

# OPTIMIZATION OF FRICTION STIRS WELDING OF ALUMINUM 6063 BY USING TAGUCHI APPROACH

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## ABSTRACT

Friction stir welding is a solid state welding. It is most commonly used in light weight vehicles and aerospace etc. By applying ANOVA find out the mechanical properties by using FSW process. Three parameters may have been taken. These are tool speed, feed rate, shoulder diameter. Initially welded the material using solid state welding. In a welding tool speed, shoulder diameter and feed rate has been varying. Friction stir welding is carried out in vertical milling machine. Aluminium 6063 is used as the work piece material for carrying out the experimentation to optimize the Tensile strength. The plates used are of thickness 6mm and length & breadth of 50mm. Using Taguchi approach the nine experiments have been taken in three parameters and we found out tool speed is optimum parameter at the rest of other parameters. And the optimum tool speed is 3080 rpm. The main aim is to measure the mechanical strength of material.

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## I. INTRODUCTION

Friction stir welding is solid state welding. It is commonly employed in these days. It is best replacement and advanced welding which is most commonly used in light weight particles. N. Rajamanickam(1) studies mechanical properties by applying ANOVA and regression approach. They vary tool speed, weld speed and find out strength of material. And they found out that weld speed is most influential parameter rather than other. Suyash Tiwari(2) Uses DOE method to find the BHN value and tensile strength. He varies tool pin profile, shoulder diameter and fixed the workpiece in fixture and find the optimum parameter in friction stir welding.

## II. METHODOLOGY AND DESIGN OF EXPERIMENT

Aluminum 6063 is used as the work piece material for carrying out the experimentation to optimize the Tensile strength. The plates used are of thickness 6mm and length & breadth of 50mm.



Fig. 1: Welded Piece

**Table 1: Process Parameters**

Level	Tool Speed(rpm)	Feed Rate(mm/min)	Shoulder dia(mm)
1	1800	20	14
2	1950	25	16
3	3080	30	18

### III. DESIGN OF EXPERIMENT

Taguchi's designs aimed to allow greater understanding of variation than did many of the traditional designs. Taguchi contended that conventional sampling is inadequate here as there is no way of obtaining a random sample of future conditions. Taguchi proposed extending each experiment with an "outer array" or orthogonal array should simulate the random environment in which the experiment would function. The design of experiment is shown in Table 2

**Table2: Design of Experiment**

Sr. No.	Tool Speed(rpm)	Feed Rate(mm/min)	Shoulder dia(mm)
1	1800	20	14
2	1800	25	16
3	1800	30	18
4	1950	20	18
5	1950	25	20
6	1950	30	16
7	3080	20	20
8	3080	25	16
9	3080	30	18

### IV. RESULTS

After applying taguchi in three different parameters then nine reading has been taken to find the optimum value. The S/N ratio for Tensile Strength is calculated on Minitab 15 Software using Taguchi Method. Regardless of the category of the performance characteristics, a greater S/N value corresponds to a better performance. Therefore, the optimal level of the welding parameters is the level with the greatest value.

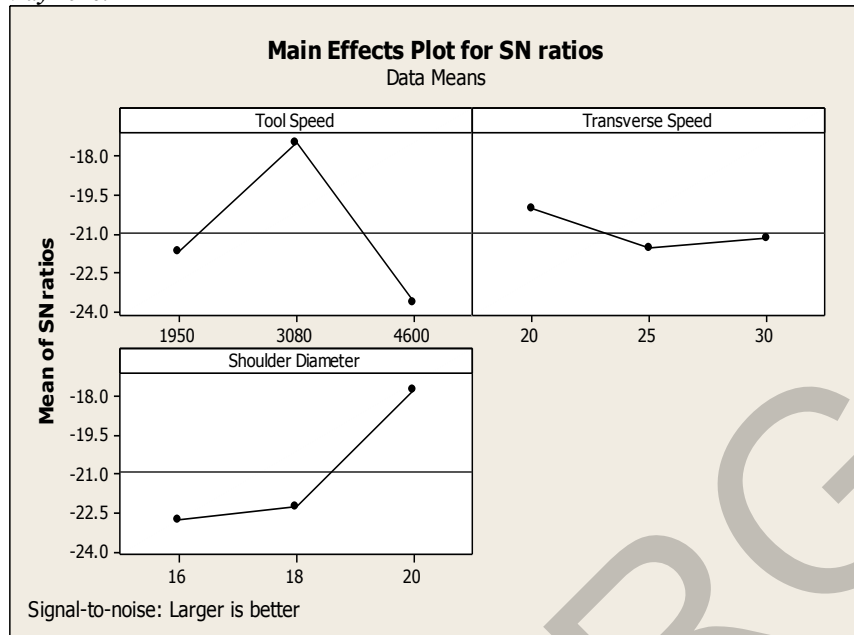
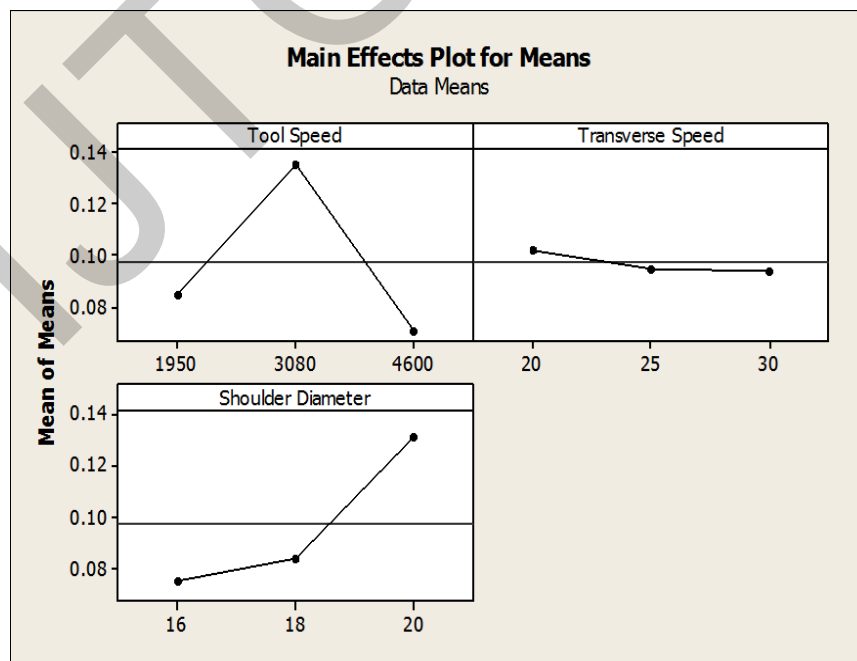


Fig. 2. Effect of Welding Parameters on Tensile Strength for S/N Ratio

As the tensile strength value increases, its effect is increasing with increase in tool speed up to 3080 RPM. So the optimum tool speed is level 2 i.e. 3080 RPM. In feed rate Its effect is decreasing with increase in feed rate. So the optimum feed rate is level 1 i.e. 20mm/min. In shoulder diameter its effect is increasing with increase in shoulder diameter. So the optimum depth of cut is level 3 i.e. 20 mm.



**Fig.3.Effect of Welding Parameters on Tensile Strength for Means****Table 3: Optimum Value of Parameter According to S/N Ratio**

Tool Speed(RPM)	Feed Rate(mm/min)	Shoulder Diameter(mm)	Tensile strength (KN/mm <sup>2</sup> )
3080	20	20	0.164

## V CONCLUSION

The level 2 at speed 3080 rpm is optimum value .also the speed having the optimum parameter to measure the mechanical properties of friction stir welding.

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