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Optimizing Oxidation Process Parameters of Al-Li Base Alloys Using Taguchi Method

Authors : Muna K. Abbass, Laith A. Mohammed, Muntaha K. Abbas

Abstract : The oxidation of Al-Li base alloy containing small amounts of rare earth (RE) oxides such as 0.2 wt% Y2O3 and 0.2wt% Nd2O3 particles have been studied at temperatures: 400ºC, 500ºC and 550°C for 60hr in a dry air. Alloys used in this study were prepared by melting and casting in a permanent steel mould under controlled atmosphere. Identification of oxidation kinetics was carried out by using weight gain/surface area (ΔW/A) measurements while scanning electron microscopy (SEM) and x-ray diffraction analysis were used for micro structural morphologies and phase identification of the oxide scales. It was observed that the oxidation kinetic for all studied alloys follows the parabolic law in most experimental tests under the different oxidation temperatures. It was also found that the alloy containing 0.2 wt %Y 2O3 particles possess the lowest oxidation rate and shows great improvements in oxidation resistance compared to the alloy containing 0.2 wt % Nd2O3 particles and Al-Li base alloy. In this work, Taguchi method is performed to estimate the optimum weight gain /area (ΔW/A) parameter in oxidation process of Al-Li base alloys to obtain a minimum thickness of oxidation layer. Taguchi method is used to formulate the experimental layout, to analyses the effect of each parameter (time, temperature and alloy type) on the oxidation generation and to predict the optimal choice for each parameter and analyzed the effect of these parameters on the weight gain /area (ΔW/A) parameter. The analysis shows that, the temperature significantly affects on the (ΔW/A) parameter.

Keywords : Al-Li base alloy, oxidation, Taguchi method, temperature
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