

Comparative Study of FSW in Milling Setup with Tig Welding In Aluminum (He9 63400) Alloy

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ABSTRACT: The theme of our project is to install FSW setup in milling machine to afford the friction stir welding in local marketable welds. Because the Friction stir welding process is very high in cost. So that FSW welding tool is made and attached into vertical milling machine and it does the operation of FSW. To know the betterment of this weld, it is further analysed with workpiece welded with TIG welding

I. LITERATURE SURVEY

Friction stir welding (FSW) was invented at The Welding Institute (TWI) of UK in 1991 as a solid-state joining technique by W. M. Thomas et al. Frankel and Xia were first to investigate pitting and stress corrosion cracking behaviours of FSW 5454Al and compare them with those of base alloy and GTAW samples. Their study revealed following important observations. First, the pits in FSW samples formed in the HAZ, whereas in GTAW samples the pits formed in the large dendritic region just inside the fusion zone. Second, FSW welds showed a pitting resistance higher than those of base alloy and GTAW welds. Frankel and Xia pointed out that although the differences in pitting potential were not very large, the trend of higher pitting potential for FSW samples was observed consistently. Third, in stress corrosion cracking (SCC) tests using U-bent specimens, base alloy and FSW welds did not show SCC susceptibility in 20 days tests in 0.5 M NaCl solution, even if polarized at +60 mV in respect to corrosion potential.

However, GTAW U-bent specimens cracked at the same conditions. Fourth, slow strain rate tests (SSRT) revealed that both base metals and FSW and GTAW welds, anodically polarized, exhibited a reduction in ductility, indicating a certain SCC susceptibility.

However, the reduction in ductility for FSW welds was air and solution was attributed to a defect associated with some remnant of original interface. The breakup of the original interface depends on the process parameters as well as tool design. It is important to completely breakup and distribute the oxide surface layer to avoid crack nucleation sites.

The experimental observations that the pitting and SCC resistances of FSW welds were superior or comparable to those of the base material were also recently reported by Corral et al., Zucchi et al. and Meletis et al. Corral et al. investigated the effect of FSW on the corrosion behaviour of a very common heat-treatable aircraft aluminium alloy (2024Al-T4) and a so-called third-generation Al-Li alloy (2195Al). Anodic polarization curves showed that the diffusion-limiting current densities and corrosion potentials of both 2024Al and 2195Al FSW welds were nearly identical to those of the base alloys for a 0.6 M NaCl solution. Furthermore, static immersion tests for 20 h and 25 days showed an even amount of by-product build-up both on the FSW zones and base metal sections.

II. EXISTING SYSTEM

In existing system, FSW is a whole welding machine which works under the principle of friction. A non-consumable rotating tool designed with pin and shoulder is drilled slightly and slotted along the horizontal axis of two metal

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plates. Due to rotational friction two metal plates collide and join each other. This process is high in cost so this is overcome in the proposed system.

III. PROPOSED SYSTEM

In the proposed system, the composed tool which is attached to the milling machine runs at several rpm which does the FSW operation. Under this condition aluminium plates made of He9 Al63400 are welded and these welded plates are compared and analysed with specimens welded with TIG for maximum stress.

IV. METHODOLOGY

At first, the composite of aluminium alloy is to be formed by the process of annealing under 900f and the required methods such as forging and casting are to be done. The composite material which is to be formed is fed to the FSW and other welding type. These welded workpieces are to be given to the laboratory for analysis of hardness, durability under various testing. By this, the result of workpiece of FSW and other weld type is to be recorded.

V. MATERIALS REQUIRED

The following materials are required for the survey.

- ❖ Aluminium alloy (He9 Al63400 5.1% of zinc)
- ❖ Vertical milling machine
- ❖ FSW tool
- ❖ TIG setup
- ❖ Safety equipments
- ❖ Impact testing machine
- ❖ Universal testing machine

