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A Review on Effect of Preheating on 6061 T-6 AL using Friction Stir Welding by RSM Method.

KEYWORDS

Maulikkumar Patel | Dipteshkumar Patel

Satyam Patel

ABSTRACT In this study, Friction stir welding of Al 6061T-6 plate with accepted strength is studied with the help of preheating heat source of the al 6061 T-6 plate. Al 6061 T-6 plate is preheated to 100°C, 125°C and150° C before friction stir welding. Preheating of friction stir welding joints is welded completely without any un-welded zone resulting from smooth material flow by equally distributed temperature in two sides of Al plates. Different preheating in welding to simulate defect repair at the joint. Preheating welding process is develop for high strength fine grain structure of Al 6061 T-6. Preheating improve mechanical properties such as tensile strength, cooling rate and residual stress.Preheating in friction stir welding help to improve welding speed, penetration depth, heat affected zone. The ultimate tensile strength of Al6061 T-6 plates higher than preheating of friction stir welding compare to friction stir welding. Tensile strength and microstructure can be checked as well. This work also based on microstructure that will be determined with the help of optical microscope at different preheat temperature. Preheating before welding can reduce heat generation between the rotating tool and the work-piece caused by friction. Preheating of welding also decrease wear rate of the tool.

I.INTRODUCTION

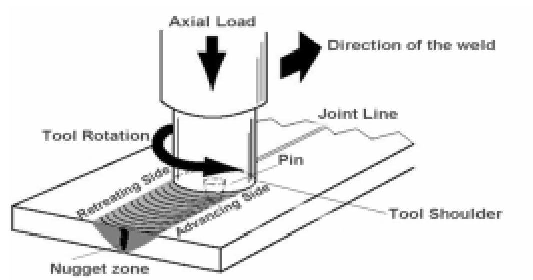
Friction stir welding is a solid state joining method suited for aluminium alloys, which are often difficult to be fusion welded without hot cracking and porosity. The process of friction stir welding widely used in aerospace, shipbuilding, automobile industries and many other industries. There are many advantages compare to another welding such as very low distortion and porosity. It also does not required fumes, consumable electrode and special surface treatment. There are few disadvantages occurs such as large down force are required, it is use only continues path for welding and at the end of welding process exit hole is left behind when tool is withdrawn.

In FSW pin is rotated at constant speed and fed at constant traverse rate in to joint line between two aluminium plates which shown in figure 1. Two Al plates clamped rigidly on to backing bar in such a manner that prevents abutting joint faces from being forced apart. The pin move against the work-piece that time heat is generated between tool and work-piece, causes Al to be soften and force apply at the two sides of the plates. The welding of the material is facilitated by severe plastic deformation in the solid state involving dynamic re-crystallization of Al plate [12].

Preheating can be defined as heating the base metal to a certain temperature before welding[3]. Today in industries very high load applied on the rotating tool, which will lead to breakage of the tools.

It is a concern of higher consumption of the tool. Preheating of material before welding can extend the tool life and improved welding efficiency and produced ductile microstructure [2]. Cooling rate is inversely proportional to the preheat temperature and heat input. Preheating before welding has following benefit:

1. Decrease cooling rate, which produces ductile microstructure that increase resistance to cracking.
2. Reduce shrinkage stress between the weld zone and base metal
3. Prevent chilling effect and ensure proper fusion
4. Eliminate moisture from the plate.



II.LITERATURE SURVEY

In this research hybrid friction stir welding of Al6061-T6 aluminum plate to Ti-6%Al-4%V titanium alloy plate is studied. Hansur Bang et al [1] were analyzed on the preheating of the friction stir welding with the help of the gas tungsten arc welding. In this research first they preheated Ti plate alloy with the help of the gas tungsten arc welding so that it is also known as the hybrid friction stir welding [1]. In this process 24% higher tensile strength compared to friction stir welding. Friction between the tool and work piece can be extensively reduce by applying high frequency induction preheating. Spot friction stir welding is same as the single point joining process like resistance friction stir welding and rivet technology. In Spot friction stir welding does not use spark or fumes, so it is environment friendly also [2]. FSW increases tool life and improve welding efficiency as it is costly rotating tools.

