Improved Corrosion Resistance of Galvanized Steel with a Zinc Phosphate Coating in Alkaline Solution

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The corrosion activity of a zinc phosphate coating (ZP layer) on galvanized steel (GS) in alkaline solution in the presence of Ca^{2+} was investigated using open-circuit potential (OCP), potentiodynamic polarization (PDP) and electrochemical impedance spectroscopy (EIS) techniques. The results showed that, compared to that for the bare GS, the phosphate-coated GS presented a robust resistance to corrosion in a saturated $\text{Ca}(\text{OH})_2$ solution with/without 0.5 M chloride. The GS pretreated with the phosphate coating was conducive to suppressing the rapid dissolution of the zinc layer and hydrogen evolution in the alkaline solution. The presence of Ca^{2+} in alkaline solution was beneficial to inhibit the dissolution of the ZP layer by precipitating calcium hydroxyzincate ($\text{Ca}(\text{Zn}(\text{OH})_3)_2 \cdot 2\text{H}_2\text{O}$) and hydroxyapatite ($\text{Ca}_{10}(\text{PO}_4)_6(\text{OH})_2$) at the corroding interface to form an effective barrier film.

Keywords: galvanized coating; phosphate coating; alkaline corrosion

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