FRICTION STIR WELDING FOR THICK ALUMINUM ALLOYS

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Friction stir welding (FSW) is an important method for joining aluminum alloys. However, producing strong and reliable welds in thick materials can be challenging. We are studying advances in FSW technology for joining 10 mm thick aluminum alloy sheets. One approach explores the use of an S-shaped friction mixing joint in a 6061-T6 aluminum alloy joint. This method prioritizes maintaining tensile strength while increasing impact strength and corrosion resistance.

The study varied the turning radius of the S-shaped trajectory and compared it to a traditional linear connection. The results showed that with the optimized parameters, the S-shaped joint achieved significantly higher impact strength (80.74 J/mm²) and better corrosion resistance compared to both the base material and the straight joint track. This improvement is attributed to the formation of a unique "thousand layers" structure in the mixing zone, which results in a stronger bondand this advantage is becoming more and more obvious with the improvement of the plate thickness [1].

The second approach focuses on optimizing the process parameters of conventional FMA of 6010-T6 aluminum alloy sheets using a 0° tool [2]. The purpose of the study was to determine the parameters that create effective joints while analyzing the performance of the welding zone.

The optimal parameters were a rotational speed of 400-600 rpm and a welding speed of 200-400 mm/min. These parameters made it possible to achieve a tensile strength of 86.4% compared to the base metal, with the highest strength achieved at 600 rpm and 400 mm/min. In addition, the microhardness of the deposited zone increased and the grain size became finer compared to the base metal the above experimental data were obtained under the tool-free inclination, which is very rare.

Both methods presented here offer improvements in the processing of thick aluminum alloys. The S-shaped gauge joint demonstrates the potential for improved impact strength and corrosion resistance, while the optimized process parameters for conventional FSW emphasize the importance of parameter selection to produce strong and efficient welds. These advances may contribute to the wider application of mechanized welding in various industries.

References:

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