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Friction stir welding parameters optimization of heterogeneous tailored welded blank sheets of aluminium alloys 6061 and 5083 using response surface methodology

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Abstract

Today, tailored welded blank sheets have found various applications in automotive, aeronautic and many other industrial fields. One of the most efficient methods for production of tailored welded blank sheets is application of the friction stir welding process. In the present article, the effect of friction stir welding parameters on the microstructure and mechanical properties of heterogeneous tailored welded blank sheets made from aluminium alloys of types 5083-H12 and 6061-T6 with the similar thickness of 1.5 mm is studied. The considered parameters are rotational speed of the tool, linear speed of the tool, pin diameter and shoulder diameter. In order to come by a tailored welded blank sheet with optimal mechanical properties, response surface methodology, which is considered as a strong tool in design of experiments, has been employed to design the experiment matrix, and the corresponding experiments have been conducted under laboratory conditions. Tensile strength of tailored welded blank sheets are determined as the relation in the mathematical model. The optimal condition and objective effects of parameters are determined via this relation. Data variance analysis showed that rotational speed and diameter tool have the most and the least effect on tensile strength, respectively. Rotational and linear speed are more effective than pin and shoulder diameter in input heat, which is produced by friction.

Keywords

Friction stir welding, heterogeneous tailored welded blank sheets of aluminium alloys, response surface methodology method.