TECHNICAL REPORT

EFFECT OF SOME SURFACE ACTIVE SUBSTANCES ON CORROSION OF ZINC

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Attempt has been made to evaluate the inhibiting action of some surface active agents towards corrosion of zinc in acidic sulphate solution at 27°C. Galvanostatic polarisation measurements were carried out to find out the corrosion rate of zinc in various sets of experiments. Mechanism of adsorption of inhibitors have been studied employing Langmuir adsorption isotherm.

Zinc is an industrially important metal, and is corroded by many agents of which aqeous acids are more dangerous. Looking to its increasing usage, corrosion inhibition study is of paramount importance. Organic compounds containing nitrogen, sulphur, oxygen and selenium have been used as corrosion inhibitors for metals [1–5]. Kolevatova et. al [6] and Bundzle [7] et. al. have also studied some surface active substances as corrosion inhibitors for zinc in acid solution.

In the present investigation an attempt has been made to evaluate the inhibiting action of some surface active agents like congo red, crystal violet and alizarin towards corrosion of zinc in acidic sulphate solution.

Experiment

Zinc (BDH) sample having rectangular shape were used for the corrosion rate measurements. Samples embedded in araldite so as to expose an area of 2 square cms of cross section was used for polarisation studies.

All organic compounds used were of pure grade. Galvanostatic polarisation measurements were carried out to find out the corrosion rate of zinc in various sets of experiments.

The current—potential characteristics for a corroding metal may be written as

$$I = I_{corr}\left[\exp\left\{-2.303\frac{(E-Ecorr)}{bc}\right\} - \exp\left\{2.303\frac{(E-Ecorr)}{ba}\right\}\right] \quad \ldots (1)$$

Where I_{corr} is corrosion current at the corrosion potential E_{corr}, bc and ba are numerical values of experimentally determined Tafel slopes for the cathodic and anodic polarisation curves respectively. I is the current at the electrode potential E.

Results and Discussion

The effect of inhibitor concentration on corrosion current and potential is given in Table 1.

TABLE 1 Effect of inhibitor concentration on Corrosion potential, Corrosion current and percentage inhibition of zinc in 0.1N sulphuric acid solution

Inhibitor	Conc. %	Corrosion -Potential (S.C.E.) (mV)	Corrosion current mA	% inhibition
Sulphuric acid	0.1N	1016	14	–
Crystal violet	4×10^{-3}	1018	1.90	86
	8×10^{-3}	1010	1.70	88
	1×10^{-2}	1020	1.50	89
	2×10^{-2}	1015	1.15	92
Congo red	1×10^{-4}	1035	3.20	77
	2×10^{-4}	1050	2.20	84
	4×10^{-4}	1045	1.75	87
	6×10^{-4}	1055	1.20	91
Alizarin	4×10^{-5}	1008	3.00	78
	1×10^{-4}	1005	2.10	85
	2×10^{-4}	1002	1.40	90

In the case of congo red excellent protection was observed. The anodic tafel values increases slightly while large increase in cathodic tafel slope was observed. This indicates that congo red interferes with the cathodic reaction without affecting the anodic reaction during the corrosion of zinc. With concentration, the inhibition efficiency increased. At the lower

concentration 1×10^{-4}% it shows 77% inhibition which goes on increasing to 91% at 6×10^{-4}% concentration of congo red.

Crystal violet shows good inhibition. The change in tafel slopes are as in congo red case.

In case of alizarin, at the low concentration 10^{-5}% to 10^{-4}% it has high protection of metal. Higher values of cathodic tafel slope observed in this case with varying inhibitor concentration clearly indicates the cathodic reaction at the metal surface.

All the three compounds show that they are cation active substances. It may be assumed that organic cations contribute increased protection by formation of a film on metal surface. All the substances that were adsorbed or which deposited films caused inhibition.

The adsorbed inhibitor ions or molecules can be supposed to have a great influence on the corrosion process only when they combine with metal ions on the surface to form difficultly soluble films which are nearly impervious to the acid medium.

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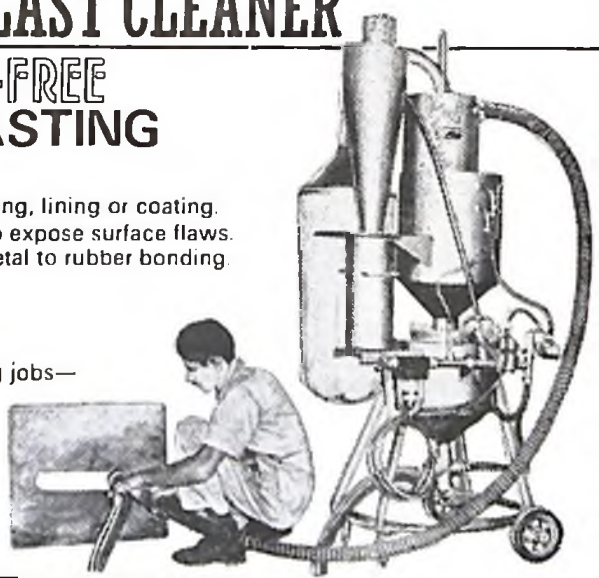
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