



Preparation and Evaluation of Polymeric Coatings Supported by Nanomaterial to Control Corrosion in Metallic Oil Tanks

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Abstract

The study aimed to investigate the corrosion protection of metallic oil tanks using a multi-protection method with three layers of protection, the basic (initial) layer using a zinc phosphate coating, the middle layer using a Hydrazine hydrate coating, and the upper layer using a composite coating layer consisting of a polymeric matrix, it is made of epoxy, polyaniline (Epoxy resin + PANI), and Nano-oxides (TiO₂-ZnO-MgO nanocomposite), nano-TiO₂ by weight of 1%, Nano-zinc oxide by weight of 3%, and Nano-magnesium oxide by weight of 3% (TiO₂-ZnO-MgO nanocomposite). The three layers were coated on a metallic base of metal oil tanks corroding. The findings of the diagnosis of the upper layer coating supported by nanomaterials (Epoxy resin/PANI/TiO₂-ZnO-MgO nanocomposite) using (Energy dispersive X-ray spectroscopy) (EDX) spectroscopy, which confirmed the presence of elements (Ti, Mg, Zn, Fe, C, O) and this confirms the success of the method for preparing the Nano-coating. The results of the electrochemical corrosion test for the metallic base of metal oil tanks corroding that contains three layers of coating and the presence of the upper protective layer supported by Nano-oxides provides the best corrosion protection because it has the lowest corrosion current density (187.25 nA / cm²), the chemical corrosion test results for this sample which it has the lowest percentage of corrosion based on the previous results from electrochemical corrosion test revealed that there is no corrosion even after seven days of immersion it in the corrosion solution.

Key worde: Nanomaterial, Epoxy resin ,PANI, TiO₂-ZnO-MgO

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Introduction

Corrosion in oil tanks causes serious economic and environmental damage in the oil field [1]. Coating oil tanks is the best way to protect them from corrosion [2]. However, many coatings have defects such as weak adhesion and high permeability [3], and we know that epoxy has mechanical properties and high corrosion resistance compared to other materials [4], but it lacks a sufficient barrier layer due to epoxy has high permeability, which hinders its function as anti-corrosion coating [5]. Phosphate materials are considered basic components of epoxy

coatings because of their ability to prevent epoxy damage, this is because phosphate materials have an effect on the anti-corrosion properties of the coating [6].(PANI) has a higher ability to oxidation than iron because it interacts with oxygen in the air to form oxidized polyaniline as an intermediate material in an aqueous environment that interacts with the iron on the metal surface, thus, coating the metal surface with polymer (PANI) generates an electric field in the opposite direction to the electrons produced by metal oxidation and effectively prevents metal corrosion [7], therefore, (PANI) has high

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