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FRICION WELDING OF AA6063T-6 & SS304

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I. INTRODUCTION

In welding process mainly high temperature and pressure are used for making a good joint. This high temperature can be produced by different methods depending upon, properties and applications of joint.

In friction welding piece is held stationary and the other is rotated in the chuck of a friction welding machine. As they are brought to rub against each other under pressure, they get heated due to friction. When the desired forging temperature is attained through throughout the rubbing cross -section of work pieces, the rotation is stopped suddenly and the axial pressure is increased to cause a forging action and hence welding. This method has been used for welding of thermoplastics during decade of 1950. But this process of friction welding is adopted for welding of metal in 1956.

Friction welding is a high speed process suited to production welding. However initial trials are required to standardize the process parameters for a given job. Friction welding of two pieces rarely takes place more than 100 seconds though it may be about 20 seconds for small components. One of the parts to be friction welded needs to be round which puts a serious limitation on the use of this process. However, it is increasing in popularity and can weld most of the metals and their dissimilar combinations such as copper and steel, aluminium and steel, aluminium and titanium, etc. Typical applications of the process include welding of drill bits to shanks, i.e. engine valves head to stems, automobile rear axle hub end to axle casing. The Tensile strength being the response had a great effect by varying parameter combinations. The friction pressure made tensile strength decreased and increased due to the formation of finer to coarser to grain structure as in the Figure. The forging pressure made tensile strength increased and decreased due to formation of coarser to finer grain structure as in the figure. As the friction time increased the tensile strength increased and decreased due to the formation of coarser to finer grain structure as in the figure. And as the forging time increased the tensile strength decreased.

II. EXPERIMENTAL SETUP

For doing friction welding vertical milling machine and lathe machine both can be used. The joining of Al6063t6 and SS304 is obtained by using lathe machine at different r.p.m.

1. **Lathe machine:** This machine is used to weld aluminium and stainless steel with help of friction generated in between these alloys.
2. **Stop watch-** Stop watch was also used to note down the weld time during friction welding.
3. **Vernier calliper:** This was used to note down the burn off length during welding.

III. SPECIMEN SPECIFICATIONS

The following are the specifications which will be used:

- Length of specimen : 80mm (each)
- Diameter of specimen : 12.5mm

Two cylindrical specimens of same size 80 mm lengths & 12.5mm diameter were used

For friction welding we put facing operation both on the aluminium & stainless steel specimen. Chamfering on aluminium is done and drilling in the stainless steel specimen.

Chemical Composition:

The following table shows the composition of base materials.

Sr. no	Elements	Observation (% Weight)
1	Copper	0.1
2	Magnesium	0.75
3	Silicon	0.9
4	Iron	0.35
5	Manganese	0.1

6	Zinc	0.1
7	Titanium	0.1
8	Chromium	0.1
9	Aluminium	97.5

Table 1: Chemical composition of aluminium (6063T6)

Sr. no.	Elements	Observation (%)
1	Nickel	10
2	Silicon	0.38
3	Manganese	1.67
4	Phosphorus	0.045
5	Chromium	18.2
6	Sulphur	0.03
7	Carbon	0.054

Table 2: Chemical composition of Stainless Steel (ss304)

IV. RESULTS

Hardness

Sample No.	R.P.M.	Hardness No. on 1 mm on Stainless Steel Side	Hardness No. on 5 mm on Stainless Steel Side
1	1400	320	295
2	700	317	301
3	1500	311	298
4	900	312	303
5	1800	315	302

Sample No.	R.P.M.	Hardness No. on 1 mm on Aluminum Side	Hardness No. on 5 mm on Aluminum Side
1	1400	58	50
2	700	50	49
3	1500	52	49
4	900	49	47
5	1800	51	49

V. CONCLUSIONS

- 1) Friction welding has been successfully employed to weld dissimilar metals.
- 2) Highest micro hardness values were observed in the specimen on the steel side due to high friction and high heat at the welding zone. Among all the specimens prepared at different speed the hardness obtained at 1400 rpm is more.
- 3) Also the specimen having high burn off length have good tensile strength and hardness number.

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