Second International Conference on Multidisciplinary Design Optimization and Applications

2008

Conception of a friction stir welding tool

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Abstract : Friction stir welding is a new process that allows a solid-state joining technology of metallic components. Applications and development within this approach has incr eased during the last decade. In this process, the geometry of friction tool plays a fundamental role to obtain suitable microstructures in the weld and the heat affected zones, thus it will be then possible to improve the strength and fatigue resistance of the joint. Among the articles related to the friction process, only few have treated the manufacturing process of the tool. In this work, we will focus on this last point. To increase the welding quality and the process reliability, the design of the tool includes a shaft-spring-based system aimed at avoiding premature damage, furthermore to allow the measure of applied friction pressure. Our improved friction tool has then been tested for applied this welding technique on Al-2024 and Al-7075 aluminium alloys sheets. The weld quality has been evaluated by means of a microstructure analysis and micro-hardness measurements. The ability to increase the welding speed, the changes of the crystalline plans orientation in the mixed part of thermo-mechanically affected zone and grains sizes observed in micrographics underline the effect of the pin geometry and its displacement. The micro-hardness curve shows good mechanical properties. Finally, the obtained results show a su ccessful welding with accep table quality and open new interesting perspectives.

Keywords : Aluminium, conception, Friction Stir Welding, tool, Micro-hardness