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Abstract: P2

Investigation on inhibiting effect of indole and its oligomers on the corrosion of carbon steel in deaerated 0.5 M H_2SO_4

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Abstract

Inhibition of the carbon steel corrosion by means of indole and its oligomers, (initial indole concentration were from 6.5×10^{-4} M to 6.5×10^{-3} M) was studied in deaerated 0.5 M H_2SO_4 at 15°C, 25°C, 35°C and 45°C using potentiodynamic polarization, electrochemical impedance spectroscopy techniques. Indole in 0.5 M H_2SO_4 forms oligomers and an equilibrium exists between indole, the indole dimer and the indole trimer. Kinetic studies at temperature of 15°C, 25°C, 35°C and 45°C indicate that at equilibrium indole is the species with prevailing concentration. Moreover the indole trimer concentration is higher than indole dimer one at 15°C and 25°C only. Inhibition efficiency percentage (IE) for different inhibitor concentrations was calculated according to following relation :

$$IE = [(R_{ct} - R°_{ct})/R_{ct}] \times 100$$

Where R_{ct} and $R°_{ct}$ are the charge transfer resistances in the inhibited and uninhibited solutions respectively. The results revealed the good inhibiting action of the indole and its oligomers . The inhibition efficiencies reached the maximum value of 99 % at 15°C an 25°C with higher indole concentrations. The values of electrical double-layer capacitance (C_{dl}) were calculated by the relation:

$$C_{dl} = \left(T \times R_{CT}^{1-n}\right)^{1/n}$$

Where T the double-layer capacitance quantity and n the fractional exponent (usually assumes the values: $1 > n > 0.8$). In general in the inhibited solutions C_{dl} values decreased. These facts could be in relation to the adsorption of indole and its oligomers at solution-metal interface. A structural model of the mild steel/0.5 M H_2SO_4 interface was proposed. Transformation rate of the indole dimer in indole and indole trimer was very high at lower temperatures too. To explain which species mainly contribute to the corrosion inhibition other impedance tests were been carried out. Results indicated that the indole trimer probably contributed mainly to the corrosion inhibition at lower temperature and higher concentrations.