Laboratory Manual
MANUFACTURING TECHNOLOGY LABORATORY (MTI-191)

Title of the Experiment: Tungsten Inert Gas (TIG) Welding

1. Aim of the Experiment: To measure joint efficiency at various welding conditions and determine corresponding mechanical and metallurgical properties.

2. Performance Objective:

- Compare this process with other arc welding methods and judge its applicability.
- Realize the importance of root run and why TIG welding is preferred for it.
- Analyse joint properties and arc characteristics with respect to input parameters.

3. Theory

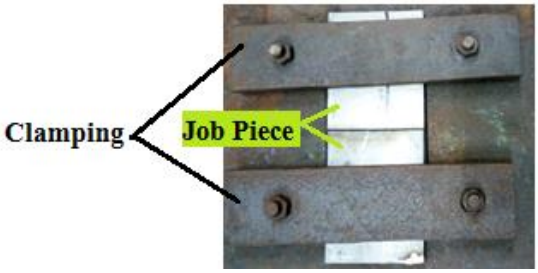
Tungsten inert gas (TIG) welding is one of the cleanest process. In this process filler metal is supplied from a filler wire. As the tungsten electrode is not consumed in this operation, a constant and stable arc gap is maintained at a constant current level. The filler metals are similar to the metals to be welded, and flux is not used. The shielding gas is usually argon or helium (or a mixture of the two). Welding with GTAW may be done without filler metals—for example, in the welding of close-fit joints. Depending on the metals to be welded, the power supply is either DC at 200 A or AC at 500 A. In general, AC is preferred for aluminum and magnesium, because the cleaning action of AC removes oxides and improves weld quality. Thorium or zirconium may be used in the tungsten electrodes to improve their electron emission characteristics. The power supply ranges from 8 to 20 kW. Contamination of the tungsten electrode by the molten metal can be a significant problem, particularly in critical applications, because it can cause discontinuities in the weld. Therefore, contact of the electrode with the molten-metal pool should be avoided. The GTAW process is used for a wide variety of applications and metals, particularly aluminium, magnesium, titanium, and the refractory metals. It is especially suitable for thin metals. The cost of the inert gas makes this process more expensive than MMAW, but provides welds of very high quality and surface finish. GTAW is used in a variety of critical applications with a wide range of work piece thicknesses and shapes.

3.1 Equipment Used

Model: Magic Wave 2500 TIG Welding Machine
Brand: Fronius
Voltage: 220V
Frequency: 50Hz
Automatic Grade: Semi-Automatic
Phase: 3 Phase
Working voltage: 10.1-20.0 V

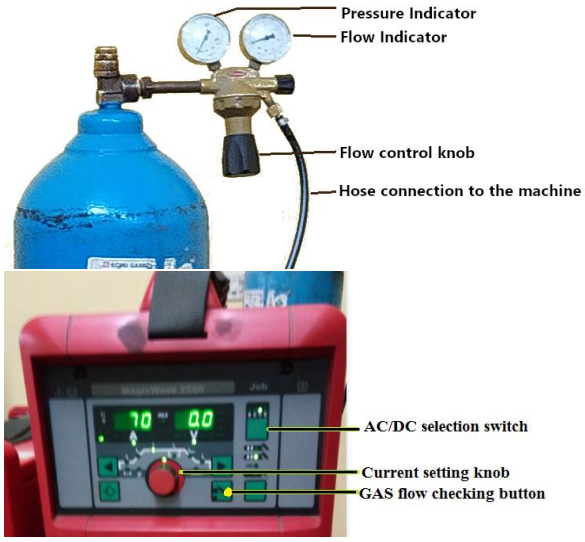
3.2 Specimens to be welded:

Give material specification and give joint preparation detail if any.
Give specification of the filler material used.



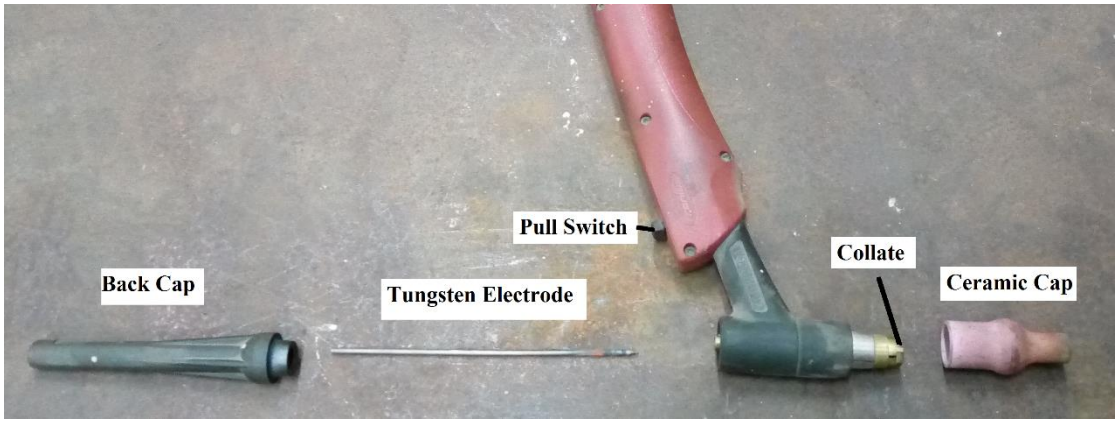
4 Procedure

First fix the job pieces in the fixture securely.
Turn on the gas supply and adjust the flowrate using the regulator and flow meter.



Now press the gas flow checking button on the machine to ensure inert gas supply to the torch.

Next the tungsten electrode has to be fitted in the torch. The torch assembly layout is as follows.



Now set the welding current from the machine.

Check the electrical connections and AC/DC selection.

After checking everything hold the torch and electrode in proper position. Pull the button on the torch to and hold it continue welding

4.1 Precautions

1. Protective gears must be used while performing the welding.
2. Bare electrode must be handled with care so that no chance of electric shock arises.
3. The electrode tip must not touch the weld pool to avoid contamination.
4. Filler wire must be of similar composition with respect to the job piece.
5. Sharpen the electrode properly to avoid poor arc characteristics.

5. References

1. Kalpakjian, S.; Steven, R. S. Manufacturing Engineering and Technology; Prentice Hall: New Jersey, 2010; 6th ed.
2. ASM Handbook: Vol. 9 Metallography and Microstructures; Materials Park, OH: ASM International, 2004

3. Text Book of Welding Technology (PB) O.P Khanna

4. Audel Welding Pocket Reference (English, Paperback, Brumbaugh James E.).

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