ЗАЩИТНЫЕ СВОЙСТВА АМИНО- И ФОСФАТСОДЕРЖАЩИХ ИНГИБИТОРОВ В РАЗНЫХ СРЕДАХ

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PROTECTIVE PROPERTIES OF AMINO- AND PHOSPHATE CONTAINING INHIBITORS IN DIFFERENT MEDIUMS

Abstract. Inhibition properties of some compounds containing in their composition amino- and phosphate groups were investigated. It was shown that inhibition properties of investigated compounds have increased with increasing in their composition of number of radicals and their limentions.

Аннотация. Исследованы ингибирующие свойства соединений, содержащих в своем составе амино- и фосфатные группы. Показано, что их ингибирующая способность возрастает с увеличением в их составе числа радикалов и их размера.

Key words: corrosion, inhibitor, corrosion lasses, inhibition

Ключевые слова: коррозия, ингибитор, коррозионные потери, ингибирование.

Lust years at elaboration of corrosion inhibitors the trend was known to using of row-materials containing transition metals; complexes on their base and also complex-forming compounds which can interact with some transition metals which are present in electrolytes or on the protective surface [1]. It was shown [2] that on the base of such compounds and complexes with using some waste of catalytical production and exhaust catalysts as row materials some high-effective, ecologically pure inhibitors of corrosion of carbon steels in water solutions com be obtained. To more investigated systems can be aributed compounds and complexes on the base of organopolymoliblates, aromatical and aliphatical amines,

hydro rides of some organic acids, three azols of Zn, Al, Co and their salts.

In work (3) it was shown that salts of amines with acids can well adsorbed on the ferrum sulphates and by this reason they have a high protective effect in the presence of H_2S in comparison with oxygen- containing systems. Also above mentioned salts have an washing action what has to remove from metals surface of corrosion products what allowed to inhibitors to alsorbite on the pure metallic surface. From inhibitors for netral mediums it is necessary to note the group of corrosion inhibitors for systems of cooling and water-supply from which the more important are polyphosphates and polycar-boxylic aminoacids. Polyphosphates and compo-sitions on the base of

phosphoric acid have braked corrosion processes even in case of completely corroded surfaces. Also it is known that polyphasphates have decreased concentration of atomaric hydrogen absorbed by steel what has decreased it' s corrosion fracility.

The aim of this investigation is a study of braking of corrosion processes under action of amines of different type.

Amines with different radicals and their mixtures with phosphoric acid and sodium polyphosphate in different ratios that is compounds contain iny amino- and phosphate groups were choose as the base objects of this investigation. J study of corrosion behavior of steel was carried out on its samples in form of plates. Action of different mediums and inhibitors was deter mined by melbad of gravimetry by decreasing of sampler mass after corrosion test. Investigations were carried out in phone solutions of followiny composition fP-1: 3% H_2SO_4; pH 3; fP-2 2-3% NaCI , pH 7,3; fP-3 H_2O pH 8,2 at temperature 25^0C. Solutions were prepared from reagents of mark "chemical pure" on the distillyat. Electrodes were obtained from St.3 of following composition (%): Fe- 98,36; C-0,20; Mn-0,52; Si-0,15; P-0,04;

S-0,05; Cr-0,30; Ni-0,20. The rate of corrosion of steel samples was calinlated by following formula:

$$K_m = \frac{m_1 - m_2}{S \cdot \tau} \text{ г/м}^2\cdot\text{ч},$$

where; m_1; m_2 – masses of steel sample befor and after tests correspondently; S- area of the steel sample surface m^2; t- duration of test, h; K- corrosion rate, g/m^2.

For quantital value of corrosion protection of steel by investigated inhibitors also the coefficient of braking (γ), and the degrees of protection (Z) were calculated. Calculation were carried out by using following formulas;

$$\gamma = \frac{K_m}{K_{m_0}} \; ; \qquad Z = \frac{K_m - K_{m_0}}{K_m} \cdot 100\%$$

I Already over 16-18 hours after placing of steel samples in aggressive medium on their surface appeared of corrosion as patch's which have increased with time and then were covered by "cap" of corrosion products.

The obtained experimental data (table) have shown that investigated compounds have shown inhibition properties and at this the optimal concentration is about 0,001% from the point of economy and technology; at this the protection degree of steel corrosion has changed from 70,84 to 93,60%.

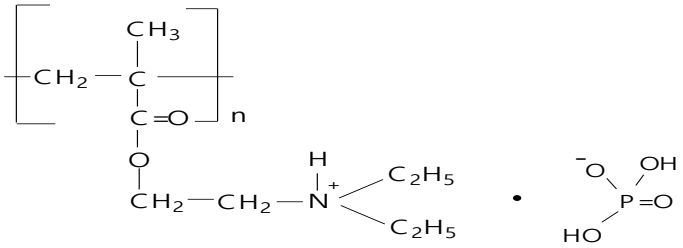
Comparasion of tests results has shown that with increasing of medium acidity the values of the braking coefficient and the protection degree have increased. For example for such inhibition systems as phosphoric acid diethylaminoethyl-methacrylate (DEAEMA) and sodium polyphosphate (DEAEMA) on different phones (FP-1; FP-2 and FP-3) the values of above-mentioned parameters at duration of experiment 720 h were equaled: 14,7 and 93,2; 7,80 and 87,19;6,90 and 85,50 (for first system on different buffer systems) and 15,6 and 93,62; 9,00 and 88,89; 6,21 and 84,79 (for

second system on the same buffer systems); that is the both systems have show the best inhibition effect in acid medium.

According to literature date the action of inhibitors of the acid corrosion has bounded with their adsorption on the of phases division Me /acid.

