Zn-Fe and Zn-Fe-Y Cementation Coatings for Enhancing Corrosion Resistance of Steel

Sirong Yu^{*}, Li Liu

College of Mechanical and Electronic Engineering, China University of Petroleum (East China),
Qingdao 266580, P.R China

^{*}E-mail: liuli1212006@outlook.com

doi: 10.20964/2017.06.84

Received: 22 March 2017 / Accepted: 18 April 2017 / Published: 12 May 2017

This work aims to enhance the corrosion resistance of medium carbon steel 45. Zn-Fe coatings on steel 45 were prepared at different temperatures (380°C, 390°C, 400°C and 410°C) by pack cementation process. The microstructure, formation mechanism and corrosion behavior of the Zn-Fe coatings were investigated. The Zn-Fe coating possessed a two-layered structure consisting of a thin diffusion layer and a thick outer layer. The coating thickness increased with the increase of the temperature. Zn-Fe-Y coating on steel 45 was prepared by the pack cementation process at 390°C. The effect of Y addition on the microstructure and corrosion behavior of the Zn-Fe coating was studied. The structure of the Zn-Fe-Y coating was similar to that of the Zn-Fe coating. The coating thickness increased with the addition of Y. The activation energies for the formation of the Zn-Fe and the Zn-Fe-Y coatings were 82.31 kJ/mol and 81.12 kJ/mol, respectively. The corrosion resistance was measured by the immersion test and polarization test. The results showed that the corrosion resistance of the Zn-Fe coating firstly increased and then decreased with the increase of temperature. The Zn-Fe-Y coating had better corrosion resistance than the Zn-Fe coating.

Keywords: Coating; Microstructure; Y₂O₃; Activation energy; 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/>).