




Corrosion performance of polypyrrole-bilayer coating on carbon steel

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ABSTRACT

Polypyrrole doped with phosphoric acid was electrochemically synthesized on carbon steel from acetonitrile medium, and then a coating of polypyrrole doped with a long carbon chain acid, dodecylbenzenesulfonic acid or lauric acid, was electrodeposited to form a bilayer. The more protective performance of the bilayers in relation to monolayers was explained in terms of adherence and low porous, as confirmed by scanning electron microscopy. The corrosion performance was also confirmed by electrochemical measurements of open-circuit potential, potentiodynamic polarization curves and electrochemical impedance spectroscopy in chloride solution. The polarization experiments indicated that the corrosion potential values for polypyrrole-bilayer-coated steel were shifted to the positive direction in relation to uncoated carbon steel, indicating anodic protection. Tafel plots also indicated that the anodic current densities were smaller for steel coated by polypyrrole-bilayer. In addition, the electrochemical impedance data showed that the charge transfer resistance values are associated with the resistance to electron exchange between the metal and the coating, and depend on the type of long carbon chain dopant used in the outer-layer. Thus, the suggested mechanism to explain the protection of carbon steel surfaces against corrosion was associated to the passivation and barrier effect of the polypyrrole-bilayer.

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