DESIGN AND ANALYSIS OF MANUFACTURING FACILITIES FOR FRICTION STIR WELDING PROCESS

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DECLARATION BY THE CANDIDATE

"I declare that this thesis is the result of my own work except the ideas and summaries which I have clarified their sources. The thesis has not been accepted for any degree and is not concurrently submitted in the candidature of any degree."

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ABSTRACT

Friction stir welding, FSW is a solid-state welding process. This welding process involved the penetration of rotating tool which consists of shoulder and prolonged by a pin into a metal plate, followed by advancing speed to weld the metal plate. The aim of this project is to contribute in developing manufacturing facilities for friction stir welding process. A conventional milling machine has been converted to perform a friction stir welding process by designing a suitable rotating tools and jigs and fixtures. In the process, a tool made of H13 steel was designed and used. Then, for the design of jigs and fixtures, a clamping system was applied in order to prevent the workpieces from dispersal or lifting and to ensure that the uniform distribution of temperature and pressure along the specimen throughout the process. The design of the tool, jigs, and fixtures was fabricated and tested by joining two similar plates of aluminum alloys AA6061-T6 to verify the designed. The tests showed promising results with defects-free welds, good strength and smooth surface finish without gap creation between the welded specimens. The percentage of losses of the material during FSW welding process was too small which is 0.67%. The smoothest surface roughness of the specimen weldment was 2.519 μm at 1270 rpm rotating speed and 218 mm/min welding speed. The maximum efficiency of the weldment strength was 65% respected to AA6061-T6 at 218 mm/min welding speed and 1270 rpm rotating speed. These results encourage using and improving the present design for future studies of FSW.

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