

Analysis of mechanical properties of friction stir spot welding by using EN19 circular profile tool on Al(6061-T6) and Brass(IS319)

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ABSTRACT

Friction stir spot welding (FSSW) is a solid state welding procedure (original of friction stir welding) which was developed as a original way for fusion aluminum alloys. During FSSW, the frictional heat produce at the tool-work piece boundary make softer the adjacent material, thus the rotating and moving pin cause material to flow. The forge pressure and addition of the plastic material effect in the configuration of a solid bond region.. In the present work, Aluminum alloy and Brass alloy are tied by friction stir spot welding (FSSW) using EN19 circular profile tool .It is study that pin tool ,rotating at a stable speed, plunges into divergent metals of Al-6061 to Brass-IS319 and Brass-IS319 to Al-6061 specimens, in spot-joint configuration. Test samples showed a Brass-IS319 to Al-6061 specimens of friction stir spot weldment joints of different metal better joint than Al-6061 to Brass-IS319 through breaking load test.

Keywords - Friction stir spot welding; tool design;EN19; Al-6061 and Brass-IS319 alloy;breaking load test; process parameter.

I.INTRODUCTION

Welding is the course of metal joining by the aid of heat, with or absence of pressure. Welding is a manufacture or sculptural course for joining the resources several contrasting energy source use for welding purpose, with a gas flame, electric arc, laser, electron beam, friction and ultrasound,group an industrial course, welding could be executed in several diverse environments, with on open air, beneath water and inside surface space. Welding is a dangerous undertaking and defense are necessary to evade burns, electric stun, vision harm, breathing of toxic gases and smoke and exposure to powerful UV radiation.

II. LITERATURE REVIEW

Friction stir Spot welding (FSSW) is a solid-state fusion technique to use a third remains tool to bond two face exterior. Heat is produce inside the tool and material which lead to a tremendously soft region by the FSSW

tool. Later mechanically concept the two piece of metal can bond, then the lighter metal can be attached by mechanical pressure , like fusion clay, or dough. It is mainly use on extruded metals and also on structures which require better welding strength without a later weld heat treatment.

Friction stir spot welding (FSSW) produce welds by a rotating, non-consumable welding tool to nearby soften a work-piece, during heat produce by friction and plastic work, allow the tool to ‘stir’ the combined surface. The reliance on friction and plastic flow, the heat cause for important melting in the work-piece, avoid several of the difficulty arise from a vary in state, such as modify in volumetric changes ,gas solubility and which also fusion welding method. Further, the condensed welding temperature makes possible radically lower distortion and residual stresses, enabling improved fatigue act, new construction techniques, and making likely the welding of extremely thin and very thick materials.

III. EXPERIMENTAL SETUP

On vertical milling machine friction stir spot welding is performed. We have machined our Al 6061-T6 & Brass IS319 plates in the size of 100*55*2mm thickness. Circular tool profile EN 19 and speed of 900 rpm and feed of 38mm per minute. The method of operation is started and the tool penetrated between two plates. At the time of penetration some chips came out, after that the shoulder of tool made the material to go inside and to form the good weld as the tool .

3.1 TOOL DESIGN: Tool design is a vital factor as a good tool can get improved both the fame of the weld and the utmost potential welding speed. The tool metals is strong, tough and hard at the welding temperature.

Table 1: chemical composition of EN 19 Alloy Steel

C	Mn	Cr	Mo	Si	S	P
0,35-0.45	0.5-0.8	0.9-1.5	0.2-0.4	0.1-0.35	0.05	0.035

Table 2: Mechanical properties of EN19 Alloy Steel

Tensile N/mm2	Yield N/mm2	Elongation %	IZOD KCV J	Hardness Brinell
850-1000	680	13	50	248-382

3.2 EN 19 TOOL SPECIFICATION

EN19 is known as 709M40 is alloy steel, good ductility, shock resistant and wear property. It is suitable for gears, pinions, shafts and spindles.

EN19 is high tensile grades EN 19T (709M40T) OR EN19U. EN19T has a tensile strength of 850-1000 N/mm². For other wear resistance EN19T can be nitride. A intimately related grade to EN 19 is 708M40. High peak steels can provide EN19 in bright and black bar form.

3.3 ALUMINUM

It denoted by Al and its atomic number is 13. It silver-white, soft, non magnetic and also the boron group. It is the third most plenteous element next to O₂ and Si and the most plentiful metal in the earth crust, although it is a smaller amount common in the mantle below.

