using their experiments he found that with increasing in the levels of the fixed parameters for MIG weldingg of AISI-1050, the tensile strength of welded – metal joint is enhanced and all the selected parameters have shock on the strength of the joint.

Sanjay A. Swami et al [9] carried out the research and it was obtained that the gas flowing rate has greater contribution in increasing the tensile.strength of welded joint followed by welding current & gas combination. Gas flowing rate has 93% contribution followed by welding current & gas combination An empirical relation is developed for correlating the tensile strength of welding joint with the process parameters. The correlation coefficients reaches close to 0.9 indicates that the developed model is significant. Therefore this prototype can be efficiently used for the prediction of the responses within the area of the welding parameters.

Manoj Singla et al.[10] By their examination reasoned that the Welding current was observed to be most impacting variable to WDA. At the point when a consistent warmth input is given, and the welds are made utilizing cathode negative extremity having a little width anode and low voltage with low welding speed, it deliver substantial dot region. Best plan was found for two level fragmentary half zone partial outlines to measure to primary and collaboration impacts of variable on the weld globule territory.

Pushpendra Kumar Sharma et al [11]through their examination found that the Tensile quality of weld increment in extent to the weld dab width, due to the higher MIG parameters we watch more extensive weld head amid the development weld dot hardness. Hardness esteems are comparable in them two.

Biswajit Das, B. Debbarma et al [12]through their examination inferred that the higher voltage (> 26.5 V) causes sudden ascent in entrance profundity esteem, though high present (> 150 An) additionally causes the same. High welding speed (> 0.16 m/min) cause a lessening in entrance profundity.

H.J. Park et al. [13] through their examination for improving the wire nourish speed against the welding speed while performing MIG lap joint filet weld of 1.6 mm on aluminum amalgam. The analyses were conveyed with different wire bolster speeds and the dot qualities were assessed. The wire nourish speed was essentially improved for different welding speeds in their exploration.

Vikas Chauhan et al. [14]conveyed an examination for concentrate the disparate metal plates joined by MIG welding. Current, voltage and travel speed were decided for the examination. Taguchi procedure was utilized to design the examination configuration to obtain the information. The impact of each factor was inspected by utilizing the ANOVA.

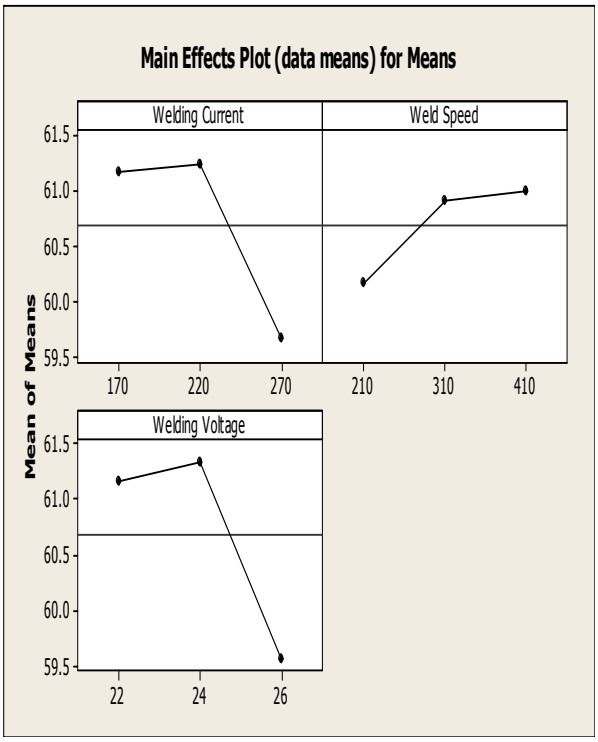
S.Sivakumar et al.[15]as in their study they tries to find out the affect of variousfactors on welding depth, micro structure and measurement of hardness for(AISI1045)mild steel of 6mm thickness by using MIG **welding.**

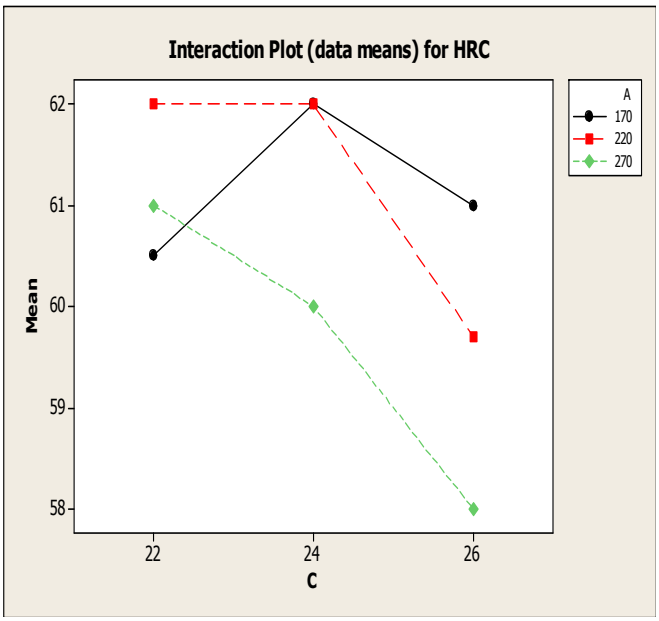
**Experimentation L9 Orthogonal Array**

| S.No. | Welding Current | Weld Speed | Welding Voltage |
|---|---|---|---|
| **1** | 170 | 210 | 22 |
| **2** | 170 | 310 | 24 |
| **3** | 170 | 410 | 26 |
| **4** | 220 | 210 | 24 |
| **5** | 220 | 310 | 26 |
| **6** | 220 | 410 | 22 |
| **7** | 270 | 210 | 26 |
| **8** | 270 | 310 | 22 |
| **9** | 270 | 410 | 24 |

**ANOVA of Hardness**

| Source | DOF | SS | Adj MS | F Value | Contribution |
|---|---|---|---|---|---|
| **Welding Current** | 2 | 4.709 | 2.354 | 1.95 | 33.47% |
| **Weld Speed** | 2 | 1.242 | 0.621 | 0.52 | 8.83% |
| **Welding Voltage** | 2 | 5.709 | 2.854 | 2.37 | 40.57% |
| **Error** | 2 | 2.409 | 1.204 | | 17.13% |
| **Total** | 8 | 14.069 | | | 100% |




## CONCLUSIONS

Hardness initially have negligible influence with both "welding current(A) and welding voltage(V)" but with extra increase in their levels, hardness going to decrease.

With increase in welding speed, initially hardness increase at a faster pace but with extra increase in weld speed the hardness increases at a slower pace.

Hardness first increases then get decreases with welding voltage(V). Here also the same pattern can be seen.

Welding voltage is the mainly affecting constraint for hardness with a role of 40.57%.

Welding Voltage(V) is the most convincing factor for hardness (HRC). Here also we achieved the same outcome.

The second most dominating factor found for harness of the weld-bead joint is welding current(A) with a part of 33.47%.

Welding speed(mm/min) is the least affecting constraint for hardness with a part of 8.83%.

The porosity at lower level is because of few quantity of air disturbed the delivery of shielding gas. The MIG welding gun is laid at such an angle that it spreads the flow rate of gas out and actually sucks in the atmosphere from the back side, opposite the nozzle direction.

At 170 Ampere welding current, 410 mm/sec weld speed and 26 V welding voltage. Odd surface of the weld-bead is seen but none of the flaws are visible on the surface of the weld and a good weld joint is obtained.

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