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Establishment and Development of Titanium Welding Facility

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Abstract

Titanium and most titanium compounds are promptly weld capable, utilizing a few welding forms. Legitimately made welds in the as-welded condition are malleable and, in many situations, are as consumption safe as base metal. Titanium is perceived for its high quality to-weight proportion. It is a light, solid metal with low thickness. Titanium welding isn't care for typical welding because of its temperament of material. To decide the different parameter and testing technique for welding which will give best weld quality with ideal welding parameter for titanium.

Keywords: *Titanium, Welding, Strength-to-weight ratio, Aerospace Application*

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INTRODUCTION

Titanium is a compound component with image Ti and nuclear number 22. It is a shiny move metal with a silver shading, low thickness and high quality. It is very impervious to consumption in ocean water, water district and chlorine. Titanium is the ninth-most bottomless component in Earth's covering (0.63% by mass) and the seventh-most copious metal.

The world generation of titanium is all things considered little, a huge number of tones, which contrasts say and steel at 750 million tons for every annum [1]. Titanium falls into a group of metals called responsive metals, which implies that they have a solid fondness for oxygen. At room temperature, titanium responds with oxygen to shape titanium dioxide.

This detached, impenetrable covering opposes further association with the encompassing climate, and it gives titanium its renowned erosion resistance. The oxide layer must be evacuated before welding since it softens at a much higher temperature than the base metal and in light of the fact that the oxide could enter the liquid weld pool, make discontinuities and lessen weld honesty [2].

DISCUSSION

Whenever warmed, titanium turns out to be very receptive and promptly consolidates with oxygen, nitrogen, hydrogen and carbon to frame oxides (titanium's acclaimed hues really originate from fluctuating thickness of the oxide layer). Interstitial assimilation of these oxides cause embrittlement of the weldment and may render the part pointless. Hence, all parts of the warmth influenced zone (HAZ) must be protected from the environment until the temperature drops underneath 650°F [3].

A metallic component, titanium is perceived for its high quality to-weight proportion. It is a solid metal with low thickness that is entirely flexible (particularly in a sans oxygen environment), brilliant, and metallic-white in shading. The generally high softening point (more than 1,650°C or 3,000°F) makes it valuable as an unmanageable metal. It is paramagnetic and has genuinely low electrical and warm conductivity.

Business (99.2% unadulterated) evaluations of titanium have extreme rigidity of around 434 MPa (63,000 psi), equivalent to that of normal, poor quality steel combinations; however, are less thick. Titanium is 60% denser than aluminum, yet more than twice as solid as the

most ordinarily utilized 6061-T6 aluminum composite. Certain titanium combinations (e.g., Beta C) accomplish elastic qualities of more than 1400 MPa (200000 psi). Be that as it may, titanium loses quality when warmed above 430°C (806°F) [4].

Identification of Ti plate as per the Grades

Ti alloy can be divided into five major groups as:

1. Commercially pure Ti
2. Alpha alloy
3. Near-Alpha alloy
4. Alpha-Beta alloy
5. Beta alloy

The criteria for weldability ratings are:

A. Capacity to produce defect free welding.
B. Capacity to resist weld cracking under restrain imposed in a welded fabrication.
C. Ability of the welding joints to attain the strength and toughness of parent metal.

Table 1: *Titanium Content of Different Grade.*

Grades	Ti Purity %	Oxygen content %	Nitrogen content %
1	99.8	0.03–0.10	0.012
2	99.6	0.08–0.16	0.015
3	99.5	0.13–0.20	0.02
4	99.3	0.18–0.32	0.025

As per Table 1, we can see that the purity of grade 1 is more than the others. But the cost of grade 1 plate is very high. In the grade 3 and 4 the content of Oxygen and Nitrogen is comparatively high so welding becomes difficult. Hence, it's economical to using the Grade-2 plate which also has an optimum purity.

The welding process in the titanium welding is Tungsten Inert Gas (TIG) is widely used. However, the Metal Inert Gas (MIG) process has not been applied as widely to titanium as it has been to ferrous and other nonferrous alloys. Many of the historical reasons explain why MIG welding has not been favored for titanium no longer applicable. High currents are required for stable metal transfer and the poor surfaces originally produced on titanium wire caused rapid contact tip wear. More recently, the combination of modern inverter power sources with pulsed currents gives more stable metal transfer, whilst the improved surface finish of titanium wire has reduced contact tip wear such that the problem is barely apparent in development work [3].

