

Preparation of Papers for the International Journal of Engineering and Science Friction Stir welding

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ABSTRACT

Friction welding method is one of the most simple, economical and highly productive method in joining in similar and dissimilar metal. It is widely used in automotive, aircraft and aerospace industrial application. Ceramic metal bonding is the one of the biggest challenge that have faced manufacturers and users over the years because of the inherent differences in the thermal expansion coefficient of the two types of materials. In the present work a ceramic component of AL₂O₃-YSZ was friction welded to 6061 al alloy. Alumina rods containing 0 and 25 wt % yttria stabilized zirconia were fabricated by slip casting in plaster of Paris molds and subsequently sintered at 1600 centigrade on the hand the aluminum rods were machine down using a lathe machine to the dimension required. The diameters of the ceramic and metal rods both 15 mm respectively. Rotational speed of friction welding was between 900 to 2500 rpm. Friction pressure was maintained at 7 mpa and friction time was kept constant. The mechanical properties of friction welded al₂o₃-ysz to 6061 ALLOY were determined with a 4 point bend test and Vickers micro hardness. . The experimental result indicates that the mechanical strength of friction welded al₂o₃-ysz/6061 al alloy components were obviously affected by joining rotational speed selected.

Keywords : friction welding; mechanical properties; ceramic; alumina; zirconia; aluminum; alloy;6061

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I. Introduction

Recently, requirements for lightweight and large energy blankets such as for instance aluminium alloys have improved slowly in aerospace, airplane and automotive purposes because of their extra-ordinary energy to fast rate using their opposition attributes in undesirable environments. Friction wake welding (FSW) method is just a stable state joining approach regarded as being the substantial progress in the last two decades. The weld is shaped by the exorbitant deformation of the substance at conditions under their reduction place, hence the technique is just a stable state joining technique. There's number reduction of the substance, therefore FSW has a few benefits within the frequently applied synthesis welding techniques. In the FSW method, parameter variety and software geometry are among the important thing facets that establish the calibre of the manufactured joint. Modifying the prices of various variables, such as for instance welding pace, rotational pace, lean perspective, and green geometry, can decrease the allows exerted from the TMAZ part to the tool. The plastic movement is in charge of obtaining a weld with large tensile energy and less problems and which means software geometry represents an essential position in reaching a supreme quality In FSW, a cylindrical shouldered tool with a profiled pin is rotated and plunged into the joint area between two pieces of sheet or plate material. The parts have to be securely clamped to prevent the joint faces from being forced apart. Frictional heat between the wear resistant welding tool and the workpieces causes the latter to soften without reaching melting point, allowing the tool to traverse along the welding line. The plasticized material, transferred to the trailing edge of the tool pin, is forged through intimate contact with the tool shoulder and pin profile. On cooling, a solid phase bond

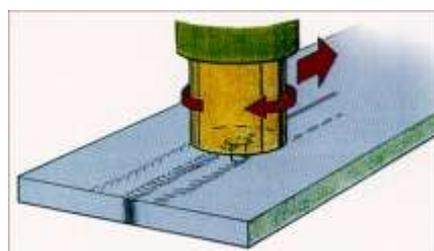


Fig. 1.1 Butt Joint through FSW

II. Literature Review

Liu et al.[1] inside their study report mentioned the friction wake weld capacity of the 2017-T351 aluminum combination and establish perfect welding variables, the relations between welding variables and tensile attributes of the joints. Scientists unearthed that the tensile attributes and fracture places of the bones are somewhat suffering from the welding method parameters. Once the perfect progressive frequency is 0.07 mm/rev equivalent to the turning pace of 1500 rpm and the welding pace of 100 mm/min, the utmost final power of the bones is equal to 82% that of the bottom material. Although the voids-free bones are fractured near or at the screen involving the weld nugget and the thermo-mechanically influenced region (TMAZ) on the improving area, the fracture happens at the weld middle once the emptiness flaws occur in the joints. Kovacevic (2003) Inside their study friction wake welding (FSW) is just a somewhat new welding method which could have substantial benefits set alongside the combination techniques as follow: joining of conventionally non-fusion weld ready alloys, decreased distortion and increased technical attributes of weld ready alloys bones as a result of genuine solid-state joining of metals. In that report, a three-dimensional design centered on finite aspect examination is employed to review the thermal record and thermo technical method in the butt-welding of aluminum combination 6061-T6. HuseyinUzun et al.[2] investigated that the joining of dissimilar Al 6013-T4 combination and X5CrNi18-10 metal was moved out applying friction wake welding (FSR) technique. Cavaliered et al.[3] investigated the physical and micro architectural attributes of dissimilar 2024 and 7075 aluminum blankets joined by friction mix welding (FSW).

Driver [4] in today's report, a three-dimensional thermo technical design for Friction Mix Welding (FSW) is presented. On the basis of the speed areas classically utilized in water aspects and integrating temperature feedback from the instrument neck and the plastic stress of the majority product, the semi-analytical design may be used to acquire the strains, stress costs, and estimations of the conditions and micro-hardness in the different weld zones.

