

Inertia Friction Pull Plug Welding, a New Weld Repair Technique of Aluminium Friction Stir Welding

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Abstract : Friction stir welding with bobbin tool is a simple technique compared to conventional FSW since the backing fixture is no longer needed and assembling labor is reduced. It gets adopted more and more in the aerospace industry as a result. However, a post-weld problem, the left keyhole, has to be fixed by forced repair welding. To close the keyhole, the conventional fusion repair could be an option if the joint properties are not deteriorated; friction push plug welding, a forced repair, could be another except that a rigid support unit is demanded at the back of the weldment. Therefore, neither of the above ways is satisfaction in welding a large enclosed structure, like rocket propellant tank. Although friction pulls plug welding does not need a backing plate, the wide applications are still held back because of the disadvantages in respects of unappropriated tensile stress, (i.e. excessive stress causing neck shrinkage of plug that will bring about back defects while insufficient stress causing lack of heat input that will bring about face defects), complicated welding parameters (including rotation speed, transverse speed, friction force, welding pressure and upset) short welding time (approx. 0.5 sec.), narrow windows and poor stability of process. In this research, an updated technique called inertia friction pull plug welding, and its equipment was developed. The influencing rules of technological parameters on joint properties of inertia friction pull plug welding were observed. The microstructure characteristics were analyzed. Based on the elementary performance data acquired, the conclusion is made that the uniform energy provided by an inertia flywheel will be a guarantee to a stable welding process. Meanwhile, due to the abandon of backing plate, the inertia friction pull plug welding is considered as a promising technique in repairing keyhole of bobbin tool FSW and point type defects of aluminium base material.

Keywords : defect repairing, equipment, inertia friction pull plug welding, technological parameters

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