International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 07 Issue: 05 | May 2020 www.irjet.net p-ISSN: 2395-0072

FRICTION STIR WELDING USING MAGNESIUM ZE41 ALLOY(BUTT-JOINT)

Y.ANANTHA REDDY[1], SAIESHWAR[2], MALLIKARJUN[3], SAIKRISHNA[4], SHIVA KUMAR[5]

[1]Assist.Professor, Mechanical Engineering st Martins Engineering College, Secunderabad, Telangana, India.
[2-5]Students of Mechanical Engineering Dept., st Martins Engineering College, Secunderabad, Telangana, India

---

Abstract-*friction stir welding is one of the solid form welding which is produced by the relative motion between the milling or any other tool and work piece. This will convert directly from mechanical energy into thermal energy. During this process atomic diffusion occurs. And also while welding it will reaches to the recrystallisation temperate at the welding zone. The principle variables are tool speed, axial pressure of tool and the time for welding. The tool used is non consumable tool.*

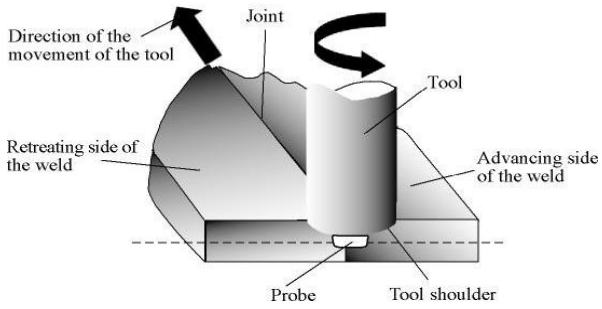
1. INTRODUCTION

It was invented in 1991 and was started using from 1996.In this type of welding the joining parts are welded without melting the workpiece material. By the generation of heat the softened region is obtained near the friction stir welding tool. Good quality of welding will be obtained. It will not evolve fumes and there is no use of filler material. In this project we used electrical discharge machine for cutting and milling machine is used for friction stir welding.

Welding is a process of joining the similar materials or di s similar materials by using of with or without pressure. It is a fabrication process. The material will melt by using high heat and after cooling the material gets solidified. In friction stir welding heat is created by friction.

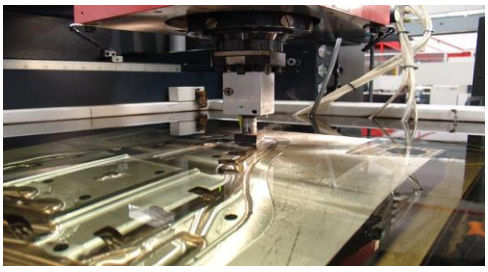
1.1 Principle of operation:

A rotating cylindrical tool with a profiled probe is fed in to butt between two workpieces which are clamped. The is shorter slightly then the depth required, the tool is moved forward along the line joint with a preset welding speed. The adiabatic heat which is generated cause the stirred material to soften without melting.



1.2 Electrical discharge machine:

Electrical discharge machine has become most sophisticated thermoelectric traditional machining options. It has been reported that aerospace related industries own 40% of EDM. In this machining very challenging to manufacture by aero space parts, industry, surgical components etc .The advantage of EDM machining process is that tool and working is not in contact to each other. The cutting accuracy is high. The time taking for cutting is high compared to other cutting process. EDM was originally observed by English scientist joseph priest ley 1770.



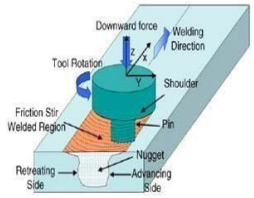
1.3 Milling:

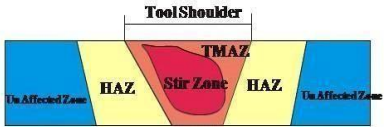
Butt joint of magnesium ze41 is obtained through friction stir welding which is performed on milling machine with the help of tool. Milling machine was adopted to get the position control during the welding process and is tested under the microscope .High mechanical properties and the defects will be low compared to other joining process.

1.4 Welding zones:

Friction stir welding in its cross section consist of three main zones they are as follows

- Heat affected zone
- Thermo mechanically effected zone
- Heat affected zone





2. Tool:

- Tool is having square profile.
- Tool profile are made of material EN19 composition

- This profile will give different properties of weld joints

• silicon	0.36-0.44%
• molybdenum	0.25-0.35%
• Chromium	0.9-1.20%
• phosphorus	0.035%
• sulphur	0.040%
• carbon	0.36-0.44%
• manganese	0.7-0.11%

Tool probe is having 2.5 mm and it is made on lathe.