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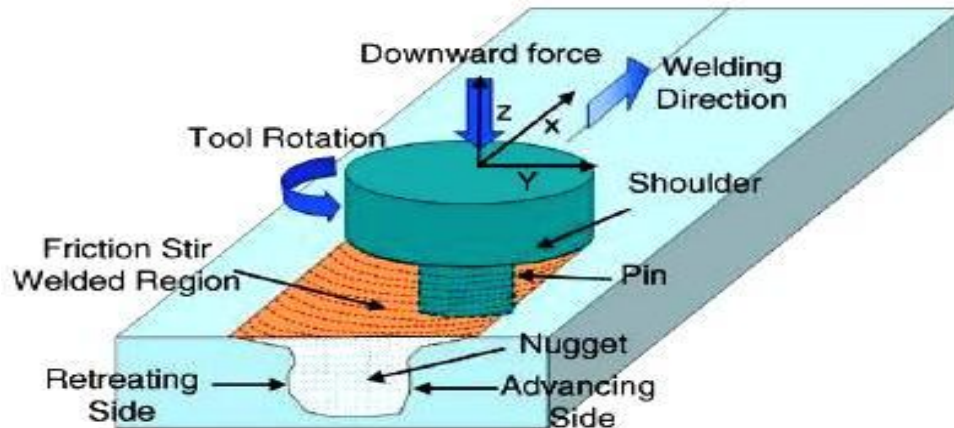
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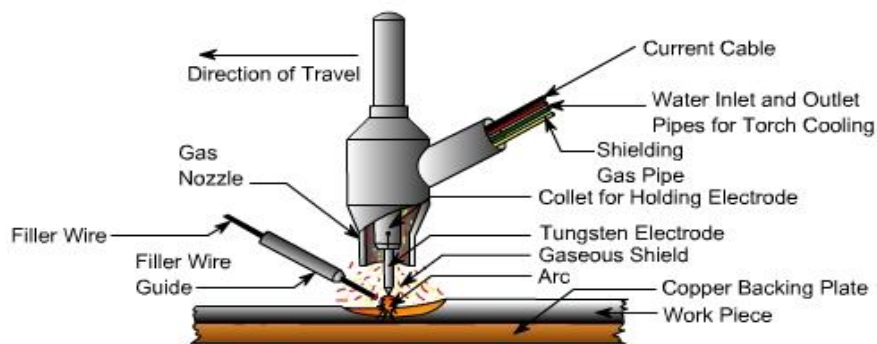
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VI. FRICTION STIR WELDING



- ❖ In FSW, two pieces are joined along the horizontal axis. The tool initially drills the axis of the pieces and shaped along its axis.
- ❖ By this process the metal melted by the friction and gets bonded

TUNGSTEN INERT GAS WELDING (TIG)



Gas tungsten arc welding (GTAW), also known as tungsten inert gas (TIG) welding, is an arc welding process that uses a non-consumable tungsten electrode to produce the weld. The weld area is protected from atmospheric contamination by an inert shielding gas (argon or helium), and a filler metal is normally used, though some welds, known as autogenous welds, do not require it. GTAW is most commonly used to weld thin sections of stainless steel and non-ferrous metals such as aluminum, magnesium, and copper alloys.

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(a)specimen before testing



(b) specimen after testing

ADVANTAGES

- ❖ Eco-friendly process
- ❖ No production of hazardous fumes
- ❖ Cutting fluid is not required
- ❖ No use of filler material
- ❖ No ark or spark is generated
- ❖ No machining needed after welding

DISADVANTAGES

- ❖ Exit hole is left. But this can be filled by post processing.
- ❖ Large down force is required.
- ❖ Rigid clamping is required.
- ❖ Slow welding speed.

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- ❖ Less flexible operation when compared with Arc or Gas welding.

VI. APPLICATION

- AUTOMOBILES

The automobile industry is working to highly reduce the weight of the automobile by employing hybrid materials. By reducing the weight of the component we can reach very high speed and also the fuel efficiency will also increase greatly.

- SHIPBUILDING AND OFFSHORE

Shipbuilding and offshore marine industries are the first one to apply Friction Stir welding for commercial purpose.

- AEROSPACE

Aluminum alloys are now highly used in the construction of the aero plane structure due to the light weight and high strength. There are also lot of research going on to develop aluminum based alloys and composites which will have high strength to weight ratio. So FSW can be used for welding them.

VIII. CONCLUSION

A maximum tensile strength of 85.67MPa was exhibited by the FSW joints fabricated with the optimized parameters of 1600-1800 r/min rotational speed, 75mm/min welding speed, 7 kN axial force, shoulder diameter of 15.54mm, pin diameter of 5.13mm, and tool material hardness of 600 HV. Adding to the above, MIG specimen showed a tensile strength of 90.32Mpa.

Thus higher performance in production rate and quality, as well as decreasing production costs, can be obtained by FSW welding. Which is somewhat equal to Fusion weldings

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