Influence of the Dissolved Oxygen Concentration in Artificial Seawater on the Corrosion Behavior of Q235 Mild Steel

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The corrosion behaviors of Q235 mild steel at different immersion times in artificial seawater containing different concentrations of dissolved oxygen were investigated using electrochemical impedance spectroscopy (EIS), electrochemical noise (EN) techniques and scanning electron microscopy (SEM). EIS results suggest that the sum of the charge transfer resistance and film resistance decreases with increasing immersion time and concentration of dissolved oxygen. A new electrochemical parameter C_{AE} , which represents the electrochemical reaction rate, is proposed and applied to evaluate the effect of dissolved oxygen concentration on the corrosion resistance and corrosion mechanism. The value of C_{AE} initially increases with immersion time and later decreases with prolonged testing time. The sum of the charge transfer resistance and film resistance shows the opposite variation trend with that of C_{AE} during the initial immersion times. Moreover, the observed morphologies of the Q235 mild steel surface agree well with the variation trend of C_{AE} at different dissolved oxygen concentrations. The above results reveal a new criterion to monitor the corrosion resistance and surface morphology in situ using an EN technique.

Keywords: mild steel; dissolved oxygen; artificial seawater; electrochemical noise

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