Optimization of Friction Stir Welded AA2024 Review

Rajkumar.T[1], Balaji.M[2], Hajha Hussain.I[3], Janarthnam.K[4], Jegadeesh.M[5], Arun kumar.G[6]
[1, 2, 3, 4, 5, 6]Dept of Mechanical Engineering
[1, 2, 3, 4, 5, 6]K Ramakrishnan College of Technology, Samayapuram, Trichy-621 112

Abstract- *In the paper, we are going to study about the welding process in the aluminum alloy AA2024. These alloy becoming increasingly attractive for producing industrial applications. The main application is the aircraft, especially wing and fuselage structures under tension. The purpose of this project is to study the welding parameter such as welding and transverse speed and axial load to investigate the tensile properties, microstructure, micro hardness and strength. This paper is used to find the optimum parameter. To identify the hardness of the welding element in the Friction Stir Welding (FSW) process AA2024 based on the experimental approach*

Keywords- friction stir welding, Aluminium alloy, Process parameter.

I. INTRODUCTION

The concept of FSW process is simple, were two sides of the plate should fixed in the specimen fixture rigidly [4]. The aluminum alloys are for the structural application high strength materials like heat treatable aluminum alloy is used. These alloys are used to overcome the difficulties in conventional fusion welding. In order to overcome the problems faced in the welding of aluminum materials using Friction welding processes [1]. Friction stir welding is used as an alternative [11]. Friction stir welding processes is a welding process which is nothing but the processes of joining the metal in the solid state without melting the work piece material [16]. During this process the metal is changed into plastic state and the metal is joined. By analyzing the journal papers the process parameters for welding the similar aluminum alloys with the rotational speed of 600-1000rpm, Transverse speed 40-60 mm/min and the axil load is 2-6kN. The aluminum alloy AA2024 is having high strength to weight ratio, tensile strength and the durability [1]. This material has high weld ability due to advanced metallurgical characterizes [9]. Due to this advantage these material is used in the most of the aerospace and automobile applications. The composition of AA2024 includes 90% of aluminum, 4.3-4.5% of copper, 0.5-0.6% manganese, 1.3-1.5% of magnesium, and less than half percentage of silicon, zinc, chromium, lead and bismuth.

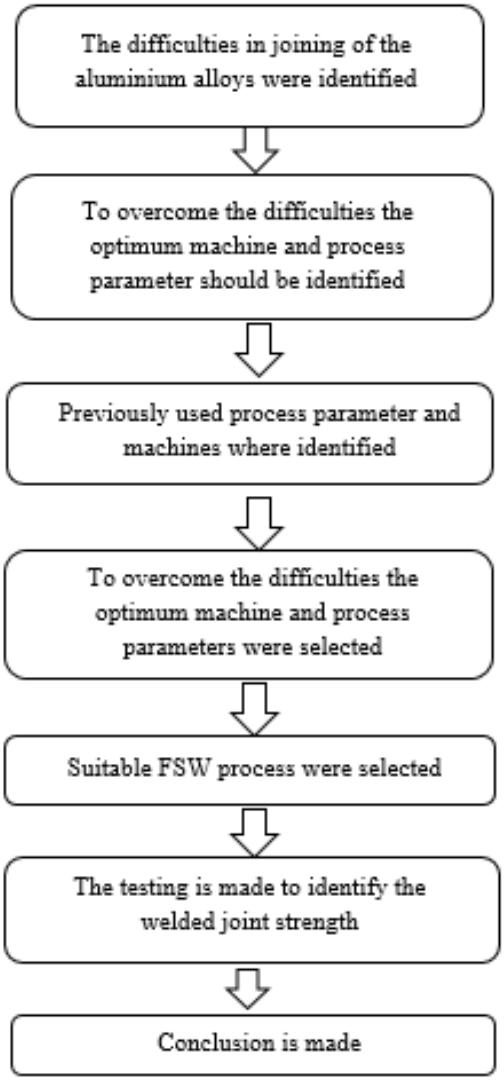

Fig 1.1 general methodology
The fig 1.1 consists of the general methodology**.**

II. SOLID STATE JOINING TECHNIQUES

2.1 DIFFUSION BONDING

It is a joining of two metallic surfaces by the diffusion of atoms under pressure and temperature over time.

2.2 PLASMA ASSISTED DIFFUSION

It is a joining of two metallic surface by hard pressing and pulsed direct electric current through pins that apply pressure to the sample.

2.3 FRICTION WELDING

It is the solid state joint that uses rotational energy under an axial load to form a joint.

2.4 FRICTION STIR WELDING

It is the solid state join that uses friction to plasticize and a stir bit to join the parts together.

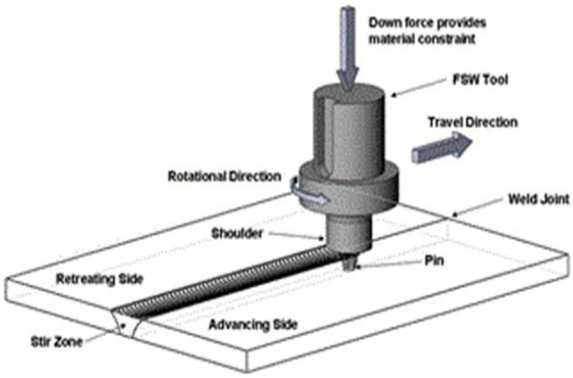

Fig 2.1 solid state joining
The fig 2.1 consists of Solid state joining techniques

