

Mechanical Properties and Micro Structure of Aluminum Alloys [Al-Mg-Si] as Results of Variation Time in Friction Welding

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ABSTRACT

Friction welding is one solution to solve the problems joining of metals which are difficult to be welded by fusion welding such as aluminum. The process was run by rotating a rod upon another metal and force was applied. Consequently, heat arose below the melting point and made the metals molten joined together as force continuously applied. In this research aluminum 6xxx series were used as this metal have good corrosion resistance, good machinability but not ease to weld. Among important parameters in linear welding are friction time, friction pressure and rotation speed; we only concern in the first one. The friction time variations were 20, 45, 80, and 120 seconds respectively. Whereas the pressure and the rotation speed were kept constantly. The joined aluminum then tensile strength tested using universal testing machine, hardness tested using Electrical Brinell hardness Tester Hauser Henry SA and also observed under optical microscope. The highest tensile strength of 61.07 MPa was gained from friction time of 45 seconds, while the least of only 28.81 MPa when using friction time of 20 seconds. Hardness in the welding areas was almost the same as that of base metal, whereas in the heat affected zone tend to little bit decreased. Friction time of 20 seconds gave the hardest in the welding are almost the same as base metals, whereas the softest as result of 120 friction time. Optical microscope observations show that there were porosities in the welding areas. It probably caused by some trapped gas which formed inter-dendritic porous.

Keywords

Friction Welding, Friction Time, Porosity, Tensile strength, Micro structure

1. INTRODUCTION

Aluminum is kind material, which has some advantages, i.e. it is light, soft and easy to be machined [1]. In order to be able to used as material for construction aluminum should be alloyed. However, both pure and alloyed aluminum are not easy to be joined by fusion welding. The reason is it has high heat factor, oxidation easy and form aluminum oxide Al_2O_3 which high melting point. Alternatively, aluminum alloy could be joined by friction welding. In the previous research, we have successfully applied friction stir welding for joining plate of aluminum alloy AA 1100 by varying speed and feed [2, 3]. The results were not significantly different from another researcher [4, 5]. This series of aluminum alloy, however, have limited application as material construction. Whereas, aluminum alloy (Al-Mg-Si) serial number 6061 have been applied for high-strength structural members, vehicles, rolling stock, marine applications, architectural applications [1]. This aluminum alloy is able to be heat treated, good machine ability, good weld ability and corrosion resist.

Friction welding is a solid state welding process [4] in which the heat for welding is produced by the relative motion of the two pieces being joined. Friction welding achieves 100 per cent metal-to-metal joints, giving parent metal properties. It is the only joining process to do this. No addition material or fillers are required and there are no emissions from the process. The process involves making welds in which one component is moved relative to, and in pressure contact, with the mating component to produce heat at the faying surfaces. Softened material begins to extrude in response to the applied pressure, creating an annular upset. Heat is conducted away from the interfacial area for forging to take place. The weld is completed by

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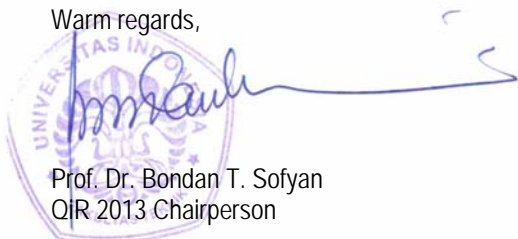
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Warm regards,



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