2.1 Tool design:

The design of the tool is the critical factor because the good tool will improve both the quality of the welding speed. Tool should have toughness, strength, and high temperature bearing capacity while welding.

3. Material:

ZE41 is a magnesium casting alloy contains zirconium, rare earth, and zinc. This alloy is well suitable for integrity casting they are operated at ambient temperature up to 149^0c.

- zinc 3.5-5%
- Rare earth 0.8-1.7%
- Zirconium 0.4-1
  Melting point magnesium 990-1180^0F

The dimensions of the workpiece

Length 160mm

Breadth 80 mm

Thickness 5mm

4 . BUTT JOINT:

5. Manufacturing process:

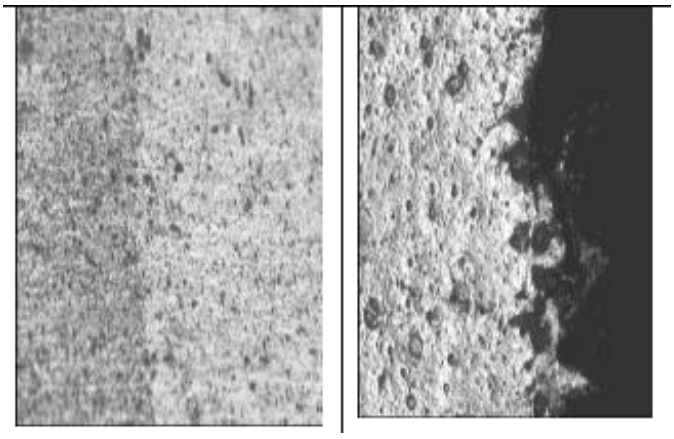
The material is cut into required dimensions by the E D M and is then welded on the milling machine by fixing the workpiece on the table.

The tool will rotate and move simultaneously. The tool probe will not be in depth up to the bottom of the workpiece.

6. Testing:

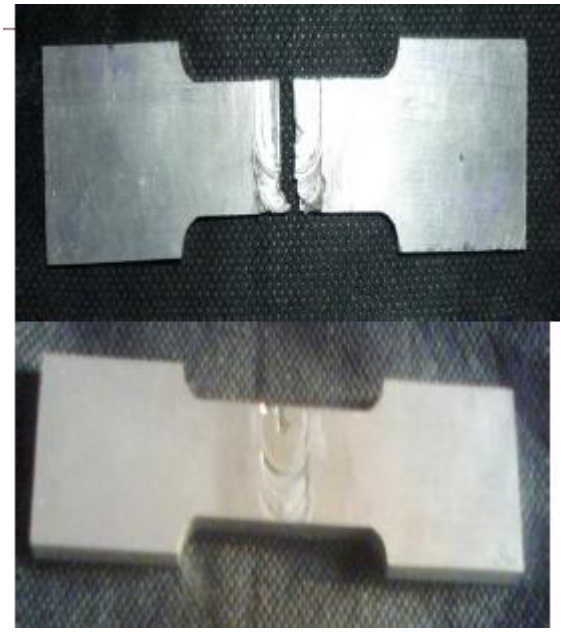
- **Microstructure test**
- **Tensile test**
- **Vickerhardness test**
- **Microstructure:**

The solid state nature of the f s w process combined with the asymmetric speed profile and tool shape will give the results in a highly characteristic microstructure. The micro structure is broken into three zones



Tool rotational speed 1000rpm	Tool rotational speed 1400 rpm
Microstructure of weld transistion zone	Microstructure of bonded zone
Microscope focal length is 200X	Micro scope focal length is 200 X

Tensile test



Tensile test is performed by using the universal testing machine. Results shows that the maximum tensile strength found in the f s w joint is 75% of the raw material which is not weld.

Radiographic test:

It is a non destructive test. Where the manufactured components are tested to verify the internal structure of the material. It is performed by using gamma rays as well as x rays the various forms of different electro magnetic energy is related to the physical process to produce them.

Failure in f s w:

The f s w tools faces difficult in stirring material which will get high flow stress and also will generate more load on the tool probe it is mainly effected by the strain rate and the temperature field

➢ CONCLUSION AND FUTURE SCOPE:

- The Variation of the hardness across the weld was found to be uniform and homogeneous in nature due to the

distribution of the interfaced strengthening of the newly formed grains in the magnesium matrix during the process with 1000 rpm tool rotational speed flow and good bonding between the plates.

- **REFERENCES:**

1. Baker, Hugh D. R.; Avedesian, Michael (1999); "Magnesium and magnesium alloys"; Materials Park, OH: Materials Information Society. p. 4. ISBN 0-87170-657-1.