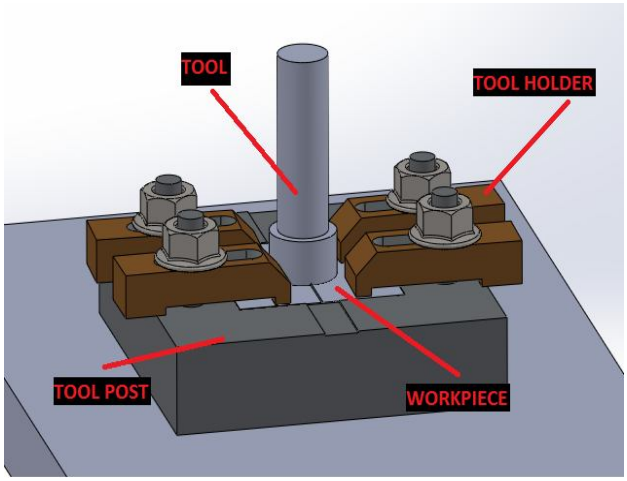

Fig 2.2 General arrangement
The fig 2.2 consists of the general arrangement diagram.

III. EXPERMENTAL PROCEDURE

The geometric size of the work piece sample is 3mm thick plate. The bar of aluminum alloy is cut into 100*50mm rectangular plate. The materials used in this study is AA2024 .The chemical composition of the materials is listed below.AA2024 contains the following si-0.10, Mn-0.61, Cu-4.53, Fe-0.20, Zn-0.16, Mg-1.28,Cr-0.010, Ti-0.012, Al-93.01. HS186 (High carbon steel high chromium steel) is the welding tool used in the study. The study consists of various tool pin profile they are cylinder pin, squared pin and hexagonal pin. Among the 3 tool pin profile the cylinder is the optimum and hence it is selected [5]. To analyze the metallurgical characterization the Energy dispersive Spectroscope (ESP), optical microscope scanning and electron microscope are used now a days.

Muralitharan.C et al [1] Showed that the aluminum alloys have much attention compare to other alloys because of their hot workability, high strength to density ratio and excellent compressive properties. They are used in the automotive and aerospace industry. Because their nature of lite weight.

M.A. Siddiqui et al [2] Attempted reduce the residual stress without melting of the metal the solid state metal joining process should be used. These are done by aluminum TWB in now a day because it has advantages such as dimensional stability and high quality material.

S. Kumar et al [3] Showed the application of aluminum alloy include automobiles, aerospace, petrochemical, generation of power and marine construction, Because of their excellent strength to weight ratio, resistance to corrosion, creep properties and recyclability.

IV. FSW TOOL GEOMENTRY

The tool used in friction stir welding have the chemical composite.

- FSW of aluminium is established method.
- FSW of steels now made possible due to the development of a tool made from Polycrystalline Cubic Boron Nitride (PCBN).

Tool design constantly being improved to extend tool life.

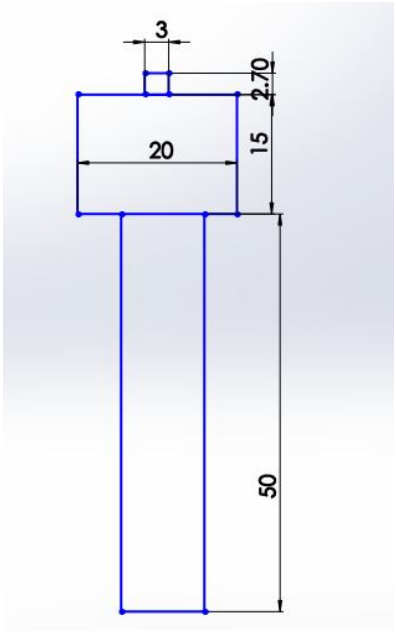

Fig 5.1 Tool dimensions

The fig 5.1 consists of the Tool dimensions. The material of tool used is high speed steel. The cutting point of the tool should have a length reduced to 0.3 mm less than the thickness of the work piece.

V. MATERIAL TO BE USED

S.No	COMPONENTS	PERCENTAGE (%)
1.	Aluminum	90
2.	Copper	4.3-4.5
3.	Magnesium	1.3-1.5
4.	manganese	0.2-0.3
5.	Zinc, Bismuth, Etc	0.5

The materials used for this investigation are aluminum alloy AA2024.The standard chemical composition and base material was discussed in introduction. The above mentioned aluminum alloy (AA2024) are used in the emerging fields of marine, space and aerospace industries. Pipelines, frames and storage tank are manufactured by this method.

VI. BASIC PROPERTIES OF ALUMINIUM ALLOY

Aluminum alloy has density of 2.78g/cm^3,electrical conductivity of 30% IACS, young's modulus of 73GPA,melting point of 500 deg.c, ultimate tensile strength of 140-210mpa maximum yield strength below 97mpa and elastic modulus 70 GPa.

VII. ANALYSIS OF FSW BENEFITS AND IMPORTANTS

8.1 BENEFITS OF FSW

1) No hot cracks and no gas pores on work samples.
2) No shielding gases while performing welding process
3) Possibilities of joining dissimilar alloys
4) Limited weld seam preparation.
5) Constant weld quality achieved together with high productivity.
6) No UV radiation while performing welding process.
7) No welding fume is generated.

IX. CONCLUSION

An overview into the evaluation and advances in Friction stir welding technology has been presented. The process can be said to have evolved significantly leading to some industrial applications in two decades. The aluminum rings consisted of the aluminum parent material extruded in the aluminum sheets while the study on the fabrication of metal matrix composites of aluminum and particles using FSW revealed that the FSW process can be successfully employed to improve and enhance the surface engineering properties of material. However, the evolution and the advancement of the FSW process endures as researches continue to explore the usefulness and the effectiveness of the processes in response to the growing demand of the industries.

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