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CHARACTERISTIC OF FRICTION STIRS WELDING OF ALUMINUM ALLOY AND COPPER DISSIMILAR METALS

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ABSTRACT

The joining of dissimilar Aluminum Alloy and Copper aluminum plates of 5mm thickness was carried out by friction stir welding (FSW) technique. Optimum process parameters were obtained for joints using statistical approach. Five different tool designs have been employed to analyse the influence of rotation speed and traverse speed over the microstructural and tensile properties. In FSW technique, the process of welding of the base material, well below it's melting temperature, has opened up new trends in producing efficient dissimilar joints. Effect of welding speed on microstructures, hardness distribution and tensile properties of the welded joints were investigated. By varying the process parameters, defect free and high efficiency welded joints were produced. The ratio between tool shoulder diameter and pin diameter is the most dominant factor. From microstructural analysis it is evident that the material placed on the advancing side dominates the nugget region. The hardness in the HAZ of 6061 was found to be minimum, where the welded joints failed during the tensile studies.

INTRODUCTION

1.1WELDING

Two metals that are similar or dissimilar can be welded together by the process of welding by being heated to the proper temperature either under stress or not, and with no addition of filler metal. the metal filler's temperature is typically around 430 degrees centigrade, and it is either roughly the same as or a bit lower than rock's melting point.

Several methods are used to heat the edges of the work piece during welding. Heat can be produced by an electric arc, an oxy-acetylene or oxy-hydrogen flame, a blacksmith's fire, or a chemical reaction, such as occurs during thermit welding.

1.1.1 AUTOGENEOSWELDING:

Filler rod made of the same metal is used to help. similar metals are joined during welding processes. Cast iron and mild steel are examples.

1.1.2 HETEROGENEOUSWELDING

It is a method for joining metals that are not suitable. The filler rod is used once the metals being joined have taken a central condition of material or heat. With a lower melting point, filler rod than the main metals, making melting easier.

EX:copper<->brass.

CLASSIFICATIONOFWELDING

Two different categories exist for welding. Those are

- Non-Pressure Welding or Fusion
- Welding under pressure

NON-PRESSURE WELDING OR FUSION:

It entails raising the temperature of the pieces over the melting point of the metal. The work's base metal used in this approach parts fuses and they are joined together without the use of pressure. Additional filler metal is used in fusion welding through an electrode.

1.1.3 PRESSUREWELDING:

It entails heating the sections to a temperature where When you push the parts together, the pieces' basic metal turns plastic of a single unit. In pressure welding, no additional filler metal is used.

SUBMERGEDARCWELDING:

MODEOFOPERATION

A bare wire electrode and the work sustain an arc. As the electrode melts, motor-driven rolls feed it into the arc. Wire feed speed is automatically matched to electrode melting rate, thus arc length is constant (similar to MIG/MAG constant voltage). Submerged arc operates under granularflux. Some molten flux protects the weld pool. Unaffected flux can be recovered and reused if dry and untainted. The operator controls a semi-automatic welding gun with a flux hopper.

LITERTURESURVEY

Robinson et al. (1962) found that aluminium alloy 2219 was the most weldable high-strength heat-treatable alloy. They compared weld quality of 2000, 6000, and 5000 series thermal aluminium alloys. Alloy 2219 is robust to solidification cracking and welding parameter and process changes. Electron beam welding improved 2219 joint tensile properties (1969; Trazil and Hood). Electron beam welds benefit from low flow rate, voltage level, and large amps.

They showed that weld width affects EB weld tensile properties. Narrow bead width increased yield strength from 193 MPa to 259 MPa in 12.7 mm 2219-T87 plates. Brennecke (1965) found that electron beam welding of heavy gauge (50-70 mm thick) 2219-T87 plates can increase joint efficiency to 80%. No weld characterization studies were available for electron beam welding of 2219 alloy, light of recent work to improve welding rates and evaluate mechanical properties.

Hartman et al. (1987) found that cutting the crown and bracing the root increased the joint's tensile strength.

In the same work, they found poor tensile values for VPPA welds, in both single pass and

Fig1: Friction stirweldin

multi pass welds the joint yield strength was only 140 MPa as welded. After adding copper-rich crown and root reinforcement, yield strength rose by roughly 10 MPa.

Aluminium alloy 5083 has strong corrosion resistance, superior weldability, and reduced hot cracking sensitivity when welded with magnesium-alloyed filler metal. This alloy is one of the best weldable al alloys and has a mildly lower Heat Affected Zone (HAZ) than most. AA5083 isn't heat treatable, hence post-welding treatments aren't used. By adding scandium to 5025 (Al-Mg) and 4043 (Al-Si) alloys, different filler metals were created (Bob Irving 1997). These fillers boost weld strength. Some 7xxx and 6xxx series alloys, which crack when welded autogenously, were welded with scandium dyes. Scandium reduced 6061 alloy cracking to zero. In Al-Mg-Sc alloys, cracking susceptibility does not change at a scandium level of 0.26% during a varestraint test (Lathabai and Lloyd, 2002). The authors suggest that weld metals may need higher scandium levels than wrought alloys to achieve a good strengthening effect and resistance to solidification cracking.

