

ABSTRACT

In recent times, lightweight materials such as aluminium, composites (high strength-weight ratio), are the preferred materials of choice owing to technology improvements and the importance of energy saving and naturally maintainable products with minimum operational costs. Some of the general lightweight materials to be considered are magnesium, beryllium and aluminium. Of these, Aluminium alloys have successfully contributed to meet the rising demand for lightweight structures, when compared to other materials such as magnesium and beryllium primarily owing to the cost and ease of manufacture. Hence, Aluminium plays a vital role in load bearing structures for many applications and is considered as research material in this thesis. Even though aluminium is a load bearing, it is found that structures fail because of weakness in joining. To overcome these failures we prefer welding parameters and their efficiency which resolves many welding related challenges

The conventional welding process is mostly adopted for mild steels, but in light weight material friction stir welding process is widely used due to its high Factor of safety. The fundamental rule of Friction Stir Welding (FSW) is warming the metal to a temperature below the re-crystallization temperature, thereby lowering the risks of welding crack, porosity, and hot split which are usually formed in the traditional welding technique because of alloy's low crystallization temperature and high warmth distribution nature.

In this study, the light weight material AA8011 aluminium combination that has high strength to weight ratio has been chosen. The material AA8011 is widely used in the area of aeronautics, automobiles and marine. In this application welding of material is a major part that contributes

to defects and which is identified in the study as an enabling solution for safety. To check the welding strength, the following experimental and analytical tests have been carried out. From those tests, yield strength, ductility and porosity, SEM and TEM will be done for the structural analysis. The experimental results of Tool Profile, Tool Rotational speed, welding Speed and Axial Forces are optimized with the help of Design Of Experiments (DOE) by using Taguchi method to increase the performance of friction stir welding process through the results.

The optimum Tensile strength of 104MPa is achieved with a tool rotational speed of 1200RPM, welding speed of 90mm/min and axial load of 2KN with Pentagon pin profile.

Through the results, the use of weld parameters has been found to upgrade the mechanical properties of the joints compared and those of continuous present joints of this alloy due to grain improvement occurring in the friction area. Numerous observations originate into the thesis and one needs to carefully balance different weld speed parameters to reach the best combination. Here a crack is made to consider the impact of current welding parameters going on mechanical properties of AA 8011aluminium alloy weldment. The best welding quality is discovered by looking at the result learned from tensile testing, yield testing and by microscopic testing. Scanning Electron Microscope procedure was utilized to inspect the natural of the surface.