

SESSION 6: LIGHT ALLOYS, MARITIME HALL

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Residual stresses relaxation in laser beam welded Ti–6Al–4V alloy treated by post-weld local rapid induction heating

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ABSTRACT

Ti–6Al–4V alloys have been used extensively due to their excellent specific strength and good corrosion resistance. However, the low thermal conductivity of Ti–6Al–4V alloy leads to steep temperature gradient during welding and residual stresses produced in the weldment. Residual stresses may cause brittle fracture, hydrogen cracking, and stresses corrosion. Therefore, residual stresses in weld structure need to be removed as a negative factor by post-weld treatment.

Numerous researches have indicated that the residual stresses in weldments could be reduced by post-weld heat treatment in past decades, such as bulk heat treatment in furnace and local electron beam treatment in vacuum chamber. However, most of the heat treatment technologies were not suitable for large-scale components because of their volume. Electromagnetic induction heating is an effective method of rapid heating metal in a short time and free from limitation of volume and shape of the workpiece.

In this paper, the effects of post-weld local rapid induction heat treatment (PWLRIH) on the residual stresses and microstructure were studied and the residual stresses were measured by X-ray diffraction method. Experimental results show that the maximum residual stresses were tensile located at weld center line. The residual stresses significantly decreased through scanning induction heating under 700°C for 1 h, and the maximum values of tensile stress reduce by 86.26%. The microstructure of weldment was almost the same in both as-weld condition and after PWLRIH treatment.

KEYWORDS: residual stresses, post-weld local rapid induction heating, laser beam welding