EXPERIMENTAL INVESTIGATION OF PLASMA ARC WELDING ON NICKEL 201

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ABSTRACT

Plasma arc welding is used for high quality joints in the air -crafts, aero space, chemical and petroleum industries. The present work discusses about the weld quality characteristics of nickel 201. In this research, welding is carried out at variable values of input parameters (current, gas flow & nozzle stand of distance) and same thickness of 10 mm for all work pieces. Nickel 201 is high temperature resistance and corrosion resistance. In this welding of filler metal is inconel 625 is used current, gas flow and nozzle stand of distance consider as welding processes parameters of plasma arc welding. the present work evaluates mechanical, micro structural and corrosion properties of an Alloy 625 weld overlay deposited on nickel 201.which is specified in ice molding machine part joints, turbine blades.

Key words: *Plasma Arc Welding, Nickel 201, Inconel 625,Hydrogen Gas, Argon Gas, tensile Strength, Hardness Test*

1. INTRODUCTION

Plasma arc welding (**PAW**) is an arc welding process similar to gas tungsten arc welding (GTAW). The electric arc is formed between an electrode and the work piece. The key difference from GTAW is that in PAW, by positioning the electrode within the body of the torch, the plasma arc can be separated from the shielding gas envelope. The plasma is then forced through a fine-bore copper nozzle which constricts the arc and the plasma exits the orifice at high velocities approaching the speed of sound and a temperature approaching 28,000 °Core higher.

The PAW welding process are best suited for metal plate of thickness around 5- 6 mm. Thicker material plate can also be welded by PAW using multi passes which results in high heat inputs, and leading to distortion and reduction in mechanical properties of the base metal. In PAW welding high quality welds can be achieved due to high degree of control in heat input and filler additions separately. These PAW welding process is extensively used in the so-called high-tech industry applications such as

- Aircraft and aerospace industries e.g. wings and fuselages.
- Shipbuilding and marine industries e.g. panels for decks and superstructures.
- Land transportation / automotive industries.
- Oil and petrochemicals industries e.g. off shore production platforms and pipelines.
- Domestic e.g. white goods and metal furniture

While in non transferred arc the arc is produced between the electrode connected at negative terminal and nozzle connected with terminal. The plasma torch is constructed with a tungsten electrode within a metal cup that direct an inert streaming gas past the electrode. The inert gas should have higher thermal conductivity. The inner wall of the nozzle is lined with the ceramic coating. The arc has passages for circulating cold water and for supplying gases from it. Normally argon, helium and hydrogen gases are used more frequently.

- Micro-plasma (< 15 Amperes)
- Melt-in mode (15–100 Amperes)
- Keyhole mode (>100 Amperes)

1.1 Material for making

Nickel201:- Nickel 201 commercially pure wrought nickels with good mechanical properties and resistance to a range of corrosive, good thermal, electrical and magneto astrictive properties. Nickel 200 but with a lower carbon content to prevent embitterment by inter granular carbon at temperature over 600f.nickel 201 particularly suitable for cold formed items.

The Nickel 201 is available in rod, hexagonal bar, sheet, wire, Foil, strip, tube.

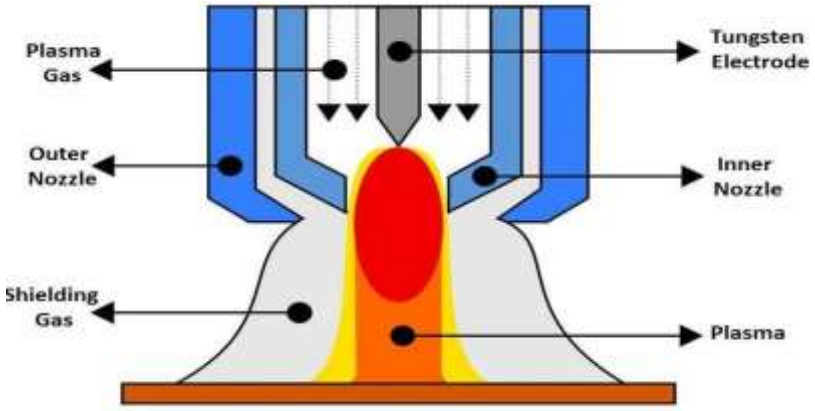

Fig.1: Components of Plasma Arc Welding
Source :(www.mech4study.com)

Fig.2:Nickel201 Material

2. Output Parameters:

1. Tensile Strength
2. Hardness test

2.1 Tensile Strength:- Tensile strength is the ability of a material to withstand a pulling (tensile) force. It is customarily measured in units of force per cross-sectional area. This is an important concept in engineering, especially in the fields of material science, mechanical engineering and structural engineering.

The ability to resist breaking under tensile stress is one of the most important and widely measured properties of materials used in structural applications. Tensile strength is important in the use of brittle materials more than ductile materials.

2.2 Hardness test: - Hardness is a characteristic of a material, not a fundamental physical property. It is defined as the resistance to indentation, and it is determined by measuring the permanent depth of the indentation.

More simply put, when using a fixed force and a given indenter, the smaller the indentation, the harder the material. Indentation hardness value is obtained by measuring the depth or the area of the indentation using one of over 12 different test methods.

Fig.4: Hardness Test on Welding Part

Fig.3: Tensile Strength on Welding Part

3. EXPERIMENTAL SETUP:-

Fig.2: Welding Torch of PAW Machine
(Source: Captured at Keepsake welding research & Skill development centre)

Fig.3: Different Gas Flow

Fig.4: PAW Machine

Fig.5: Gas Supply & torch Rod
(Source: Captured at Keepsake welding research & Skill development centre)

4. RESULTS AND DISCUSSIONS

EXPERIMENT RESULTS:-

Experiment No	Welding Piece	Voltage	Welding current (Amp)	Hardness Test (HV10)	Ultimate Load (KN)	Ultimate Tensile Strength (N/mm^2)
1	T1	24	112	392.667	49.200	412.752
2	T2	24	112	399	49.650	413.568
3	T3	24	112	416.333	49.998	419.526
4	T4	25	114	418	56.550	426.546
5	T5	25	114	413.667	50.100	429.118
6	T6	25	114	396.333	50.355	450.612
7	T7	26	116	394	54.999	420.132
8	T8	26	116	412.667	55.362	420.882
9	T9	26	116	403.667	55.497	421.798

Table 1. Experiment Results (Divine Metallurgical Services PVT.LTD)

5. CONCLUSION

In our project we used nickel 201 material and welding on plasma arc welding. After welding we try different Nine Experiment we used Different Input Parameters Current, voltage and welding speed. Then we experiment on our output parameters Tensile strength and hardness test to find welding ability and that material joining capacity .after experiments we find different result as on table 1.the material test derive as T and numbers of experiments .show table it have many different result we find on different voltages and currents we find our best material joining after welding. After this experiment we confirm find our welding and material capacity. this method we used in oil refineries and turbine blades that default in that parts.

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