

Optimization of Corrosion Behaviour of Aluminium Metal Matrix Composite reinforced with nanoparticles Using Taguchi's Techniques

Niveen J. Abd Alkadir
Materials Engineering
University of Technology
Iraq
E-mail:niveen.alwandawy@yahoo.com

Payman S. Ahmed
Faculty of Engineering
University of koya
Iraq

Ali Jamal Abdulqader
Higher Diploma Degree in Engineering Application
Center of studies and engineering designs
Ministry of water resources
Iraq

Abstract

This paper aims to study the corrosion resistance of metal matrix composite of pure aluminum reinforced by nano alumina particles with (3, 6, 9 wt%). Composite materials were prepared by stir casting process. The settings of the process parameters were determined by using Taguchi's experimental design method. Orthogonal arrays of Taguchi, the signal-to-noise (S/N) ratio, the analysis of variance (ANOVA), and regression analyses are employed to find the optimal process parameter levels and to analyze the effect of these parameters on the corrosion rates. Confirmation test with the optimal levels of corrosion parameters was carried out in order to illustrate the effectiveness of the Taguchi optimization method. The corrosion behavior of the metal matrix composite in 0.1M HCl solution under several corrosion test conditions weight percentage, solution temperature and exposure durations was investigated. The corrosion behavior of the composites after different immersion intervals in HCl solutions was carried out using weight loss measurements and the optimal composites investigation by electrochemical measurements. Corrosion measurements indicated that the presence of Al₂O₃ and the increase of its content raise the corrosion rate and reduce the polarization resistance of Al. Increasing the immersion time and the temperature of the test samples in the chloride solutions before measurements was found to decrease the general corrosion and increase the pitting corrosion. The best results (corrosion rate was 0.0282 mm/year) have been obtained at 3% weight percentage of alumina. The results were further justified by comparing with other % of metal matrix.

Keywords: Corrosion, Nano alumina particles, Taguchi method, Electrochemical measurements, ANOVA.