The rail head section preheated to different temperature before gas metal arc filling to simulate defect repair. Different preheat temperature were mostly analyses on the optimum value of the rail such as hardness value, heat effected zone, fracture toughness and microstructure [3].Preheating in welding helps to decrease cooling rate,

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reduce shrinkage stress between weld zone and base metal, prevent chilling effect, ensure proper fusion and eliminate moisture from surface pole [3]. Preheat temperature range from (200°C to 400°C) observed on the mechanical and fracture properties. Preheat temperature is mostly mixture of acicular ferrite and bainite. Preheating temperature mostly responsible to the higher carbon content and reduce cooling rates. Different preheating temperatures (25°C and 150°C) in hybrid laser welding tested cold cracking in the steel at room temperature is taken. In process of preheating first of all preheating temperature increased from 25°C and 150°C. Development of root crack is lowest at 120°C. As preheating temperature increases first of all root crack decrease and then slightly increase at the 150°C [4].At the preheating temperature 120°C yield strength and tensile strength are nearly equal. When preheating temperature increase cooling rate decreases it also reduce hardening and reduce cold crack in the welding. Notch impact toughness at preheating temperature 120°C is better than the preheating temperature of 150°C [4].

In this paper mainly three composites Filtek supreme XT, GC Kalore, and Gradia direct X are studied. Three composites are heated at the room temperature of 37 C and 60 C and later they were analysed stress development and maximum contraction stress on composites. In process composite disc were take and preheat of 40 seconds than it can check of hardness, creep, elastic modulus with the help of ANOVA method and Tukey's-hock test. At the result of preheat of 37 C and 60 C increase polymerization contraction forces but it cannot effect on the hardness, elastic modulus and creep behaviour of material [5].When increase preheating temperature, volumetric shrinkage increased. Increase in stress in material conservation but it cannot effect on the mechanical properties. Finite element simulation can be used reliable method to investigate effect of change in parameters it effect on the tolerances can be evaluation of computational program. Preheat process is not effect on the residual stress but it can effect on the thermal cycle reduce cooling rate. Thermal cycle produced a field of tensile stress and compressive stress near the weld centre line at the inner and outer surface of pipe changed by distance of the far from the weld centre line [6].GMA hybrid welding gives a brilliant quality of laser beam radiation and higher laser output. It use combination of laser beam and arc result improved welding speed, penetration depth, heat affected zone, and gap bridge ability. Preheating process improve the mechanical properties of welding. GMA hybrid laser beam welding provide high welding speed, or penetration depth, lower heat input, lower distortion, small heat affected zone and less consumption of additional material [7]

In this process preheated of ductile iron at temperature ranging from 100° C-400° C and they were analysed of microstructure at the fusion zone, un-mixed zone, partially melted zone, and at the heat affected zone [8]. Heat input during FSW process reduce the effect of heat induced defect in welding. In this paper use finite element method based on an inverse algorithm method is studied. This paper mainly concentrate on two proposed FSW process consist first one was preheating and second was that welding stage [9]. Algorithm method was determined preheat temperature and was substitute in the heat equation to review thermal behaviour of welded parts. Numerical result help to known the calculate heat for melting the material, and temperature different have two layer is minor [10]. The variation of the rotational speed of the tool resulted in a 51% contribution on the HAZ distance to weld line [12]. Preheat is beneficial to increase temperature of the work-piece in front of the tool pin, making the material easy to be welded [11].

Based on the models developed, the parametric studies and the optimization resultsanalysed by Hansur bang et al [1] the ultimate tensile strength were 91% in HFSW welds by the al alloys. Elongation of the HFSW two times of the elongation of the FSW weld so it increases strength of the joint weld. At the HFSW weld hardness in the SZ and TMAZ was lower than the al alloy compare to the FSW weld.Grains of the al alloy in HFSW was finer than the FSW welding in the HAZ and TMAZ. It can also mixed and finer recrystallized grain with Al alloy and Ti alloy in the HFSW.

III.CONCLUSION

It is concluded after extensive literature review that Preheating before welding can reduce heat generation between the rotating tool and the work-piece caused by friction. Preheating of welding also decrease wear rate of the tool and improve microstructure.

In this research, mainly concentrate on the tensile strength and microstructure of the Al6061 T-6 friction stir welding. First of all different preheat temperature is applied such as 100° C, 125° C and 150° C to Al6061 T-6 various plates then different distance are taken between the tool tip and nozzle (with help of applied preheat temperature). Later microstructure is checked of different distance and different preheat temperature with the help of optical microscope. Afterward microstructure and tensile strength is check with the help of RMS method.

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