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Analysis on Friction Stir Spot Welding (FSSW) Of HSS Using Explicit Adaptive Meshing Scheme

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Abstract*—FSSW is an advanced and popular solid state material welding method, which is achieve the different variety of popularity in serve industries and automotive. FSSW method (technique) are used for joining the similar or dissimilar material like aluminium, titanium, magnesium and copper alloys etc. The various factors such as rotational speed, transverse speed and profile of the tool on the joining quality of HSS.The main target of this analysis is to be observed variation of tool profile and welding quality of HSS as the tool speed varies. Two aluminium were lapped and provide support to the bottom of the plate know as back anvil to constrain the motion. Were we analyzed the material flow due to friction of heat generation in weld zone. HSS is one of the most commonly used HSS and it applications where low density and excellent corrosion is applied in a wide range of resistance are necessary such as aerospace industry and bio mechanical, marine, chemical industries, gas turbine, etc.*

***Keywords*—Friction stir spot welding(FSSW), AL6082-T6, Tool rotation, Plunge, Dwell, HSS TOOL.**

I. INTRODUCTION

FRICTION STIR SPOT WELDING (FSSW) is a solid state joining process that transforms the metal from solid state into a plastic state and then mechanically stirs the materials together under pressure to form a welded joint. In this process of welding, separate spot are weld by pressing a rotating tool with high force onto the surface of two sheet that overlap with each other. The frictional heat and high pressure laminate the workpiecematerial.The tool consist of a rotating pin and a shoulder. The pin is a part of tool that penetrate into the material, Tip of the pin plunges into the joint area between the adjacent material at overlap contour. The pin of the tool is plunged into the sheet until the shoulder is in contact with the surface of the sheet.The shoulder applies high pressure which hook-ups the element metallurgically . After a short dwell time, the tool is pulled out of the workpiece.

There are four steps to illustrate the process. First the tool is positioned perpendicular to the work unit and the tool start rotating, after that the tool is pushed against the surface of top sheet due to frictional heat of material tool. The pin enters the weaker metals. Then the pi plunged completely into the work piece . The tool continuously spin and apply pressure for certain period of time or dwell time. After that the material around the pin are stirred together and the lapped plate are metallurgically unite.

II. PROBLEM DEFINITION

Friction stir spot welding is characterized by a number of process advantages. Any damage to the fabric caused by the acute heat, like that produced by laser or arc welding, won't occur. TIG and MIG is a time-consuming process also this is not suitable for the thick materials. In laser welding ,due to the rapid rate of cooling, cracks may be produced in some metals. Friction stir spot welds have a high strength, in order that they are even suitable for parts that are exposed to particularly high loads. In addition to

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automotive and rail vehicle construction, the aerospace industry is developing the method e.g. for welding cockpit doors for helicopters. within the electrical industry aluminum and copper are often friction stir spot welded. Other applications are in facade and furniture manufacture, where the low heat input, especially in anodized sheets, leads to excellent optical properties. . there different materials i.e. Aluminium , Magnesium, Copper and copper alloys , Titanium , Steel and ferrous alloys , Hafnium and zirconium , etc is to be weld by using FSSW . Therefore to analysis the FSSW process by using titanium workpiece material also see the effects on workpiece and tool.

2.2 OBJECTIVES

1. To study detail analysis of FSSW and applying the boundary condition as well as mesh And Geometry.
2. To analyze the deformation and temperature distribution of work piece and tool.
3. To analyze the von mises stress distribution along cross section of work piece.
4. Graph of temperature versus radial distance from centre of tool.
5. Graph of von mises stress versus radial distance from centre of tool.

1. PROCESS ADVANTAGES

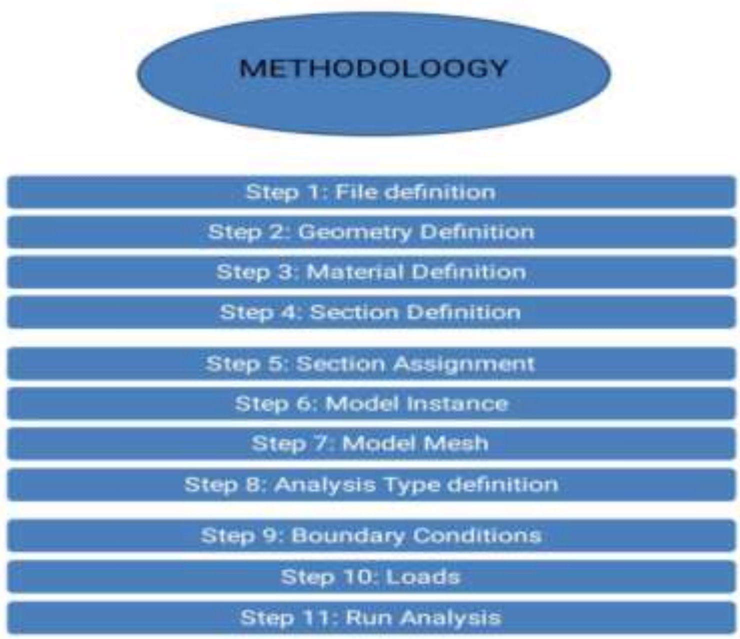
Friction stir spot welding is characterized by variety of process advantages. Any damage to the fabric caused by the acute heat, like that produced by laser or arc welding, won't occur. In particular, within the case of artificially aged aluminum alloys, the strength within the weld seam and therefore the heat-affected zone is far above in conventional welding methods.

