Tungsten Inert Gas Welding-A Review

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ABSTRACT: ***Tungsten inert gas (TIG) welding or gas tungsten arc welding is a welding method that involves a non-consumable tungsten electrode. TIG is one of the most commonly used metal joining methods in the manufacturing industry around the globe. Much scientific work has been performed in the field of TIG/GTAW welding but this is still an area of research in any particular sector. A lot of research work has been conducted on the basis of modifying the process parameter and several have even been put out using optimization techniques, etc.***

KEYWORDS: Arc, GTAW, Optimization Techniques, TIG, Welding, Metal process, Gas tungsten, Electrode.

INTRODUCTION

Basic welding processes are just as ancient as metal working on its own. Even before the Iron Age began, the ancient gold workers learned how to heat up two bits of gold and pound them together. The early brazing method is found in numerous gold artefacts in Egypt and has been dated back to 3000 BC. However, the oldest technique, close to modern-day welding, was done by blacksmiths in the Middle Ages [1]. The method consisted of heating up the ends of two bits of metal, sticking them together and hammering them together until the two ends were finished together. The second was to prevent the slag from forming. Slag is the solidification of undesirable compounds that may be contained within a weld.

1.1 GTAW: Gas tungsten arc welding (figure 1), also known as tungsten inert gas (TIG) welding, is an arc welding process that uses a non-consumable tungsten welding electrode. The metal filler is applied from an external source, typically as a bare metal filler rod. The welding pool area is shielded from the atmosphere and potential pollution by inert gas insulation, such as argon. A filler metal is usually used, but some welds, such as autogenous welds, do not require it. GTAW is ideally suited for forging thin parts of stainless steel and light metals such as titanium, magnesium and copper alloys. The process helps the operator to exert more control over the welding process than other processes, resulting in stronger, high-integrity welding. The downside is that GTAW is more complicated and slower than many other welding methods [2].

Gas tungsten arc welding (GTAW) is used for the welding of thin section tubes and sheets (up to around 7 mm wall thickness) and for root runs (and second passes) in thicker materials [3]. These joints can be completed using processes with higher deposition speeds, such as GMAW, SMAW, SAW, FCAW, etc. GTAW provides a high degree of control and typically delivers a reasonable quality root profile with mechanical and corrosion properties reaching the base materials, providing that the dilution is controlled (around 30 percent). One way to eliminate dilution is to allow a greater root distance than the wire diameter, which means that the welder applies ample filler [4].

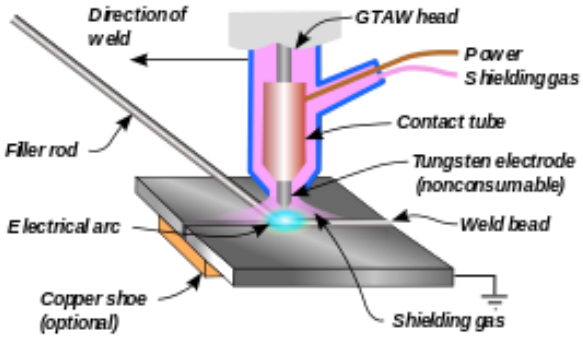

Figure 1: Gas Tungsten Arc Welding

1.2 Working of TIG: TIG welding is an arc welding process that uses a non-consumable tungsten electrode to create the weld. The welding field is shielded from the atmosphere by inert gas shielding (argon or helium) and the metal filler is usually used. Power is supplied from the power source (rectifier), via a hand piece or a welding torch, which is applied to a tungsten electrode that is fitted to the hand piece. An electric arc is then produced between the tungsten electrode and the workpiece by means of a constant-current welding power supply that creates a tungsten electrode. Energy and transferred through the arc through a column of strongly ionized gas and metal vapour [5]. The tungsten electrode and the welding region are shielded by inert gas from the surrounding air. The electrical arc can create temperatures of up to 20,000 degrees Celsius, and this heat can be concentrated to melt and join two separate sections of the material. The welding pool may be used to join the base metal with or without the filling material [6].

1.2.1 Advantages

The TIG welding process has special advantages over other method of arc welding as follows:

a. Makes high-quality welds of nearly all metals.
b. Absolutely no welding post needed to be washed up.
c. The arc and the welding pool are easily visible.
d. The arc holds no filler, because there's next to no filler.
e. GTAW absorbs about 1/3 of the compressed gas
f. No slag created that can be stuck in the weld.
g. Welding should be done in both positions.
h. No flow is needed because of inert gas shields

1.3 TIG WELDING DRAWBACKS

a. Tungsten inert gas welding is time-consuming method-These are slower than any other process.
b. Safety Issue-Welders, the discovery is too high speed of light that will operate the eye loss.
c. High initial cost.
d. It cannot be found in thicker metal sheets.

LITERATURE REVIEW

TIG welding can be carried out in both positions and the procedure is suitable for tube and pipe joints. TIG welding is a highly controllable and clean process that requires very little finishing or even no finishing. This welding method can be used for both manual and automated service. The TIG welding process is commonly used in so-called high-tech manufacturing applications [7].

CONCLUSION

The TIG welding method is ideally suited for metal plates with a thickness of around 5-6 mm. The thicker content plate can also be welded by TIG using multi passes. Results in high heat inputs, contributing to distortion and reduction of the mechanical properties of base metal. In TIG welding, high quality welding can be done thanks to the high degree of regulation of the heat input and the inclusion of the filler separately. TIG welding can be carried out in both positions and the procedure is suitable for tube and pipe joints. TIG welding is a highly controllable and clean process that requires very little finishing or even no finishing. This welding method can be used for both manual and automated service. The TIG welding process is commonly used in so-called high-tech manufacturing applications.

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