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Investigation of Surface Defects of TIG Welded Dissimilar Metals (AA6061 – T6 and AA5052 Aluminum Alloy) Using NDT

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ABSTRACT: In the gift work, the microstructure and impact of heat on hardness of base metal, hardness of weld zone and behavior of TIG welded joints of dissimilar materials were investigated using the plates of AA6061-T6 and AA5052. The soft-cast steel plates were welded with AA6061 plates by variable technique parameters. Properties like tiny hardness and microstructure of welded joints were evaluated (welding current, gas, flow rate and filler material) three input parameters each having three levels each (low, medium and high). Therefore on understand the little structural changes occurring inside the weld zone was investigated through the optical scientific instrument.

KEYWORDS: Tig Welding, Aluminum alloy, Dye Penetrant Testing, Ultrasonic testing

I. INTRODUCTION

Dissimilar weld refers to the method of connecting materials with totally different alloys through weld the filler material and each metal ought to be evaluated before selecting the simplest thanks to connecting the metals. While fusion weld could be a widespread methodology, it doesn't work well for a few combos of metals. alternative strategies could offer an additional sturdy hold, particularly for uses in high-stress environments truth, 2 metals with an equivalent name is welded along, however, if they need different core properties, they're classed as dissimilar metals. as an example, you'll be able to weld 2 steel metals along, however, they'll still differ enough to be thought-about dissimilar.

The fastening method itself leaves a powerful and permanent joint between the 2 metals, primarily let go of one final product. We've coated additional on the particular method itself within the section below. When attachment completely different metals along, the required result can assist you to select your approach.

If high performance in a very difficult engineering application is important, you'll go a technique. as an alternative, enticing creative finishes that don't need high strength might lead in another direction. for example, imagine the completely different needs of TIG-welded design, attachment mild-steel plates to high-precision tooled-steel threads, or repairing excavator bucket-teeth in production. All 3 environments might involve attachment dissimilar metals.

II. EXPERIMENTAL WORK

The rectangular plate specimen with length 100mm, width 50mm and thickness 10mm of AA6061 And AA5052 Aluminum Alloy are joined using TIG welding machine. TIG welding electrode made by tungsten. The experiment was conducted only for a single experiment of TIG.

- The tensile and hardness test are performed to check the quality and strength of the steel for best results.
- It provides a simple, efficient and systematic approach to optimize design performance, quality and cost.
- 3. Both metal (AA6061 And AA5052 Aluminum Alloy) can be purchased as our required dimension (100*50 mm) and thickness 10mm

- We can take three work piece each work piece have one AA6061 And AA5052 Aluminum Alloy
- All the work pieces have grinded by grinding machine.
- Cut the work piece “V” groove angle at 60 degree in the length of the work piece

We can make the V groove shape in the edge of the work piece with the help of grinding machine.