2. INDUSTRIAL USE:

Friction stir spot welds have a high strength, in order that they are even suitable for parts that are exposed to particularly high loads. In addition to automotive and rail vehicle construction, the aerospace industry is developing the method e.g. for welding cockpit doors for helicopters.in the electrical industry aluminum and copper are often friction stir spot welded. Other applications are in façade and furniture manufacture, where the low heat input, especially in anodized sheets, results in excellent optical properties**.**

III. MATERIAL AND METHOD

3.1 APPROACHED METHODOLOGY



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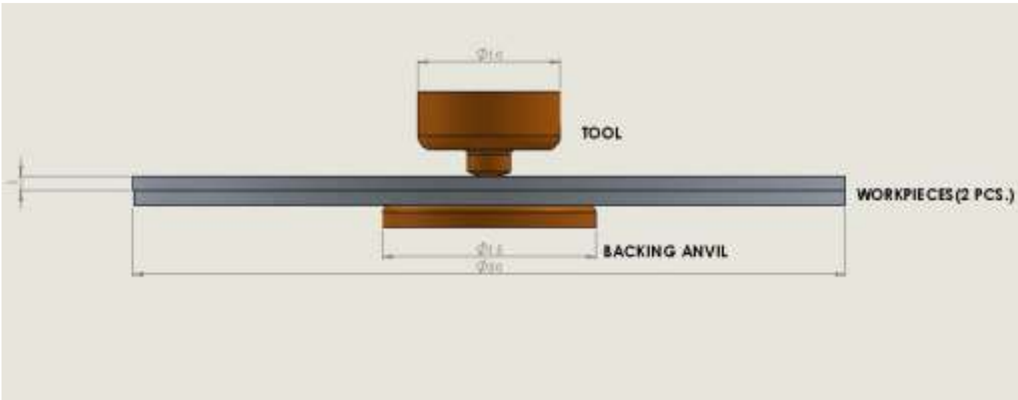

FIGURE 1: SOLID MODEL OF THE FSSW.

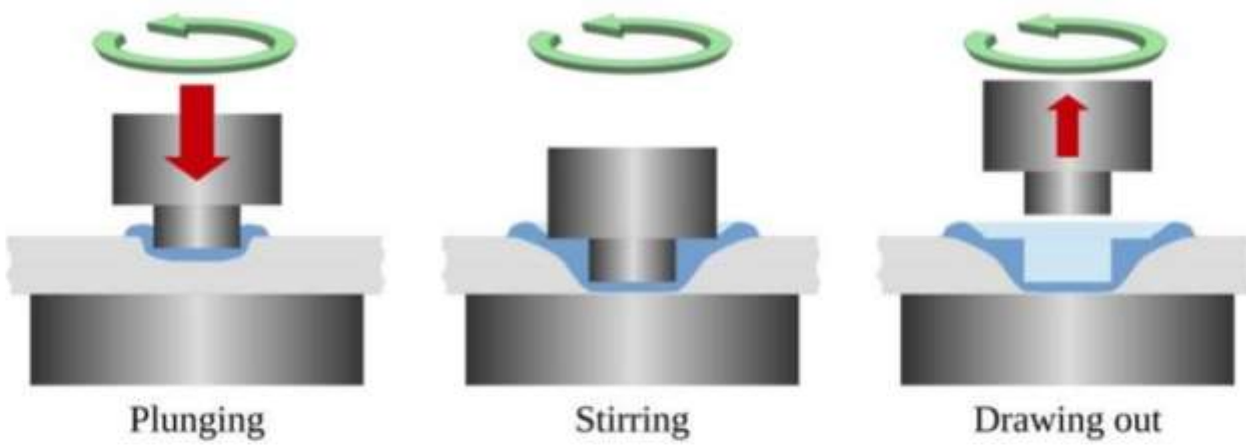

FIGURE 2: PROCESS OF WELDING.

TABLE 1
LITERATUREREVIEW

Paper name	Content
A comparison of different finite element methods in the thermal analysis of friction stir welding (fsw).	Joing of the similar material or those have minor difference is usually easier in comaparison with joining disimmilar material.
Design and exprintal study of friction stir welding of aa6061-t6 alloy for optimization of welding parameters by using lathe machine.	While designing tool and tool tip length should be less than thickness of base material.
Effect of pin length on friction stir spot welding (fssw) of dissimilar aluminium-steel joints.	Welding with tools of shoulder pin improves the forging an mixing of the aluminum onto the steel.
Identification of optimum friction stir spot welding process parameter controlling the properties of low carbon automotive steel joints.	Friction stir spot welding can also eliminate the problems associated with other convectional spot welding process.

IV. CONCLUSION

The literature represented in the study describes the finite element method has been delineate for simulation and analysis of friction stir spot welding process. which make use of effective meshing and abatement algorithm using an ABAQUS the combination of this features allow the marriage thermo-elasto-plastic response to be obtained which evidently shows the extension of the thermo mechanically affected zone and temperature profile quickly after the operation is completed without the effective meshing and abatement schemes severe elements distortion during the process of welding process would prevent the simulation from converging. While the judged overall deformation shapes are reasonable considering. The assumption made further needed refinement are underway to include the tool tip and anvil as element that absorb and release heat during conducting the operation.

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