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Corrosion behavior of Fe-Mo and Fe-Mo-P cathodic coatings in the simulated electrolyte for sodium chlorate production

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ABSTRACT

The corrosion behavior of electrodeposited binary Fe-Mo and ternary Fe-Mo-P coatings on cathodes was investigated in the simulated electrolyte for chlorate production, containing 300 g L⁻¹ of NaCl and 4 g L⁻¹ of K₂Cr₂O₇ at 80 °C. Electrochemical noise measurements (ENM), linear polarization resistance (LPR), electrochemical impedance spectroscopy (EIS) and scanning reference electrode technique (SRET) were used in this investigation under open circuit potential (OCP) in the simulated shutdown conditions of the chlorate production industry (decay). A filiform corrosion was observed on the surface of all electrodes and in the case of mild steel, a number of pitting sites were also detected. The ternary cathode (Fe₅₄Mo₃₀P₁₆) containing the highest phosphorous content showed the best resistance to corrosion compared to other coatings and mild steel. Using the ENM technique, a decrease of 67% of the corrosion rate was measured for the Fe₅₄Mo₃₀P₁₆ coating compared to Fe₅₃Mo₄₇ after 72 h of decay, whereas mild steel showed 6 times more corrosion compared to the Fe₅₄Mo₃₀P₁₆ electrode. The addition of phosphorous to the Fe₅₃Mo₄₇ alloy promoted resistance to corrosion. The corrosion resistance of ternary alloys of Fe-Mo-P were improved with the increase of phosphorous content from 9 to 16 at.%. According to LPR and EIS measurements, the Fe₅₄Mo₃₀P₁₆ showed 56%-60% less corrosion compared to the binary Fe₅₃Mo₄₇ electrode.

Keywords: Coating, Corrosion, Sodium chlorate production, Electrochemical techniques

1. Introduction

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