In the result of inhibitors adsorption the braking of anodic and catodic processes was observed what has decreased the rate of corrosion. In the presence of cations Fe^{3+} on the catodical places of metal surface the phosphates of Fe (III) have precipitated forming impermeable protective film:

$nPO_4^{3-} + nFe^{+3} + 2nH_2O \rightarrow nFePO_4 \cdot 2n\ H_2O$



Besides that molecules of phosphatediethylaminoethylmethacrylate (PDEAEMA) have the high volume and high molecular mass and by these reasins at adsorption on the surface of the protective metal they have formed the surface layer containing smaller number of molecules in comparisons with inhibition systems on the base of other aliphatical amines.

Table.

Results of the gravimetrical determination of the degree of protection of investigated inhibitors in different mediums (25^0C)

Phone	Inhibitors	360 houres			720 hour's		
		K, г/(м^{2}сут)	γ	Z, %	K, г/(м^{2}сут)	γ	Z, %
ФР-1	Whit hat inhibitors	2,1889	-	-	2,1308	-	-
	$CH_3NH_2 + H_3PO_4$	0,3325	6,58	84,80	0,3212	6,63	84,92
	$(CH_3)_2NH + H_3PO_4$	0,2891	7,57	86,15	0,2702	7,88	87,31
	$(C_2H_5)_2NH + H_3PO_4$	0,2790	7,84	87,25	0,2645	8,05	87,58
	$(C_4H_9)_3N + H_3PO_4$	0,2748	7.96	87.44	0,2586	8,23	87,86
	ДЭАЭМА $+H_3PO_4$	0,2202	9,94	89,94	0,1448	14,7	93,20
	Whit hat inhibitors	0.3911	-	-	0,3325	-	-
	$CH_3NH_2 + (NaPO_3)_n$	0.0593	6,59	84,83	0,0500	6,65	84,96
	$(CH_3)_2NH + (NaPO_3)_n$	0.0560	6,93	85,68	0,0462	7,19	86,10
	$(C_2H_5)_2NH + (NaPO_3)_n$	0.0539	7.24	86.20	0,0418	7,95	87,42
	$(C_4H_9)_3N + (NaPO_3)_n$	0,0506	7,72	87,06	0,0401	8,29	87,93
	ДЭАЭМА$+(NaPO_3)_n$	0.0390	10,0	90.02	0,0212	15,6	93,62

ФР-2	Whit hat inhibitors	0,3716	-	-	0,2342	-	-
	CH_3NH_2+ H_3PO_4	0,0856	4,34	76,96	0,0529	4,42	81,71
	$(CH_3)_2NH$+ H_3PO_4	0,0775	4,79	79,14	0,0465	5,03	83,14
	$(C_2H_5)_2NH$+ H_3PO_4	0,0649	5,72	82,53	0,0326	7.18	86,08
	$(C_4H_9)_3N$+ H_3PO_4	0,0627	5,92	83,12	0,0325	7.20	86.12
	ДЭАЭМА+ H_3PO_4	0,0518	7,17	86,06	0,0300	7,80	87,19
	Whit hat inhibitors	0.3809	-	-	0,2756	-	-
	CH_3NH_2+$(NaPO_3)_n$	0.0681	5.58	82.10	0,0468	5,88	83,01
	$(CH_3)_2NH$+$(NaPO_3)_n$	0.0562	6,77	85.24	0,0387	7,12	85,95
	$(C_2H_5)_2NH$+$(NaPO_3)_n$	0.0532	7.15	86.02	0,0369	7.46	86,61
	$(C_4H_9)_3N$+$(NaPO_3)_n$	0.0529	7.20	86.11	0,0365	7.55	86,75
	ДЭАЭМА+$(NaPO_3)_n$	0.0467	8.14	87.72	0,0306	9,00	88,89
ФР-3	Whit hat inhibitors	0,5245	-	-	0,4375	-	-
	CH_3NH_2+ H_3PO_4	0,1426	3,67	72,81	0,0952	4,09	75,60
	$(CH_3)_2NH$ + H_3PO_4	0,1365	3,84	73,97	0,0909	4,29	76,70
	$(C_2H_5)_2NH$ + H_3PO_4	0,1255	4.17	76,07	0,0885	4,94	79.77
	$(C_4H_9)_3N$+ H_3PO_4	0,1164	4,05	77,38	0,0852	5,13	80.52
	ДЭАЭМА+ H_3PO_4	0,0875	5,99	83,31	0,0634	6,90	85,50
	Whit hat inhibitors	0,6125	-		0,4826	-	-
	CH_3NH_2+$(NaPO_3)_n$	0,1786	3,42	70,84	0,1323	3,64	72,58
	$(CH_3)_2NH$+$(NaPO_3)_n$	0,1625	3,76	73,46	0,1210	3,98	74,92
	$(C_2H_5)_2NH$+$(NaPO_3)_n$	0,1523	4,02	75,13	0,1102	4,37	78,16
	$(C_4H_9)_3N$+$(NaPO_3)_n$	0,1385	4,42	77,38	0,1023	4,71	78,80
	ДЭАЭМА+$(NaPO_3)_n$	0,1136	5,39	81,45	0,0776	6,21	84,79

Thu carrin ont investigations by corrosion steel St-3 in solutions in the presence inhibitors containing amino and phosphate groups have shown their high affectivity. By the result of determination of values of the coefficient of braking and the protection degree the phosphatediethylaminoethylmethacrylate is the best inhibitor between investigated compounds owiny to inereusing of number of radicals in it' s molecule and their dimensions owing to this expence on the base of this inhibitor is lower in comparison with other systems on the base of other investigated amins.

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