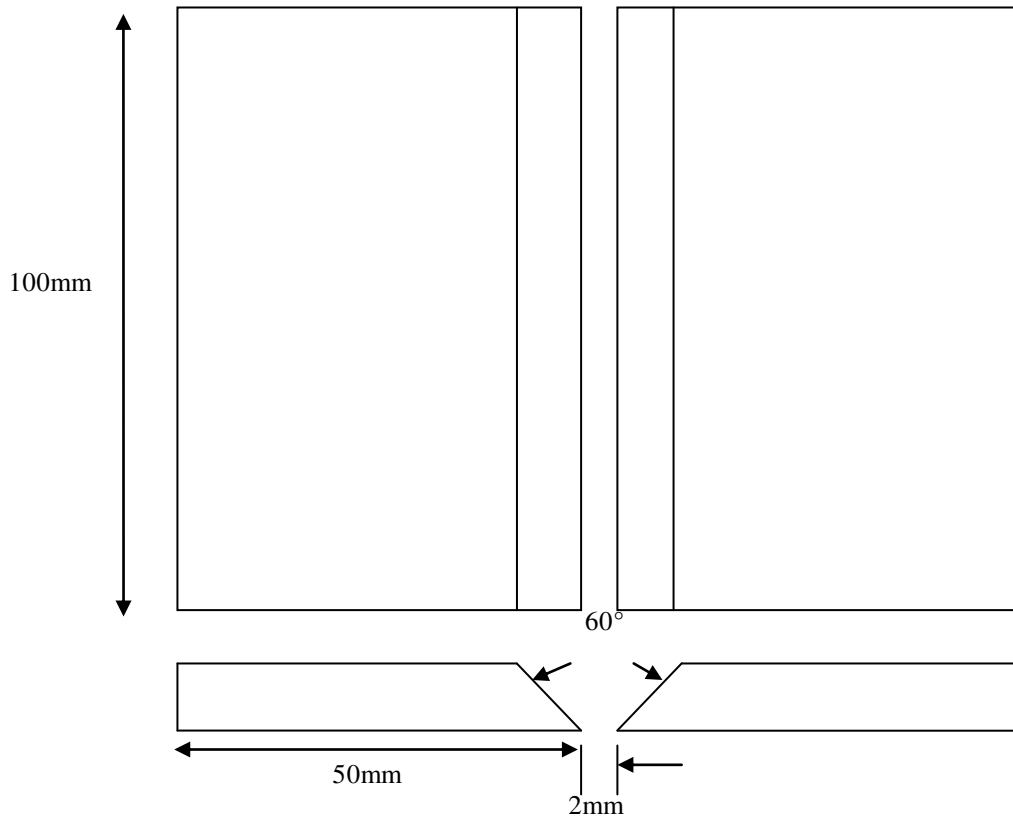


Fig 1 (a) Specimen Diagram

We have planned to join AA6061 And AA5052 Aluminum Alloy using TIG (Tungsten Inert Gas) welding process.

TIG welding is chosen because

Weld strength can be tested after joining is done by means of

- NDT (non-destructive testing) – to detect surface defects and

The AA6061 And AA5052 Aluminum Alloy has been welded at different parameters to see how the weld affects the surface area of the plate

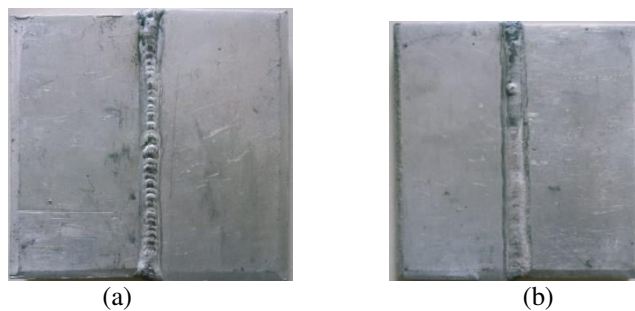


Fig 2. (a)tig welding of aa6061 and aa5052 aluminium alloy at 100amps(b)tig welding of aa6061 and aa5052 aluminium alloy at 83amps



(a)

Fig 3. (a) tig welding of aa6061 and aa5052 aluminium alloy at 130amps

A suitable liquid penetrant is applied to the surface of the element below examination and is allowable to stay there for comfortable time to permit the liquid to penetrant into any defects open at the surface. when the penetrant time, the surplus penetrant, that remains on the surface, is removed. Then a lightweight coloured, powder absorbent referred to as a developer is applied to the surface. This developer acts as a blotter and attracts out some of the penetrant that had antecedently seeped into the surface openings. because the penetrant is drawn out, it diffuses into the coating of the developer, forming indications of the surface discontinuities or flaws.



