Corrosion Inhibition of Carbon Steel by Lepidine in HCl Solution

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Carbon steel is an important metal for structure and machines, and it is easily corroded in acidic media. In this paper, lepidine was used as a corrosion inhibitor for carbon steel in 1 mol/L HCl solution. A weight loss test and electrochemical methods were used to study the inhibition performance at different temperatures; surface analysis and a thermodynamic method were used to clarify the corrosion inhibition mechanism. In the weight loss test, when the corrosion inhibitor was added, the corrosion rate was decreased from $12.54 \text{ mg cm}^{-2} \text{ h}^{-1}$ to $0.113 \text{ mg cm}^{-2} \text{ h}^{-1}$, and the rate of corrosion inhibition was 99.1%. Furthermore, the corrosion inhibition efficiency decreased with an increase in temperature. From the polarization curve test, the corrosion potential of the corrosion inhibitor was moving forward to cathode as concentration increased, and the cathode current density decreased obviously. From EIS, the radius of the resistance of the corrosion inhibitor was found to increase gradually with an increase in concentration. With an increase in concentration, R_{ct} increased and C_{dl} decreased, showing that the corrosion inhibitors replaced water and adsorbed onto the film. Adsorption of the corrosion inhibitor obeyed the Langmuir isothermal adsorption equation, and SEM and XPS proved this hypothesis. Adsorption of the inhibitor on the surface of carbon steel is a spontaneous exothermic process.

Keywords: Corrosion inhibitor; Electrochemical methods; Carbon steel; Lepidine; Langmuir isothermal adsorption

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