Short Communication

Effect of Heat Treatment on the Properties of Ultrasonic Pulse Electrodeposited Ni-W-P/Al₂O₃-LaCl₃ Composite Coatings

Qingwei Niu¹, Zili Li^{1,*}, Gan Cui¹, Guodong Liu², Bingying Wang²

¹ College of Pipeline and Civil Engineering, China University of Petroleum, Qingdao 266580, China

² College of Mechanical and Electrical Engineering, China University of Petroleum, Qingdao 266580, China

*E-mail: zilimenhuzu@163.com

doi: 10.20964/2017.06.21

Received: 6 January 2017 / Accepted: 23 March 2017 / Published: 12 May 2017

Ni-W-P/Al₂O₃-LaCl₃ composite coatings were prepared by ultrasonic pulse electrodeposition using a N80 steel matrix. The structural features and other properties of the composite coatings were analyzed using metallographic measurements, micro-hardness measurements, scanning electron microscopy, X-ray diffraction, and electrochemical measurements. The effect of heat treatment on the composite coatings' microstructures and micro-hardnesses was also investigated. The micro-hardnesses of the composite coatings increased when the temperature of heat treatment was increased up to 400 °C. However, at higher heat-treatment temperatures, micro-hardness decreased, because new Ni₃P and Ni₄W phases were generated after heat treatment. At a heat-treatment temperature of 400 °C, the composite coating had the highest corrosion resistance.

Keywords: Heat treatment; Composite coating; Ultrasonic pulse electrodeposition; Corrosion resistance

[FULL TEXT](#)

© 2017 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/>).