A REVIEW PAPER ON FRICTION STIR WELDING WELD PARAMETER OPTIMIZATION USING TAGUCHI APPROACH

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ABSTRACT

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.[2] FSW is considered to be the most significant development in metal joining. As compared to the conventional welding methods, FSW consumes considerably less energy. No gas or flux is used, thereby making the process environmentally. The joining does not involve any use of filler metal and therefore any aluminum alloy can be joined without concern for the compatibility of composition, which is an issue in fusion welding. When desirable, dissimilar aluminum alloys and composites can be joined. This joining process involves rotating tool consisting of a shoulder and probe. The shoulder of the tool applies a downward pressure on the work piece surface which plastics material around the probe as shown in figure 7. And generates the heat through the friction and causes the plastic deformation in a relatively thin layer under the bottom surface of shoulder.

Keyword:-*FSW, Parameter Optimization,, Taguchi Approach, etc.*

1. INTRODUCTION

The principle of the friction stir welding (FSW) is the rotating pin (tool) is pushed into the material until shoulder meets the work piece surface this causes the material to plasticize due to heating by frictional contact of the tool shoulder and the work piece then tool moved forward and the joint is formed

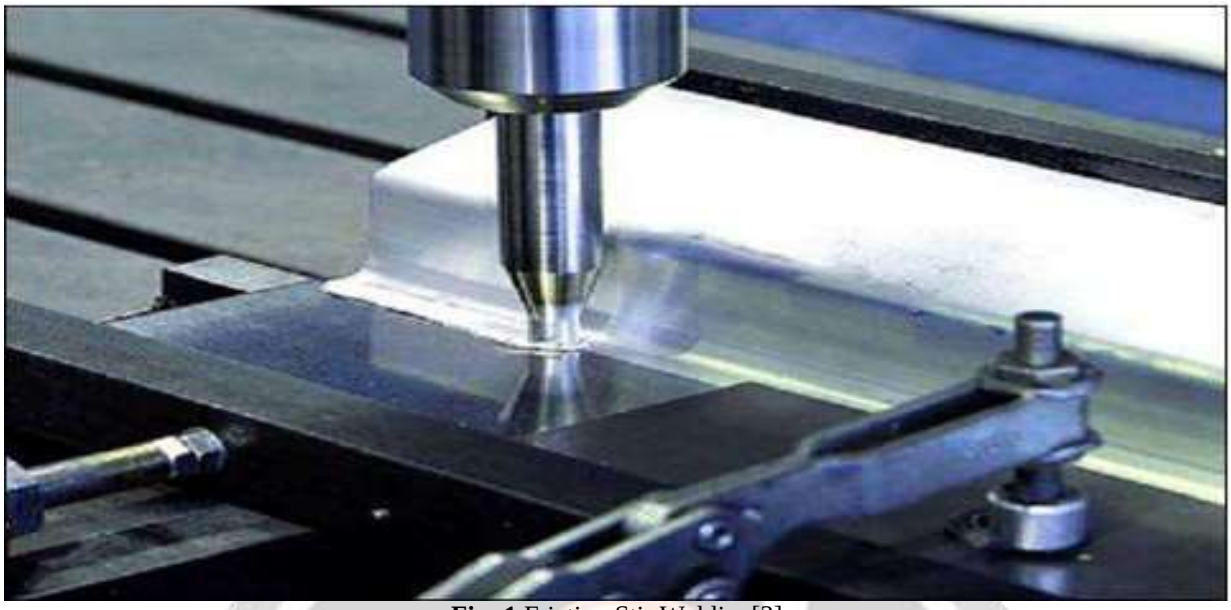

Fig -1 Friction Stir Welding[3]

The process is finished when the tool is retracted from the work piece. FSW is considered to be the most significant development in metal joining. As compared to the conventional welding methods, FSW consumes considerably less energy. No gas or flux is used, thereby making the process environmentally. The joining does not involve any use of filler metal and therefore any aluminum alloy can be joined without concern for the compatibility of composition, which is an issue in fusion welding. When desirable, dissimilar aluminum alloys and composites can be joined. This joining process involves rotating tool consisting of a shoulder and probe.

