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Abstract

In this work, the polypyrrole (PPy) film was deposited on the surface of mild steel electrode by cyclic voltammetry. Then, the electrochemical impedance spectroscopy (EIS) measurements were performed on the PPy coated mild steel samples which were exposed to 0.5 M HCl solution. After a brief review of the literature, a new equivalent circuit (EC) was proposed for the modeling of EIS data. It was shown that the proposed EC can be simplified to each of EC1, EC2 and EC3 circuits describing the corrosion behavior of PPy coated mild steel in each of short-term, medium-term and long-term immersion periods, respectively. Then, the suggested model was employed to investigate the effects of the scan rate and the cycle number of polymerization process on the corrosion protection of the PPy coated mild steel. Among the three types of PPy coatings synthesized at the scan rates of 50, 100 and 200 mV/s the second one (100 mV/s) was proved to be the optimum coating against corrosion. This is the result of the competition of two opposing effects: thickness reduction and porosity decrement. The coating prepared during 80 cycles showed the best performance against corrosion of mild steel during long immersion times among the coatings synthesized with different cycle numbers (10, 20, 40 and 80 cycles). This