Effect of Deposition Potential on the Mechanism and Corrosion Behavior of Zn-Fe-Co Thin Coatings Electrochemically Deposited on a Steel Substrate

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Herein, the effect of deposition voltage on the chemical composition, corrosion resistance, structure and surface properties of Zn-Fe-Co coatings was explored using potentiostatic measurements, cyclic voltammetry, linear sweep voltammetry, anodic linear polarization, atomic absorption spectroscopy, scanning electron microscope, and X-ray diffraction. The results indicated that the corrosion resistance is directly related to Co and Fe contents in Zn-Fe-Co deposits. A significant increase in the quantities, contents and efficiency of zinc was achieved by increasing the deposition voltage which led to a sharp decrease the polarization resistance of the coated alloys. This is due to the ease of dissolution of zinc compared to Co and Fe. Moreover, Zn-Fe-Co coatings with a high content of cobalt up to 37% possess superior corrosion resistance compared to the pure Zn coatings and Zn-Fe-Co coatings with low values of cobalt contents less than 6%. A mechanism for electrodeposition model has been proposed and discussed.

Keywords: Electrodeposition; thin coatings; Zn-Fe-Co alloy; competitive adsorption; characterizations; mechanism

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