(a)

Fig 5 (a)applying red dye penetrant on the AA6061 and AA5052 aluminium alloy

In general satisfactory results are often obtained once the surface is within the as welded. As rolled, as cast, or as cast condition however surface preparation by grinding or machining or alternative methodology could also be necessary in some instances once surface irregularities might otherwise mask indications of unacceptable discontinuities. significant grinding ought to be avoided to avoid the masking of fine defects. However, any mechanical operating leaning ought to be followed by appropriate etching. The surface to be examined and every one adjacent areas at intervals a minimum of twenty five metric linear unit ought to be dry, free from any dirt, lint, grease, attachment flux, weld spatter, oil, or different extraneous matter that would obscure surface openings or otherwise interfere with the examination. the strategy of cleanup depends on the character of the fabric of the half and contaminants. Typical cleanup facilities create use of detergents, organic solvents, desalting solutions, alkali solutions, paints removers, vapour degreasing, inaudible cleanup, abrasive blasting, etc. Blasting with shots or uninteresting sand is permissible only it doesn't part over or fill the voids, as this drastically reduces the accuracy of the examination. It is important that elements be completely dried when cleanup so FO water or solvent remains in or over the discontinuities, as this may hinder entrance of the penetrant. Drying could also be accomplished by warming the elements with infrared lamps, drying ovens, forced air circulation, etc

After the half has been completely clean, apply the penetrant to the surface to be inspected. just in case of little parts, they'll be swayback in an exceedingly tank of penetrant. wherever solely space[a neighborhood} area of a part is to be tested, the penetrant could also be applied by a brush or spray. no matter however it's applied, it's necessary that every one surfaces ar wet by the penetrant. The length of penetration time is crucial and depends upon the sort of fabric being inspected, variety of penetrant, kind and size of defect anticipated along with the temperature of the penetrant. In the commonplace testing temperature vary of 15-60°C, and exploitation post emulsified/solvent removable penetrants, a minimum of ten minutes shall be allowed as commonplace penetration time; and for cracks with particularly slim widths, double the time given higher than ought to be allowed. If water drip-dry penetrants ar used, the penetration time shall be concerning one.5 to 2.0 times of that expressed higher than. When a high consistence fluorescent penetrant is



employed, the penetration time could also be longer than the conventional penetration time. In such a case, time shall be subject to agreement between the manufacturer and also the vendee. A very long penetration time doesn't have an effect on the results except to extend the brilliance of indications slightly and build removal of the surplus penetrant tougher.

After letting necessary penetrant time, the surface film of penetrant on the half is removed by removal. The removal should be through and complete in order that the penetrant at intervals the discontinuities of the half alone is undamaged. Special attention ought to incline to trained holes and threads, that area unit extremely vulnerable to retain penetrant.

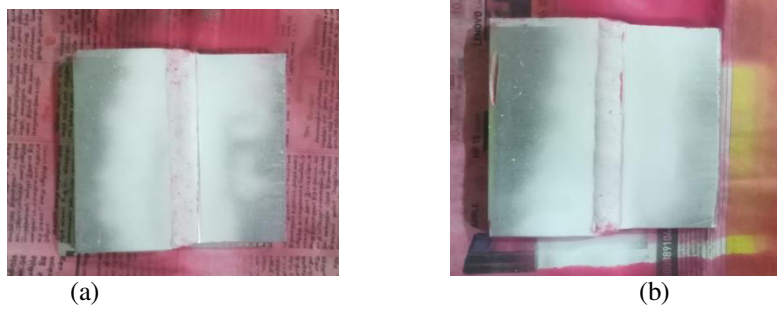


Fig 6.(a) applying solvent solution on the AA6061 and AA5052 aluminium alloy (b) after the dwell time period



Fig7 (a) after cleaning the defect was found

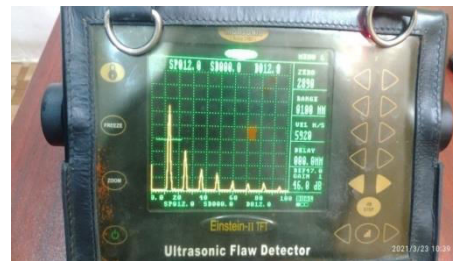
SPECIMEN NO	CURRENT	FILLER ROD	RESULT
4	130	ER4043	Surface finish not proper
5	100	ER4043	DEFECT FOUND
6	83	ER4043	NO DEFECT