3.4 BRASS

It alloy set from copper and zinc can be create a range of brasses with uneven properties. It can be change over alloy, atoms of the two element may alternate to each other in the similar crystal structure.

Table 3: Chemical composition of Brass as per IS:319

Cu	Pb	Fe	Zn
62-63	0.5 to 1.5	0.20	Balance

Table 4: Mechanical Properties of Brass as per IS:319

Tensile Mpa	Yield Mpa	Elongation %	Hardness HB
285	150	10	90-160

Table 5: The chemical composition of AL(6061-T6)

Al	Cr	Cu	Fe max
95.8 -98.6	0.04-0.35	0.15-0.14	0.7

Table 6:The mechanical properties of Aluminum(6061-T6)

Tensile Ultimate MPa	Yield strength Mpa	Hardness Vickers	Elongation
310	276	107	12%

Table 7: Process variables

Parameters	EN 19
Tool Profile	Circular Tool
Rotational Speed(RPM)	900
Feed(mm/min)	38

Depth of cut(mm)	3.5
Inclination angle	0.5 deg
Tool	



Fig 1. Experimental set up

3.5 MACHINE VARIABLES

3.5.1 Rotational Speed of the Tool: The Rotational speed of the tool is also recognized as the machine spindle RPM have an effect on the fame of the joint. By boost in rotational rate, the heat produced by friction too increase which straight affects the temperature at welding location. 900 RPM is selected for this experiment.

3.5.2 Welding Feed Speed : The welding feed speed which be able to be termed as tool advancing speed too affects the eminence of welded joints. With reduce in tool rotational rate the tool, time for which tool in contact with material increase, so the heat produced by friction also increases which directly affect temperature at welding location. Proper temperature is needed for preferred welding there for welding feed speed is 38mm/min selected properly.

3.5.3 Depth of Cut(Axial Force):Axial force necessary to weld the metal. Based on the thickness of the material . Force base on the machine condition and thickness of the materials select.In our case the depth of cut is fixed 3.5 mm.



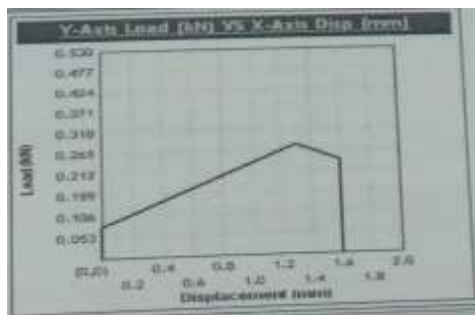
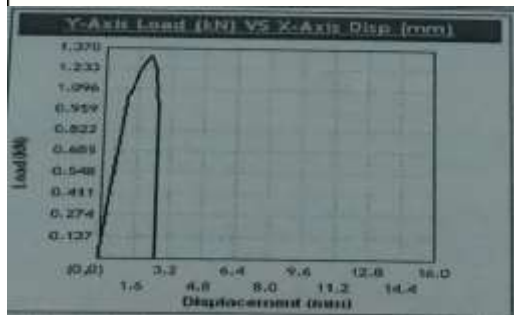
**Fig 2:- FSSW of Al(6061-T6)to Brass(IS319)
Brass(IS319) to Al(6061-T6)**

Fig 3:- FSSW of



**Fig 4:- Test of Al(6061-T6)to Brass(IS319)
Al(6061-T6)**

Fig 5:- Test of Brass(IS319) to



Graph 1:Breaking load of Brass(IS319) to Al(6061-T6)

Graph 2:Breaking load Al(6061-T6) to Brass(IS319)

IV. CONCLUSIONS

- The friction stir spot welding (FSSW) processing Al(6061-T6) to Brass(IS319) and Brass(IS319) to Al(6061-T6).
- It can be seen that Breaking load of Brass(IS319) to Al(6061-T6) is 1.320 KN and Al(6061-T6) to Brass(IS319) is 0.480 KN.
- The significance of the tool geometry and its material for the friction stir spot processing tool and its effect on base material throughout the operation.
- So, Brass to Al is better joint compare to other joint by using EN 19 circular profile tool The tool material should not be a source of infectivity to the final process joint.
- Workpiece are greatly affect due to shape and size of tool pin and shoulder.

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