Effect of Chloride Ion on Corrosion of Mild Steel in the 7.0 mol/L H₃PO₄ Solution in the Presence of 1,10-Phenanthroline

Ji-Tong Gong, Yi-Jing Liu, Lin Wang*, Yan Qin, Yin-long Bai, Dong-Mei Lu

School of Chemical Science and Technology, Key Laboratory of Medicinal Chemistry for Nature Resource, Ministry of Education, Yunnan University, Kunming, Yunnan, 650091, P. R. China

*E-mail: wanglin@ynu.edu.cn (L. Wang); wanglin2812@163.com

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The inhibition effects of chloride ion and 1,10-phenanthroline (PTL) on the corrosion of mild steel in 7.0 mol/L H₃PO₄ solution were studied by potentiodynamic polarization, electrochemical impedance spectroscopy and weight loss techniques. The results reveal that Cl⁻ can inhibit the corrosion of mild steel in 7.0 mol/L H₃PO₄ solution to some extent, while the combination of Cl⁻ and PTL obviously improves the corrosion inhibition and shows better synergistic inhibition effect on mild steel corrosion in 7.0 mol/L H₃PO₄ solution. The electrochemical studies indicate that Cl⁻ alone or the combination of Cl⁻ and PTL acts as a mixed type of inhibitor for mild steel in 7.0 mol/L phosphoric acid and the corrosion reaction is controlled by charge transfer. The adsorption of Cl⁻ on the mild steel surface follows Langmuir adsorption isotherm in the absence or presence of PTL. The kinetic and thermodynamic parameters (E_a , ΔH_a , ΔS_a , K_{ads} and ΔG_{ads}^0) were calculated and discussed. The adsorption process of the inhibitor molecules on the mild steel surface is spontaneous and contains coexistence of physical and chemical adsorption, while physical adsorption is absolutely dominant.

Keywords: Corrosion, 1,10-Phenanthroline, Chloride ion, Mild steel, Phosphoric acid, Synergistic inhibition.

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