Mechanical properties of Al weld joints prepared by friction stir welding

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The paper deals with the friction stir welding (FSW) of the EN AW 7075-T651 high strength aluminum alloy with the aim to analyze the influence of welding parameters on the mechanical properties of Al-weld joints. FSW represents relatively novel solid-state technology of material joining which can be successfully applied as well as for welding of several metallic alloys including the high-strength aluminum alloys that are hard to weld by conventional fusion welding processes [1,2].

In cooperation with VÚZ - PI SR Bratislava, nine experimental weld joints of samples with dimensions of 300 x 150 x 10 mm were prepared using the welding machine of the FSW-LM-060 type and different parameters of welding – the welding speed from 60 to 120 mm/min. and the tool rotation rate from 600 to 1000 rpm in clockwise direction. The quality of weld joints was evaluated by X-ray testing. Subsequently, the static tensile tests and microhardness measurements of weld joints were performed.

According to obtained results of tensile testing, the average values of ultimate strength of weld joints are by 32.2 % lower comparing with the ultimate strength of the base material. On the other hand, the ductility increased by 7.2 %. By the tool rotation rate of 600 rpm, the decrease in ultimate strength and also in ductility with increasing welding speed was identified probably as a result of imperfect mixing the base materials. The highest microhardness of weld joints at the level of 129 HV was measured in thermo-mechanically affected zone on the retreating side.

Based on the attained result, the following parameters of friction stir welding for joining of sheets with the thickness of 10 mm from the investigated high strength aluminum alloy can be recommended: the welding speed of 60 mm/min. and the tool rotation rate of 600 rpm.

The research has been supported by the Program to support young researchers (NUMKOM-FSW) 2015 STU Bratislava and by the Scientific Grant Agency of the Slovak Republic within the project VEGA No. 1/0470/14.

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