

ABSTRACT

Friction stir welding (FSW) is a solid-state joining process that uses a non-consumable tool to join two workpieces without melting the workpiece material. FSW is capable of joining aluminium alloys, copper alloys, titanium alloys, mild steel, stainless steel and magnesium alloys. In this project similar cast aluminium alloys AA5052 were welded by friction stir welding process. Process parameters like tool rotational speed (750 r.p.m., 850 r.p.m., & 950 r.p.m.) and traverse speed (10mm/min, 20mm/min & 30mm/min) are used for welding process. Circular tool pin profile was used to weld the joints to study the effect on the mechanical properties like tensile strength and hardness of the welded joints. The corrosion test on the weld joint for the sample which has higher tensile strength was carried out. Tensile strength of 34.58MPa was achieved for the tool rotational speed of 850 r.p.m. and traverse speed of 10mm/min and hardness of 77 VHN was achieved in the heat affected zone for the tool rotational speed of 950 r.p.m. and traverse speed of 10mm/min. Corrosion test was carried out for the sample with highest tensile strength and it was noted that there was a weight loss of 0.467 gm and the corrosion of 0.044400263 mm/year was observed since the tool profile was maintained as cylindrical.

Identification Of Material

AA5052 aluminium plates with 100 mm length x 50 mm width x 6 mm thickness were used for fabricating weldments.



Fig. 1 Wrought AA5052

Experimental Work

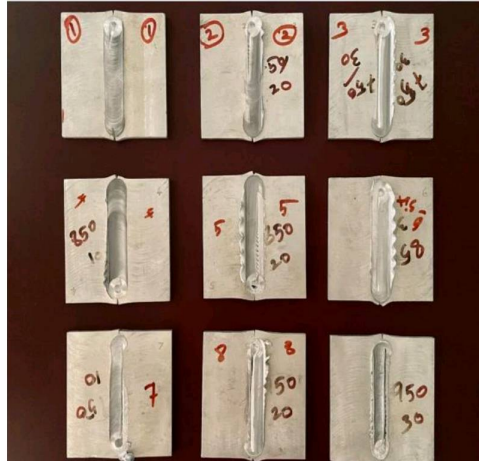


Figure 2 Samples After Welding



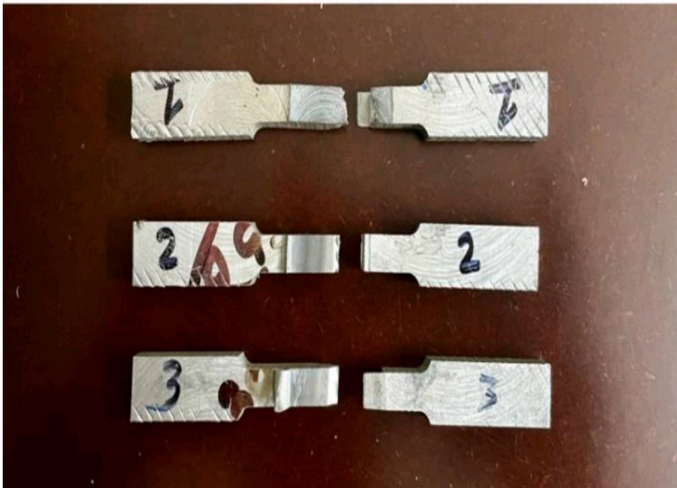
Figure 3 Welding using milling machine

Process Prameters

Sample No.	Tool rotational speed (r.p.m.)	Welding speed (mm/min)
1	750	10
2	750	20
3	750	30
4	850	10
5	850	20
6	850	30
7	950	10
8	950	20
9	950	30

Results

Tensile specimen



Tensile Test

SAMPLE	TOOL ROTATIONAL SPEED [rpm]	TRAVERSE SPEED [mm/min]	TENSILE STRENGTH [Mpa]
1	750	10	13.435
2	750	20	2.739
3	750	30	4.860
4	850	10	34.588
5	850	20	2.573
6	850	30	3.859
7	950	10	3.430
8	950	20	4.288
9	950	30	3.859

Hardness Specimen

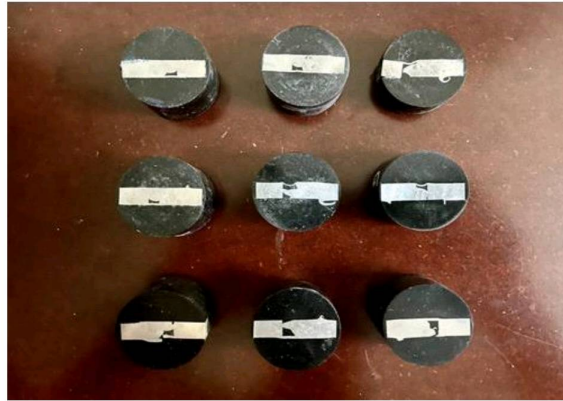


Figure Hardness test samples

Hardness Test Result

Sample	Left Parent	LHAZ	Weld Zone
1	58.6	64.4	63.4
2	59.9	68.3	69.4
3	60.9	68.3	67.2
4	67.6	65.7	65.4
5	48.2	56.9	58.9
6	69.3	59.0	71.2
7	63.7	61.0	77.0
8	63.4	61.6	59.6
9	63.3	61.4	61.3

Corrosion Test Result

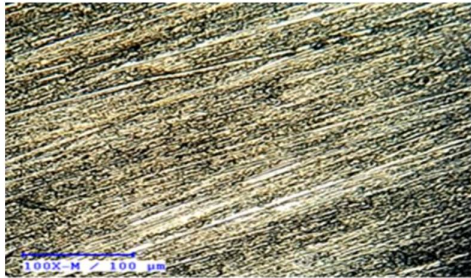


Figure Before Corrosion Test

Figure After Corrosion Test

S. Id	Initial weight in gm	Final weight in gm	weight loss in gm	Width in mm	Thickness in mm	Height in mm	volume in cm ³	Density g/cm ³	Corrosion mm/year	Corrosion mils/year
1	7.721	7.254	0.46	13.38	6.27	33.97	2.8498	2.71	0.0444	20.956

Conclusion

- Friction stir welding of similar material of cast aluminium AA5052 was successfully performed. It was observed that at a tool rotational speed of 950rpm & traverse speed of 10mm/min the tensile strength of 77MPa was achieved.
- At moderate traverse speed it is noted that the tensile strength of the welded zone is noted to be much low when compared to other high and low traverse speed.
- Corrosion test is carried out for the weld material which has the highest Tensile strength and it shows the corrosion rate of welded region when the region was exposed to the 5.0% NaCl Spray test chamber at the maintained air pressure of 2 bar.
- It is observed that higher hardness of 77VHN was achieved in the heat affected zone for the tool rotational speed of 950 r.p.m. and traverse speed of 10mm/min.