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Effect of Friction Stir Processing on Pitting Corrosion and Intergranular Attack of 7075 Aluminum Alloy

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The effect of friction stir processing (FSP) on the pitting corrosion and the intergranular attack of 7075 aluminum alloy was investigated. Three friction stir processed samples were produced by employing a constant tool travel speed of 100 mm/min at the rotating speeds of 630, 1000 and 1600 rpm. It was demonstrated that the processed samples suffered from both pitting and intergranular corrosion. Also, the sample processed at 1600 rpm exhibited the best pitting corrosion resistance. For all FS processed samples, the corrosion attack in the heat affected zone was pitting corrosion, whereas no intergranular corrosion was detected in this area.

Key words: Al alloy; Friction stir processing; Pitting corrosion; Intergranular corrosion

1. Introduction

Friction stir processing (FSP) is a relatively new surface modification technique recently developed by Mishra and Ma[1]. It is based on the same principles of friction stir welding (FSW), which was originally invented by The Welding Institute (TWI) in 1991[2]. In FSP, a non-consumable rotating tool with a specially designed pin and shoulder is plunged into a monolithic workpiece until the tool shoulder is in close contact with the work surface. As the tool travels in the expected direction, the surface experiences a dramatic plastic deformation. The heat is generated on the surface by the friction between the rotating shoulder and the workpiece or induced by the visco-plastic dissipation of the stirring material[3]. The FSP technique is responsible for such advantages as microstructural refinement, densification and homogeneity at the processed zone, as well as the elimination of defects from the cast plates[4]. FSP has proven to be a very successful surface modification technique[5–7] for aluminium alloys. A comprehensive review of FSP technology has been presented by Ma[4], which covers topics