Corrosion Behavior of Waterborne Epoxy Ester Coatings with Different Composition in NaCl Solution

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In this paper, the effect of water resistance, crosslinking degree, pigments addition, and immersion time on corrosion behavior of the waterborne epoxy ester coatings with different composition in 3.5 wt.% NaCl solution have been studied by electrochemical impedance spectroscopy (EIS). Results show that the coating of higher water resistance and crosslinking degree has higher corrosion resistance. However, much higher crosslinking degree may lead to decreased water resistance of the coating, and it is necessary to minimize the content of hydrophilic groups in the waterborne coating while ensuring a qualified crosslinking degree for improving its corrosion resistance. The waterborne epoxy ester varnish coating without pigments addition degrades quickly in NaCl solution compared with the coating with pigments addition of ZnMoO₄ and Zn₃(PO₄)₂. For the corrosion evolution of waterborne epoxy ester coating in NaCl solution, it has better shielding effect at 6 h immersion. At 72 h immersion, it still has corrosion protection effect to steel substrate; the NaCl electrolyte has penetrated into the coating but has not reached the coating/substrate interface. At 120 h immersion time, NaCl electrolyte has reached the coating/steel interface, and the steel corrosion has occurred. At 240 h immersion time, serious corrosion attack has occurred on the steel substrate, and the waterborne epoxy ester coating has lost its shielding effect and corrosion protection effect to the underlying steel substrate.

Keywords: Waterborne coating; Epoxy ester coating; Corrosion behavior; NaCl solution; Shielding effect

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