Influence of Calcium Nitrite on Electrochemical Corrosion Behavior of API X120 Carbon Steel and 316LN Stainless Steel Reinforced Concrete in Marine Environment

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This study was carried out to evaluate the corrosion behavior of API X120 carbon steel and 316LN stainless steel reinforced concrete in marine environments with calcium nitrite as an inhibitor. The electrochemical impedance spectroscopy (EIS) technique and SEM were applied to study the concentration effect of calcium nitrite on the corrosion behavior of API X120 carbon steel and 316LN stainless steel reinforced concrete in a 3.5% wt NaCl solution containing calcium nitrite at pH values of 8, 10 and 12. Results showed that double-layer capacitance decreases and charge-transfer resistance increases by increasing the inhibitor concentration which is associated with improvement of the 'blanketing' property of the film. The surface coverage and inhibition efficiency also increase with an increase in inhibitor concentration. A calcium nitrite concentration of 50 μM showed 87.7% and 93% inhibition efficiency at pH 12 at room temperature for API X120 carbon steel and 316LN stainless steel, respectively. A comparison between the electrochemical corrosion behavior of API X120 carbon steel and 316LN stainless steel reinforced concrete revealed a remarkable decrease in the lifetime of the structure and damage due to reinforcement corrosion of API X120 carbon steel, indicating an increase in the cost associated with monitoring and maintenance. Therefore, replacing the API X120 carbon steel reinforcement with 316LN stainless steel can decrease the corrosion rate and can also considerably decrease the costs related to expensive equipment for rehabilitation.

Keywords: API X120 carbon steel; 316LN stainless steel; Electrochemical impedance spectroscopy; Calcium nitrite; Inhibitor; Corrosion

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