Role of Some Plating Parameters in the Properties of Ni-P/Al₂O₃ Nanocomposite Coatings on Mg alloy

Fakiha El-Taib Heakal^{1,*}, Maanoum A. Maanoum²

¹ Chemistry Department, Faculty of Science, Cairo University, Giza 12613, Egypt.

² Central Metallurgical Research and Development Institute (CMRDI), Cairo, Egypt.

*E-mail: fakihaheakal@yahoo.com, feltaibheakal@gmail.com

doi: 10.20964/2016.08.67

Received: 3 April 2016 / Accepted: 17 June 2016 / Published: 7 July 2016

Electroless Ni-P/Al₂O₃ nanocomposite coatings on AZ91D magnesium alloy have been deposited by incorporating nanoalumina particles into Ni-P alloy matrix to stimulate the wear and corrosion resistance of the substrate. NanoAl₂O₃ particles were uniformly suspended in the bath for 1 h using magnetic stirring, and the Al₂O₃ content in the composite was determined gravimetrically. The effect of nanoparticle concentration in the plating bath on each of nanoAl₂O₃ in the deposit, its deposition rate, and its micro-hardness and wear resistance was thoroughly studied. The influence of SLS surfactant as a wetting agent on the porosity of the deposit and on its content from the nanoparticles was explored. Coat micro-hardness as well as phase transition were also examined in relation to temperature of the heat treatment process. Furthermore, the impact of bath temperature on the deposition rate and on the amount of incorporated nanoparticles in the deposit was discussed. The role of other plating parameters such as stirring speed and nickel sulfate concentration of the plating bath solution in determining the amount of nanoparticles embedded in the Ni-P matrix were assessed and rationalized. Electrochemical polarization curves were measured to evaluate the corrosion performance of AZ91D alloy samples coated with different prepared nanocomposite deposits. In all cases, the obtained as-plated or heat treated Ni-P/Al₂O₃ nanocomposite coating can perfectly act as a potential physical barrier to protect AZ91D substrate from corrosion in the aggressive chloride environment.

Keywords: EN nanocomposite; magnesium alloy; XRD; polarization curves; corrosion protection.

[FULLTEXT](#)

© 2016 The Authors. Published by ESG (www.electrochemsci.org). This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution license (<http://creativecommons.org/licenses/by/4.0/>).