Electrochemical Impedance Spectroscopy Evaluation of Corrosion Protection of X65 Carbon Steel by Halloysite Nanotube-Filled Epoxy Composite Coatings in 3.5% NaCl Solution

Duo Zhang, Haoqiang Zhang*, Song Zhao, Zhaogang Li, Suoxia Hou

School of Mechanical Engineering, North China University of Science and Technology, Tangshan, China

*E-mail: cgkzhang@ncst.edu.cn, 956191638@qq.com

doi: 10.20964/2019.05.09

Received: 3 January 2019 / Accepted: 18 February 2019 / Published: 10 April 2019

Corrosion by seawater is an electrochemical Corrosion, and all types of metals or alloys when they are in contact with seawater have a specific corrosion potential at a certain level of seawater alkalinity or acidity. Metal corrosion is a major technical problem and plenty of methods have been developed to provide solution. Inhibitor-enhanced coating can be recognized as the most efficient method. In this research, Halloysite nanotube (HNT) was used to create HNT-epoxy composite as protection towards corrosion without the inhibitor. The electrochemical impedance spectroscopy (EIS) study was done on HNT-epoxy composite coatings for corrosion protection carbon steel in 3.5% NaCl solution. The morphology analysis of the HNT was done by optical microscope and field emission scanning electron microscope (FESEM). The EIS characterizations showed a turning point of the composite coating from good to poor corrosion resistance performance. According to EIS measurements, increasing the halloysite concentration had resulted in the enhancement of the barrier effect and an increase in the ability to protect corrosion coating in NaCl solution. The corrosion morphology observations indicated that an increase in nanoparticle loading lead to an increase in the intercalation site and make the composite opaquer. Furthermore, the nanoparticles loading showed poor interaction with the epoxy composite, due to clustering of the nanoparticles and visible as wavy opaque surface. The findings show that the HNT is a very good alternative as a corrosion barrier in coating due to their viability and compatibility with diversity of water- and oil- based coatings onto a protected surface.

Keywords: Electrochemical impedance spectroscopy; Halloysite nanotube; Epoxy composite coating; Electrochemical Corrosion; seawater

[FULL TEXT](#)

© 2019 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/>).