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A Case Study :

A study on the inhibition of aluminium alloy's corrosion by thiourea derivatives in organic acid

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ABSTRACT

The effects of diphenyl thiourea, phenyl thiourea and N,N'-diethyl thiourea on the corrosion of 1060 aluminium in varying concentration of (0.1N and 0.5N) trichloroacetic acid at 30^0C are investigated by weight loss method in conjunction to the concentration of corroding media, period of immersion of Aluminium alloy grade 1060 at the temperature 30^0C with respect to the concentration of inhibitor and activation energy and adsorption isotherms are plotted to elucidate the mechanism of adsorption of inhibitor on surface of alloy in that support corrosion potential and polarization behaviour is also observed.

KEY WORDS : Aluminium alloy 1060, Tri-chloroacetic acid, Weight loss, Diphenyl thiourea, Phenyl thiourea, Adsorption, Activation energy

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The carboxylic acid and its chloro derivatives are used in various applications and it has been observed that in the production of these acids or in the other chemical synthesis where chloro-substituted carboxylic acids are used, no metal withstands corrosion [1, 2]. Thiourea has been investigated as corrosion inhibitor extensively and organic compounds that containing both nitrogen and sulphur are reported to have excellent inhibition compared with other compound that containing only nitrogen or sulphur [3-5]. The use of thiourea as corrosion inhibitor for the aluminium alloys in organic acid is not much acknowledged. [6-13]

The present investigation deals with the use of thiourea and its derivatives as inhibitors in Trichloroacetic acid corroding media. For the purpose, aluminium alloy 1060 has been used. The experiments follows varying parameters of inhibitor concentrations (50, 100, 200 and 300 ppm) and also at two concentrations of Trichloroacetic acid (0.1 N and 0.5 N) at 30^0C. The exposure period was kept constant for 24 hours.

Percentage inhibition efficiency calculated as

$$E = \frac{W_u - W_i}{W_u} \times 100$$

where:

W_i = Weight loss in inhibited solution
W_u = Weight loss in uninhibited solution

The values of the energy of activation (E_a) and heat of adsoption (Q_{ads}) were given in Table 4. These values were calculated from datas of Table 3 using the following equation:

$$\text{Log}\ \frac{P_2}{P_1} = \frac{E_a}{2.303R}\left\{\frac{1}{T_2} - \frac{1}{T_1}\right\}$$

Where, P_1 and P_2 are the corrosion rates mg.dm^{-2} per 6-hour at temperatures T_1, and T_2 in K, respectively.

The Q_{ads} values were calculated using the equation:

$$Q_{ads} = 2.303 \times R\left(\log\frac{\theta_2(1-\theta_1)}{\theta_1(1-\theta_2)}\right) \times \left(\frac{T_1 \times T_2}{T_2 - T_1}\right)$$

where Q_{ads}= heat of adsorption.

R= Gas constant=1.987kcal mol^{-1} θ_1 = inhibition efficiency at a temperature T_1. θ_2 =inhibition efficiency at a temperature T_2.

Results were summarized in Table 1, 2 and 3 and