Friction Stir Welding Parameter Optimization

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ABSTRACT

The focus of the research work will be concentrated in the mechanical performance and the stir zone microstructure by FSW butt welded part having 150mm × 50mm × 5mm thick sheet 5000 series aluminum alloy 6061 and 150mm × 50mm × 5mm thick The same sheet using tool steel material having taper tool pin profile. And same specimen plates having size (150mm × 50mm × 5mm) welded by Oxyacetylene welding process. All the testing of welded part will be tested by ASTM standard. In this work, (UTM), Inverted Microscope (IM) to get the microstructure properties.

Keyword: -*Friction stir welding (FSW), oxy-acetylene gas welding , stir*

1. INTRODUCTION

Welding is a fabrication process used to join materials, usually metals or thermoplastics, together. During welding, the work pieces to be joined are melted at the joining interface and usually a filler material is added to form a weld pool of molten material that solidifies to become a strong joint. In contrast, Soldering and Brazing do not involve melting the work piece but rather a lower melting point material is melted between the work pieces to bond them together.

1.1 Types of Welding

1. Arc welding
a. Metal Inert Gas Welding (MIG, GMAW)
b. Electro slag Welding (ESW)
c. Tungsten Inert Gas Arc Welding (TIG, GTAW)
d. Submerged Arc Welding (SAW)
e. Shielded Metal Arc Welding (SMAW)
f. Carbon Arc Welding
g. Plasma Arc Welding (PAW)
2. Resistance Welding (RW)
a. Flash Welding (FW)
b. Resistance Butt Welding (UW)
c. Spot Welding (RSW)
d. Seam Welding (RSEW)

3. Electron Beam Welding (EBW)
4. Laser Welding (LW)
5. Solid State Welding (SSW)

a. Forge Welding (FOW)
b. Cold Welding (CW)
c. Friction Welding (FRW)
d. Explosive Welding (EXW)
e. Diffusion Welding (DFW)

2. LITERATURE SURVEY

N.T. Kumbhar and G.K. Dev et al. Welding of high strength and low weight materials like Aluminium Alloys without any defects by conventional welding techniques is a major challenge in industries. Hence research on solid state welding techniques like Friction stir welding and Friction welding techniques have got much importance in joining of Aluminium alloys. However most of the industries are not changing conventional techniques as skilled workers are available on that area. Most common conventional welding techniques used for joining of Aluminium alloys are Gas welding and Arc welding. Friction welding is a solid-state welding process that generates heat through mechanical friction between a moving and a stationary component with the addition of a lateral force called "upset" to plastically displace and fuse the materials. In this work, experimental study on tensile and micro structural characteristics of welded joints formed from conventional welding techniques and Rotary friction welding(suitable for weld specimens with circular cross section) has been carried out and the same were compared.

3. PROBLEM STATEMENT

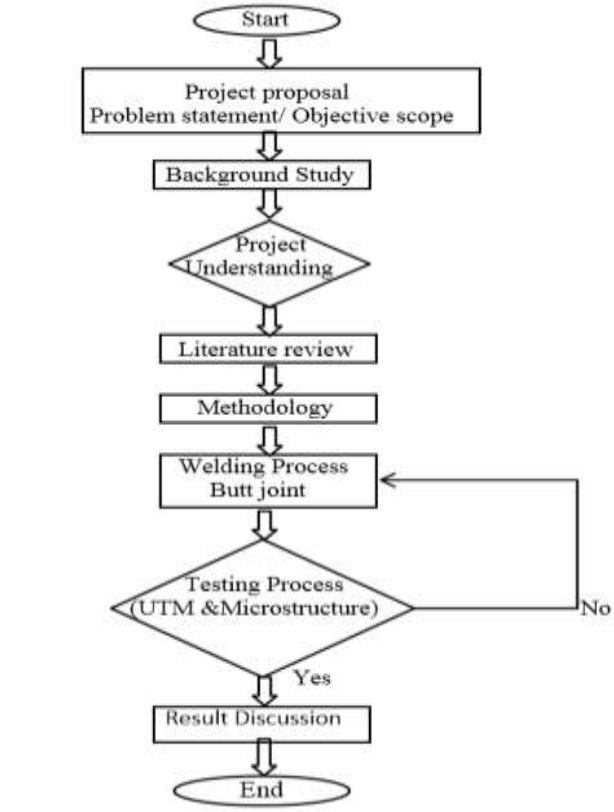
To evaluate the Mechanical Properties of welded joint of Aluminium alloy (Al 6061) specimen by adopting the Friction stir welding method of solid joining process by manufacturing the tool for welding the selected specimen and weld the same specimen by using oxy-acetylene gas welding process. Study the microstructure and Tensile strength analysis of welded joint specimen. and evaluate the which welding process is suitable for join the aluminum alloy 6061.

4. OBJECTIVES

Following objectives will be achieved during this project work.

1. To manufacture of H13 taper tool for welding.
2. To weld the specimen by friction stir welding.
3. To weld the same specimen by oxyacetylene welding.
4. To perform micro structural study of welded joint.
5. To take tensile testing on UTM.
6. To find out which welding process is suitable.
7. To develop environmental and human safe welding process.

5. METHODOLOGY:



6. OPERATING MACHINES

FSW Machine:

Friction Stir Welding (FSW) is a solid-state joining process that creates extremely high-quality, high-strength joints with low distortion. A non-consumable spinning tool bit is inserted into a work piece. The rotation of the tool creates friction that heats the material to a plastic state. As the tool traverses the weld joint, it extrudes material in a distinctive flow pattern and forges the material in its wake. The resulting solid phase bond joins the two pieces into one.

Figure: FSW machine

7. TAGUCHI APPROACH

Optimization of is the important aspect in the Taguchi method. It will used to achieving quality of product without increasing cost. In optimization process not only parameters improve quality but also the optimal process parameters variation as per environmental conditions and other noise factors. The process parameter is complex method and it used to determine a mean performance characteristic with a certain specification limits. We perform large experiments as per increase in number of the process parameters. In this process of experiments Taguchi is best tool that used a orthogonal arrays. Orthogonal array in the experiments will help the designers to understand the influence of multiple controllable factors with the quality average characteristics and the variations of physical parameter in a fast and economic way. Number of experiments performed as per selection of process parameters. In order to obtain this task, the Taguchi method with orthogonal arrays is vital tool.

8. CONCLUSION

1.The welding of aluminium alloy is possible by using friction stir welding process. The different mechanical properties of base material joint were found as per the experimentation.
2. The maximum strength of joint is found by using FSW Metal joining technique.
3.Oxy-acetylene welding method is cheaper than Friction Stir welding , but tensile strength is low of oxyacetylene weld joint.

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