Table 4. Table showing defects of AA6061 and AA5052 aluminium alloy

The review are often used for flaw detection I analysis, dimensional measurements, material characterization, and more. A typical UT review system consists of many purposeful units, like the pulser/receiver, transducer, and show devices. A pulser/receiver is associate device that may turn out high voltage electrical pulse. Driven by the neutron star, the electrical device of varied varieties and shapes generates high frequency energy in operation supported the piezo effect technology with exploitation quartz, atomic number 3 salt, or numerous ceramics. Most inspections area unit meted out within the frequency vary of one to 25MHz. The area unit to transmit the waves from the electrical device to the take a look at piece; typical area unit water, oil, glycerol and grease. The sound energy is introduced and propagates through the materials within the sort of waves and mirrored from the opposing surface. an enclosed defect like crack or void interrupts the waves' propagation and reflects back some of the wave. The amplitude of the energy and therefore the time needed for comeback indicate the presence and placement of any flaws within the work-piece. The review methodology has high penetrating power and sensitivity. It are often used from numerous directions to examine flaws in massive elements, like rail road wheels pressure vessels and die blocks.



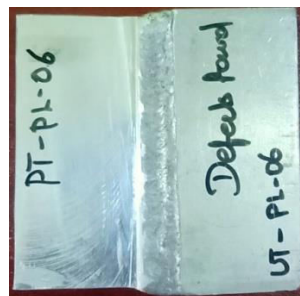
(a)



(b)

Fig 8 (a) Ultrasonic flaw detector before testing (b) Ultrasonic flaw detector after testing

This technique is often performed by elastically stressing the half or structure, as an example, bending a beam, applying force to a shaft, or pressurizing a vessel and observation the acoustic responses emitted from the fabric. throughout the structural changes the fabric like plastic deformation, crack initiation, and propagation, section transformation, abrupt reorientation of grain boundaries, bubble formation throughout boiling in cavitations, friction and wear of slippy interfaces, are the supply of acoustic signals. Acoustic emissions ar detected with sensors consisting of electricity ceramic components. This methodology is especially effective for continuous police work of bearing structures. this method consists of sound the surface of AN object and paying attention to and analyzing the signals to observe discontinuities and flaws. The principle is largely identical as once one faucets walls, desktops or countertops in varied locations with a finger or a hammer and listens to the sound emitted. vitreous grinding wheels ar tested in an exceedingly similar manner to observe cracks within the wheel that will not be visible to the optic. this method is simple to perform and may be instrumented and automatic. However, the results rely on the pure mathematics and mass of the half thus a reference customary is important for distinctive flaws.



(a)

Fig 9 (a) Defect found in 6mm from the welded area

SPECIMEN NO	CURRENT	FILLER ROD	RESULT
4	130	ER4043	NO DEFECT
5	100	ER4043	NO DEFECT
6	83	ER4043	Defect found in 6mm from the welded area

Table 5. Table ultrasonic defects of AA6061 and AA5052 aluminium alloy

IV. CONCLUSION

In this present work AA6061 - T6 and AA5052 is taken as the base materials for joining to occur through TIG welding process. The TIG welding is resulted in interior surface defects of the welds. A design of experiment technique, the penetrant test method has been used to identify the crack ability and TIG welding parameters (current, welding speed, gas flow rate). Microstructure studies have been carried out on the TIG welded specimen. The following conclusions are drawn from this work.

- In this study 12mm thick of AA6061 - T6 and AA5052 plates were successfully welded using TIG welding machine.
- TIG welding of AA6061 - T6 and AA5052 was investigated with different process parameters and also developed the testing methods to optimize parameters.
- Penetrant test has been performed to identify the defect on the material mainly cracks and porosity of welded specimen.
- Each specimen is examined by penetrant test and the defects are noted down for study
- The penetrant tests are carried out and the defects are being analyzed and studied

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