

Accepted Manuscript

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PII: S0925-8388(15)00751-3

DOI: <http://dx.doi.org/10.1016/j.jallcom.2015.03.052>

Reference: JALCOM 33658

To appear in: *Journal of Alloys and Compounds*

Received Date: 25 November 2014

Accepted Date: 7 March 2015



Please cite this article as: S.M. Mousavifard, M.M. Attar, A. Ghanbari, M. Dadgar, Application of artificial neural network and adaptive neuro-fuzzy inference system to investigate corrosion rate of zirconium-based nano-ceramic layer on galvanized steel in 3.5% NaCl solution, *Journal of Alloys and Compounds* (2015), doi: <http://dx.doi.org/10.1016/j.jallcom.2015.03.052>

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Application of artificial neural network and adaptive neuro-fuzzy inference system to investigate corrosion rate of zirconium-based nano-ceramic layer on galvanized steel in 3.5% NaCl solution

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Abstract

A nano-ceramic Zr-based conversion solution was prepared and optimization of Zr concentration, pH, temperature and immersion time for the treatment of hot-dip galvanized steel (HDG) was performed. SEM microscopy was utilized to investigate the microstructure and film formation of the layer and the anticorrosion performance of conversion coating was studied using polarization test. Artificial intelligence systems (ANN and ANFIS) were applied on the data obtained from polarization test and the models for predicting corrosion current density values were attained. The outcome of these models showed proper predictability of the methods. The influence of input parameters was discussed and the optimized conditions for Zr-based conversion layer formation on the galvanized steel were obtained as follows: pH 3.8 to 4.5, Zr concentration of about 100 ppm, ambient temperature and immersion time of about 90 s.

Keywords: Zirconium conversion coating; corrosion prediction; galvanized steel; DC polarization; artificial neural network.

1. Introduction

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