2. PROBLEM STATEMENT

To evaluate the Mechanical Properties of welded joint of Aluminum 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 which welding process is suitable for join the aluminum alloy 6061.
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.

3 .BASE MATERIAL SELECTION

In the process of friction stir welding the material selection is important part from the base materials the other parameters are decided like tool material, rotational speed, down force, translational speed FSW can be used for

joining many types of materials and also different material combinations. Most of the efforts done in FSW research and development have been performed to optimize the process for joining aluminum and its alloys. Most of the efforts done in FSW research and development have been performed to optimize the process for joining aluminum and its alloys. A group of TWI Industrial Members demonstrated that the following aluminum alloys could be successfully friction stir welded to produce high integrity welds within defined parametric tolerances: 2000 series aluminum (Al-Cu), 5000 series aluminum (Al-Mg), 6000 series aluminum (Al-Mg-Si), 7000 series aluminum (Al-Zn) and 8000 series aluminum (Al-Li).[7] In the case of different alloys, joining aluminum and steel alloys is of significant importance, and recently Honda Company has successfully performed such welding in a vehicle suspension system for mass production. In terms of high-temperature materials, FSW has been a successful of alloys and materials. [7]

1. Aluminum and its alloys
2. Copper and its alloys
3. Titanium and its alloys
4. Magnesium alloys
5. Zinc
6. Plastics
7. Mild steel
8. Stainless steel
9. Nickel alloys

In the process of friction stir welding the material selection is basic part. From the literature review, there are large number of materials were used for this process. From the various alloys of Al 6061 are selected because this alloys having low density as compare to steel so it is lighter weight, this material is having also good strength, ductility and corrosion resistance. It is available in the sheets and round bars also. As per the availability of the material in the market, I selected the desired alloys of aluminum 6061 with 4mm thickness. The material is probably locking from industry.

4. OPERATING MACHINES

4.1 FSW-

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.

4.2 UTM-

A universal testing machine, also known as a universal tester, materials testing machine, materials test frame or tensile strength tester is widely used to test the tensile stress and compressive strength of materials. A UTM (Universal Tensile Machine), also known as tension test, is probably the most elementary type of mechanical test you can perform on the material. Tension tests are simple, relatively economical, and fully standardized. UTM Machine to Perform Tensile Test The strength of material is the prime factor that explains the quality of the material. The strength refers to the ability of material to resist loads without failure because of excessive stress or deformation. The strength of the materials can be determined easily with Tensile Test. The UTM Machine (Universal Testing Tester) gives highly accurate force measuring system for testing a variety of materials, components, and structures.[1] Load cells, grips, fixtures can be interchanged easily to perform different tests like: Flexural, Elongation, Compression Coefficient of Friction, Peeling & bonding strength. Measurement is done using a tensile tester by applying a constant rate of elongation to the test strip. The control panel is an integral constituent of the testing system, decreasing setup time and increasing testing efficiency through the use of display helps to record the load and extension of the sample. Tests can be set up and run directly from the control panel. As the machines have to go through a number of testing methods, there is a need that machine have to be calibrated on the routine basis, which ensures reliability & durability; it is advised that well-known manufacturer must be looked for universal testing machines.[4]

5. WORK TO BE DONE IN STAGE II -

Following path is followed for the proceeding project work for project stage II

Table 1 Probable work in project stage II

Sr. No.	Month	Task to be done
1	November 2019	Review research paper proceeding and paper publication on project stage I
2	December 2019	Base material selection and manufacturing of fixture for the same for Friction Stir Welding.
3	January 2020	Welding of different material and testing of weld under UTM.
4	February 2020	Microstructure study of different weld and selection of proper weld as per different weld parameter which selected by Taguchi approach.
5	March 2020	Final research paper proceeding and paper publication on project stage II.
6	April 2020	Report writing with guidance from project guide and final presentation preparation.

6. 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.[6] 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. [5] 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.[7]

7. REFERENCES

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