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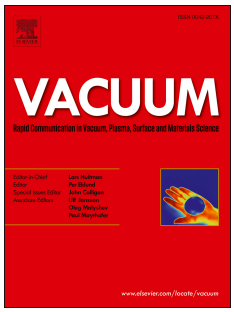

Microstructure and properties in the weld surface of friction stir welded 7050-T7451 aluminium alloys by laser shock peening

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PII: S0042-207X(18)30262-8

DOI: 10.1016/j.vacuum.2018.03.002

Reference: VAC 7845

To appear in: *Vacuum*

Received Date: 18 February 2018

Revised Date: 1 March 2018

Accepted Date: 2 March 2018

Please cite this article as: Liu P, Sun S, Xu S, Li Y, Ren G, Microstructure and properties in the weld surface of friction stir welded 7050-T7451 aluminium alloys by laser shock peening, *Vacuum* (2018), doi: 10.1016/j.vacuum.2018.03.002.

Microstructure and properties in the weld surface of friction stir welded 7050-T7451 aluminium alloys by laser shock peening

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Abstract

Laser shock peening (LSP) was used to treat the weld surface of friction stir welded joints of 7050-T7451 alloys. After the LSP, a large number of micro-holes were formed in the shock region. The hardness of thermo-mechanically affected zone (TMAZ) and heat-affected zone (HAZ) at a distance from the upper surface of 0.5mm increased obviously. The average hardness increased 9HV. The fatigue life after the LSP increases 30%, 27% and 5% when the loading stress is 200MPa, 250MPa and 300MPa. The residual stress in weld nugget zone, TMAZ and HAZ generated a compressive residual stress, and the biggest value is 100MPa after the LSP.

Keywords：friction stir welding; aluminium alloys; laser shock peening; microstructure; residual stress

Friction stir welding (FSW) is a novel method of joining materials, patented by the welding institute (TWI) in 1991[1]. FSW can assure the absence of porosity, hot cracking and rather large distortion that are typical defects of the fusion processes [2]. However, there is a large different in microstructures and properties among the weld nugget zone (WNZ), thermo-mechanically affected zone (TMAZ) and heat-affected zone (HAZ) in friction stir welded aluminium alloys [3, 4]. Therefore, it is quite important to choose an effect treatment method to strengthen the surface of joints. Laser shock peening (LSP) is an innovative surface treatment technique to enhance fatigue, corrosion and wear resistance of metallic materials by the microstructure and properties changes [5]. LSP applies