Marzol et al.[5] recognized a friction wake welding (FSW) method variables package for an AA 6061 metal strengthened with 20% of Al₂O₃ contaminants, and establish qualities of the acquired joints.

Watanabe et al.[6] attempted to butt-weld an aluminum mix menu to a delicate metal menu by friction wake welding, and investigated the consequences of a flag turning rate, the career for the green axis to be put on the tensile power and the microstructure of the joint.

Finding New through literature Review

Following getting literature evaluation discovering that in the literature review various Aluminum combination are utilized and various different proportion of AI are utilized through different state of aspect include in (FSW).of a systematic laboratory investigation on the static behavior of silica sand containing various amount of plastic and non-plastic fines. Ojha and Trivedi (2013) conducted triaxial test on sand fines mixes and reported changes in shear strength parameters.

EXPERIMENTAL SETUP: EQUIPMENTS USED

1. VERTICAL MILLING MACHINE

2. TENSOMETER

3. HARDNESS TESTING MACHINE

Fabrication of FSW: Most of the sophisticated welding produced in friction wake welding have now been permitted by the growth of new welding tools. The welding instrument style, including equally their geometry and the product that it's built, IS is crucial to the effective Utilization of the process.

Three kinds of resources were picked in that study. They are:-

Right round

Tapered

Threaded

METHODOLOGY: TAGUCHI METHOD

Dr. Taguchi of Nippon Phones and Telegraph Business, China is rolling out a technique predicated on "ORTHOGONAL ARRAY" tests gives significantly paid down "deviation" for the test out " ideal adjustments " of get a handle on parameters.

Therefore the union of Style of Studies with optimization of get a handle on variables to acquire BEST effects is accomplished in the Taguchi Method. "Orthogonal Arrays" (OA) offer a couple of well-balanced (minimum) tests and Dr.Taguchi's Signal-to-Noise ratios (S/N), which are wood features of preferred result, function as aim features for optimization, aid in information examination and forecast of ideal results.

EXPERIMENTATION PLAN

In this project research the plan of action was formulated according to the objective of our research

- STEP 1 ---- Choosing the appropriate process parameters.
- STEP 2 ---- Choosing the appropriate orthogonal array.
- STEP 3 ---- Assigning the process parameters proper places in the arrays.
- STEP 4 ---- Fabrication of weld joints using different parameters.
- STEP 5 ---- Preparation of specimens for testing
- STEP 6 ---- Carrying out the various tests
- STEP 7 ---- Analyzing the test result data and deduce a conclusion.

SELECTION OF PROCESS PARAMETERS & THEIR LEVELS

In this research paper we have chosen to optimize three process parameters.

- These are:-
- Rotor Speed
- Tilt Angle
- Tool Profile

Table 6.1 Process Parameters

Rotor Speed (in rpm)	950	1880	2262
Tilt angle(in degree)	1	2	3
Tool Profile	Straight cylindrical	Threaded	Tapered

TESTING PHASE

Hardness testing: The hardness check is moved out to check the hardness of the weld joint. The hardness could be the way of measuring power of product to fight plastic deformation frequently by indentation each time a compressive power is applied. Hardness is determined by ductility, flexible rigidity, stress etc.



Hardness specimen

Hardness table

Show in table 8.1

Major load = 100kgf Minor load = 10kgf

Ball dia = 1.5 mm

Table : Hardness Test Readings

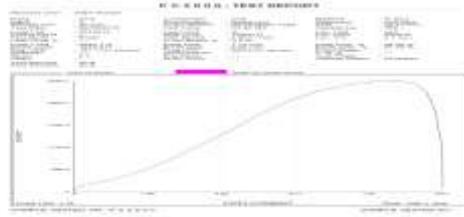
Experi ment No.	Hardn ess value (at base metal)	Hard ness value (at edge of weld)	Hares s value (at centre of weld)	Hard ness value (at edge of weld)	Hard ness value (at base metal)
1.	83	73	84	81	83
2.	76	75	78	77	75
3.	98	100	105	102	95
4.	80	92	100	90	88
5.	82	98	102	91	80
6.	84	88	92	90	85
7.	72	86	90	82	75

TENSILE TEST

The tensile check of the welded mutual is moved on the tensometer machine. Tensometer is really a system applied to gauge the tensile attributes of components such as for instance their Young's modulus and tensile strength. It is generally a common screening equipment laden with an example between two grabs which are possibly altered physically or immediately to utilize power to the specimen. The equipment operates possibly by operating a prop or by hydraulic ram.

III. RESULT AND DISCUSSIONS

The data collected from the tensile test by tensometer has been graphically shown :-



IV. CONCLUSION

Friction stir welding is now a very trending process. Which is increasingly establishing for the fabrication of complex component? It is right to say that FSW has elaborately use of welding in some material application, in particularly in the fabrication joining 2xxx and 7xxx alloy for the across pace industry. The improvement making the process attractive include reduce cost, minimize repair need, better properties & complete automation leading to high level of consistency. The present review demonstrated for the Testing report different variation of load and displacement find , Also this variation or the report plot as an graph.

The fact FSW is actually a device instrument process. It's nevertheless, prevailed to make the welding of large energy mix realty.

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