Different tool pin profiles' impacts on friction stir welding are tested. Square and circular tool pins exist. In this project, we wish to develop a simple model of an FSW tool and two work pieces to be joined by butt using Creo software, and study how thermal stress affects the working pieces.

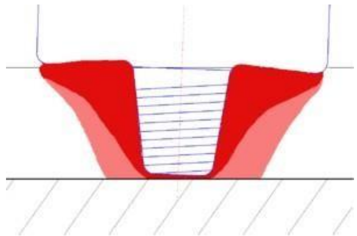
METHODOLOGY

3.1 WELDINGPARAMETERS

3.1.1 LINEUP OF TOOL AT ROAM VELOCITY

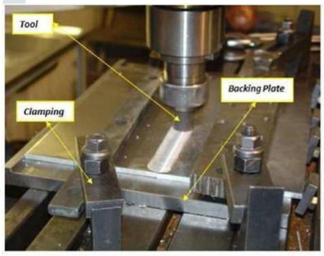
When using a stir casting device, rotate and crossing speeds must be considered. The two events are crucial for a spot weld cycle. Higher spin or tool rotation produces a hot fusion. The central issues must hot just to permit free deformation and limit device loads. Quite fluid can produce voids or flaws in the surface layer, breaking the device.

Heat may harm the weld's final properties. This might theoretically cause flaws from Boiling limited phases. The 'treating frame' is the area of encoding that provides a satisfactory joint.In this range, the joint can receive sufficient energy to sustain metal ductility without becoming overheated and losing some of its weld characteristics.



TOOLTILTANDPLUNGEDEPTH

Fig7:Tooltiltand plungerdepth



Edge range & pitch are shown. Leave.

Fall width is the length of arm far below enable better. Spiraling the arm under the edge creates stress and speeds front forge. Swaying the cutter 2-4 inches assists forge. The drop width can be set accurately for optimal easing and solder penetration.

Due to the high loads, the welding machine may deflect and lower the plunge depth, result in weld. An excessive plunge depth may cause the pin to rub on the backing plate or cause the weld thickness to be too thin. Variable load welders automatically adjust for tool displacement, and TWI has a roller system that keeps the tool above the weld plate.

3.2 THEMACHINE

This chapter describes the core materials,

3.3 THETOOL

Tools shown. Each tool's shoulder generates heat while rolling against the substrate. The tool's pin is placed into the substrate to stir solid-state metal.

3.4 CHEMICALCOMPOSITIONOFT HEBASEMATERIALS

This study used 6-mm alloy to make welds. 5mm plates were used to determine optimal welding parameters. Table 3.1 shows the base materials' chemical compositions.

Fig12: Tensiletestingmachine

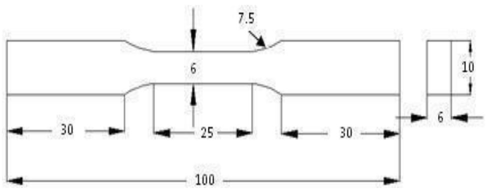
RESULTSANDDISCUSSION

Different writings friction stir welding parameters were tried. For defect-free, elevated elding methods and parameters, mechanical properties, and chemical compositions. Characterization and mechanical analysis techniques are also described. Figs. 1 and 2 show the Dynamic mix riveting technique.

3.5 TENSILETESTING

As-welded weld coupons were used produce 25 mm x 6 mm (100 mm overall) transverse tensile specimens. Upon static loading machine, materials were stiff occupancy evaluated per ASTM E8 (2010). (Fig 3.5). Smooth tensile sample was cut with EDM wirecut To eliminate milling risk, 3 formulations were tested on every aggregate depth (noise). Fig. 3.6 shows the tensile specimen. The ultimate tensile strengths of prepared tensile test sections.The machine's code computed 0.2% yield strength values.

welds, friction stir welding is conducted at 800 rpm, 40 mm/min, and 3 neck diameter. Process parameters were set by trial and error.



4.1.1 MicroStructure

The study's base materials had elongated grains and eutectic and

Metallic particles. The borders between the contact region and sintering screen shot or the thermally area can be seen. On each end of molten pool as in Heater Damaged Region

Fig17: Frictionstirwelded partAl-Al

CONCLUSION

Some results were reached like a result of trials or a review involving dynamic mixture riveting between Al steel 6061 cu And:

- With AA6061-Cu layers, dynamic mix riveting produces butt joints that are 95% safe and fault (based on the yield strength of the softer material i.e. AA6061).
- Steel 6061 experiences stress losses in its thermal band rivets.
- As increase unit hardness, contact mix metal cutting factors got tuned. An optimal cyclic, axial, or head length numbers of 900 rpm, 15 mm/min, and 2.5.
- Using AA6061 cu And, contact mix fusing may generate 95% flawless, solid butt got larger (based on the yield strength of the softer material i.e. AA6061). Merging riveting between different superalloys is not possible because of gelation fracture.

(HAZ), the grain structure is unaffected.

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