Prerequisite

Connect Torch

While using an air-cooled torch, use the adapter for accessory package. Plug the torch into the front of your machine as well as connect your gas hose and regulator (Figure 1).

Connect Work Clamp

Plug your work clamp (also known referred to as a ground clamp) into the machine as well as Clamp the other end to your work piece or work table.

Select Polarity

For steel and steel alloy welding, switch your amperage setting to DCEN (for stick welding, switch your amperage setting to DCEP).

Prepare Tungsten

Grind tungsten to a point. When welding on aluminum, the tungsten will begin to form a ball. Grind in the long direction and make the point roughly 2-1/2 times as long as the diameter.

Assemble Torch

Loose a back cap and remove 3/32″ diameter tungsten from torch. Remove the nozzle and copper collet pieces from torch. Put the collet and collet body back into the torch and tighten. Put the nozzle back onto the torch.

Install Tungsten

Place the tungsten into the collet. Leave about 1/8″ to 1/4″ sticking out of the collet (not more than the diameter of the cup). Tight the back cap.

Check and Connect Power

Ensure the power supply is connecting to the matches the rating of machine. In case, machine is supplied with a plug, plug it into the appropriate power outlet when ready for begin welding.

CONCLUSION

This study shows that one can know that how difficult it is to weld the titanium metal as the atmospheric contamination plays a vital role. Results variation can also been seen, if the diameter of the torch is increased. As titanium

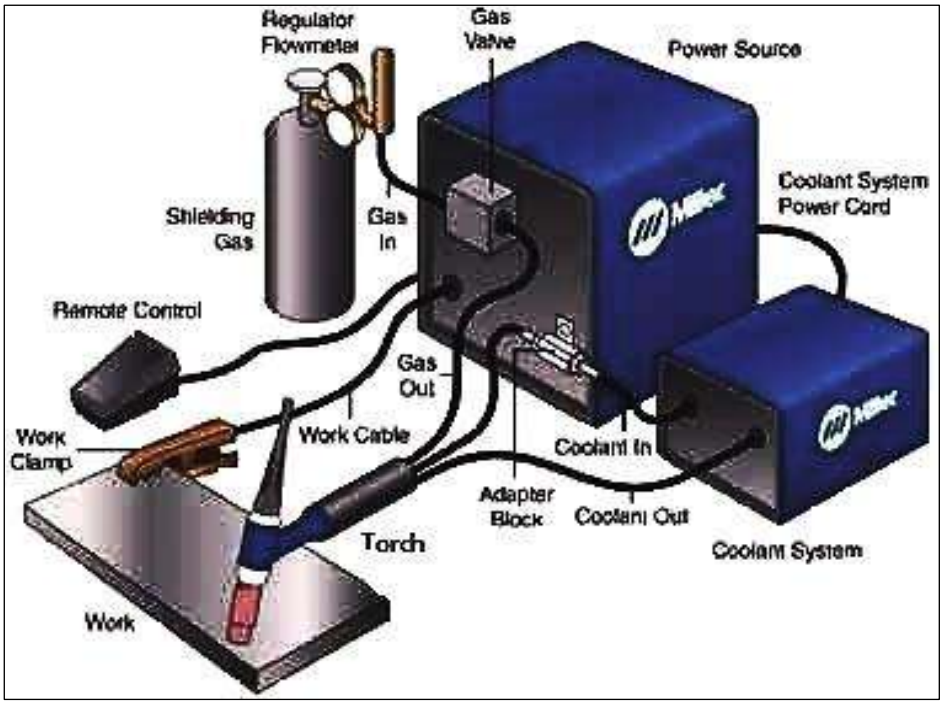

Fig. 1: *Welding Equipment Setup.*

is completely inert to human body fluids; making it ideal for medical replacement structures such as hip and knee implants. Titanium is used for critical jet engine rotating applications. In the newest technology jet engines, wide chord titanium fan blades increase efficiency while reducing noise.

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