Effect of adding Lanthanum (La^{3+}) on surface performance of Ni-P electroless plating coatings on RB400 support anchor rod steel

Ruizhen Xie¹, Hongyan Zhang¹, Jiaojuan Zou¹, Naiming Lin^{1,2,*}, Yong Ma¹, Zhenxia Wang¹, Wei Tian^{1,3*}, Xiaofei Yao⁴, Pengju Han⁵, Zhihua Wang², Bin Tang¹

¹ Research Institute of Surface Engineering, Taiyuan University of Technology, Taiyuan, 030024, P. R. China

² Shanxi Key Laboratory of Material Strength & Structure Impact, Taiyuan University of Technology, Taiyuan, 030024, P. R. China

³ China United Northwest Institute for Engineering & Research, Xi'an, 710082, P. R. China

⁴ School of Materials and Chemical Engineering, Xi'an Technological University, Xi'an, 710032, P. R. China

⁵ Department of Civil Engineering, Taiyuan University of Technology, Taiyuan, 030024, P. R. China

*E-mail: lnmlz33@126.com, 76134289@qq.com

doi: 10.20964/110343

Received: 6 January 2016 / Accepted: 2 March 2016 / Published: 1 April 2016

Anchor rod, a common support material in engineering which is often used in civil engineering structures, such as roadway, mines, underground tunnels and rock slope supporting and so on. Owing to the complex service environment and condition, the anchor rod is susceptible to wear and corrosion. In order to improve the wear and corrosion resistance of anchor rod and increase the service lifetime during operation, Ni-P coatings have been prepared on RB400 anchor rod steel via electroless plating. Rare earth element of Lanthanum (La^{3+}) with various concentrations have been added into the electroless plating solution. The surface morphologies, phase constitutions and cross-sectional composition distributions of phosphorus contents in the coatings were characterized by scanning electron microscope (SEM), X-ray diffraction (XRD) and glow discharge optical emission spectroscopy (GDOES). Tribological performance and corrosion resistance of the obtained Ni-P coatings were investigated by reciprocating wear testing machine and electrochemical workstation. The results showed that the La^{3+} which played an important role on refining and modifying grain, had significantly influences the properties of Ni-P coatings. In terms of wear resistance, 0.25 g/L is the optimum supplementation, but the effect of La^{3+} on the wear resistance is not significant. While the La-coatings with outstanding corrosion resistance exhibit the highest corrosion potential, lowest corrosion current density and maximum resistance value between solution and substrate when the supplementation is 0.50 g/L.

Key words: electroless plating; anchor rod; Ni-P coating; rare earth; Lanthanum; wear; corrosion

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