Effect of Shielding Gas Control : Improving the strength in Welded Joints by changing the Gas Mixture in GMAW Welding.

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ABSTRACT:-

Many research activities were developed in order to study the strength in welded joints by using the minimum coast & time. So, We tried to do the research for increasing the Penetration rate & flow rate in mild steel materials by using the different proportions of shielding gases . To achieve the better strength in Welded joints is the key factor in any type of welding to sustain in the competitive market. Initially we tried to do the analysis by using the different shielding gases then we used different proportions in gas welding mixture.

KEYWORDS:-

1) Argon & Helium Gas mixture in Welding

2) Strengthening the Welded Joints in MIG Welding.

3) Better Flow Rate in MIG Welding

4) MIG Welding Process Optimization Parameters.

INTRODUCTION:-

MIG welding is a welding process in which an electric arc forms between a consumable wire electrode and the work piece metal, which heats the workpiece metals causing them to melt &join. Along with the wire electrode, a shielding gas feeds through the welding gun, which shields the process from contaminants in the air. Four primary methods of metal transfer in MIG called globular, short circuiting, spray and pulsed spray. Nowadays MIG is widely used in various constructions such as Pressure vessels,steel structures, bridges ,autos, motorcycles, construction machinery, pressure vessels and pipelines due to high welding efficiency. The strength of MIG welding is greatly affected by the shielding Gas mixture and types of shielding gas is being used.

It has been found from the past that sometimes Fabrication Industries could not able to fetch the Repetitive orders because after sometimes of Fabrication,End users are complaining the leakage problems in the Pressure Vessels and others as well. During our study I had observed that fabricators are using the CO2 as an inert gas along with other inert gases as it is cheaper and easily available. However it will create several weld defects in long duration.

To Overcome those Problem I did an extensive studies to find out the Long term solution by using the several different mixtures and rigorous testing into the particular problem. During Experiments I have performed numerous different types of mixture in shielding gas and also change the percentage of mixture into the products and find out the optimal solution which is being describe in detail in the Working & Conclusion section.

WORKING:

- First I tried to add the oxygen with 8-9 % typically in the range, which improves arc stability, provides cleaning action, and improves the wetting action and bead shape of the weld. Oxygen is a stronger oxidizer than CO_2, so a lower concentration is needed; however, it may require a filler metal with higher levels of deoxidizers to scavenge up the free oxygen to prevent porosity .

Fig. 1 MIG Welding Gun

- Secondly try to use the CO_2 produces a sound weld with good mechanical properties. The downside is it doesn't produce the most stable arc and typically generates a fair amount of weld

spatter. Additionally, CO_2 is not capable of producing the spray-transfer mode in the GMAW process. to overcome this problem Argon is an inert gas that does not react with anything. It is more expensive upfront compared to CO_2, but that doesn't necessarily mean it's more expensive to use. Its many benefits make it a desirable shielding gas for many applications. Argon can be used by itself to weld any ferrous or nonferrous base material. Small additions of other shielding gases are added to it to produce certain desired welding effects, such as helium for higher travel speeds or CO_2 for cleaning action in the weld.

Fig. 2 Mig Welding Apparatus

- Now by Removing the CO2 & O2 as a shielding Gas and addition of the Argon & Helium inert Gas. After this I have analyzed with different Proportion of Argon & Helium. While increasing the Percentage of Argon I could not able to get the better Penetration Rate .If I Could not able to get the Better Penetration Rate then on thick materials I could not able to achieve that much strength . I changed the proportion and increased the percentage of Helium than Argon I have found out that Penetration rate is far better than the previous one along with Flow Rate .If Penetration rate is better ,Arc is almost stable and flow rate is also higher while
adding the more amount of Helium then better to go with that option however cost is comparatively Higher in Helium than Argon .But after looking in to all other advantages Cost is not the Prime issues than the leakage Problems as Leakage Problem can cause a much more cost than one time Higher Cost of the Helium.By putting 70 % of Helium I could able to achieve the more strength in the M.S. Materials .After increasing from 70 Helium I have found out the Arc initiation problem. thats why if Strength is the Prime issues then better to use the Argon and Helium mixture rather than traditional Co2 & O2 mixture.
    - Helium has a Better Ionization Potential than Argon as Helium has the Ionization Potential is +25 ev thats why the Penetration Rate & Flow rate is Higher in Helium than Argon.

Fig. 3 Pressure Gauge

Fig. 4 Specimen after using the 80% Helium +20 % Argon

Fig. 5 Final Weld Sample

SUMMARY:-

- The project carried by us is a step to move towards better strength solution GMAW welding Process .
- Several Industries who are not aware about the % of Gas mixtures ,Now then can try to use this for better Product and enhancement of the customer retention ratio.
- That will help the Organization to create their Brand image among the customers.

CONCLUSION:-

Now a Days CO_2 + O2 or CO2 + Argon are being used as a shielding Gas for the cost effective solution however as I have explained the New mixture Argon + Helium with higher percentage of Helium will help to boost the penetration rate and flow rate that can lead to achieve the better strength .

REFERENCES:-

- https://en.wikipedia.org/wiki/Gas_metal_arc_welding
- Manufacturing Process - II by Dr. H.N.Shah, Books India Publication,Vol.2
- https://www.sciencedirect.com/science/article/pii/S1877705812027427
- Manufacturing Process by O.P.Khanna Vol 5 ,2017
- http://www.ijmerr.com/uploadfile/2015/0409/20150409123345146.pdf

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