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INFLUENCE OF THICKNESS UNDER SURFACE AND PROTECTED PROPERTIES OF FILM FORMING ANTICORROSION OIL COMPOSITIONS

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Abstract

The surface and protected properties of film forming anticorrosion oil compositions were investigated. It was investigated the influence of different thickeners. It's known that presence of polar groups in the molecules of the thickeners improve the properties of the obtained mixtures, as increase common adhesive properties and support forming of stable film under the protected metal surfaces.

Keywords: corrosion inhibitor; mechanism; surface properties; protected properties.

1. Introduction

In the latest years in the world practice is enforced a new class from conservation and work-conservation stuffs, called with whole name "Film forming Anticorrosion Oil Composition" (FAOC) [1-3]. Formed from them covers must easy flow under the metal surfaces, as penetrate in all cracks and narrow apertures.

In them are contenting components: thickener, plasticizer, corrosion inhibitor and solvent must sure at bringing in FAOC, fast removal of water from the metal surfaces [4, 5]. So that are eliminated the possibilities for development of electrochemical corrosion [6-9]. At the same time the protected surface if there are such and to interrupt collecting [10].

2. Aim

The aim of the present work is to investigate surface and protected properties of FAOC, which are composed from 5% corrosion inhibitor, 25% thickener, 50% plasticizer and 20% solvent [11, 12]. In quality of corrosion inhibitor is used CIC-2A and CIC-2B contenting components with anode, cathode and shielded character.

For plasticizer is used industrial mineral oil, for commonly purpose AN-12, for solvent - low octane gasoline from distillery of oil, boiling at interval 30÷100ºC.

For thickener is used products, which are obtained in different refinery productions: low viscosity, intermediate viscosity and residual paraffin; ceresin; oxidative - low viscosity; intermediate viscosity and residual paraffin and petrolatum, colophony, pyrolene, petrolatum (table 1).

3. Experimental and discussion

Hydrophobicity of the film of investigated FAOC and its ability to cover the metal surfaces is determined by so called "limited angle to wetting - Θ", it determines with apparatus and the surface tension – by method of flooding and drawing of platinum disk with standard sizes. Data for surface properties is obtained by determination of diameter of flowing of drop from product under steel disk (St.10) and by the high of column at penetrate though narrow apertures or at penetrate in product of corrosion - in case Fe_2O_3 [13]. The adhesion (Z_A) is calculated by formulas [14]:

$$Z_A = \frac{1 - \cos \Theta}{2}$$

The values of cohesion – adhesion forces are evaluated on the effort for separating of two steel disks with area from 16 cm^2 from layer of FAOC [15]. For stability and the isolated properties of forming film under metal surfaces are put on trial by permittivity and relating volume conductivity. And for its ability to protect from corrosion – though determination

of corrosion aggressiveness of water extracts – by galvanostatical method at density of electricity I = 2A/m^2 [15].

Investigating reological characteristics of obtained FAOC, with help of rotary viscometer, it's known that at usage as thickeners of the different paraffin's and ceresin are obtained structure dispersion. In the result of this, the obtained mixtures may refer to "non-Newtonian liquids". With all rest plasticizers are obtained protected materials, whose dispersions may refer to "Newtonian liquids" (fig.1).

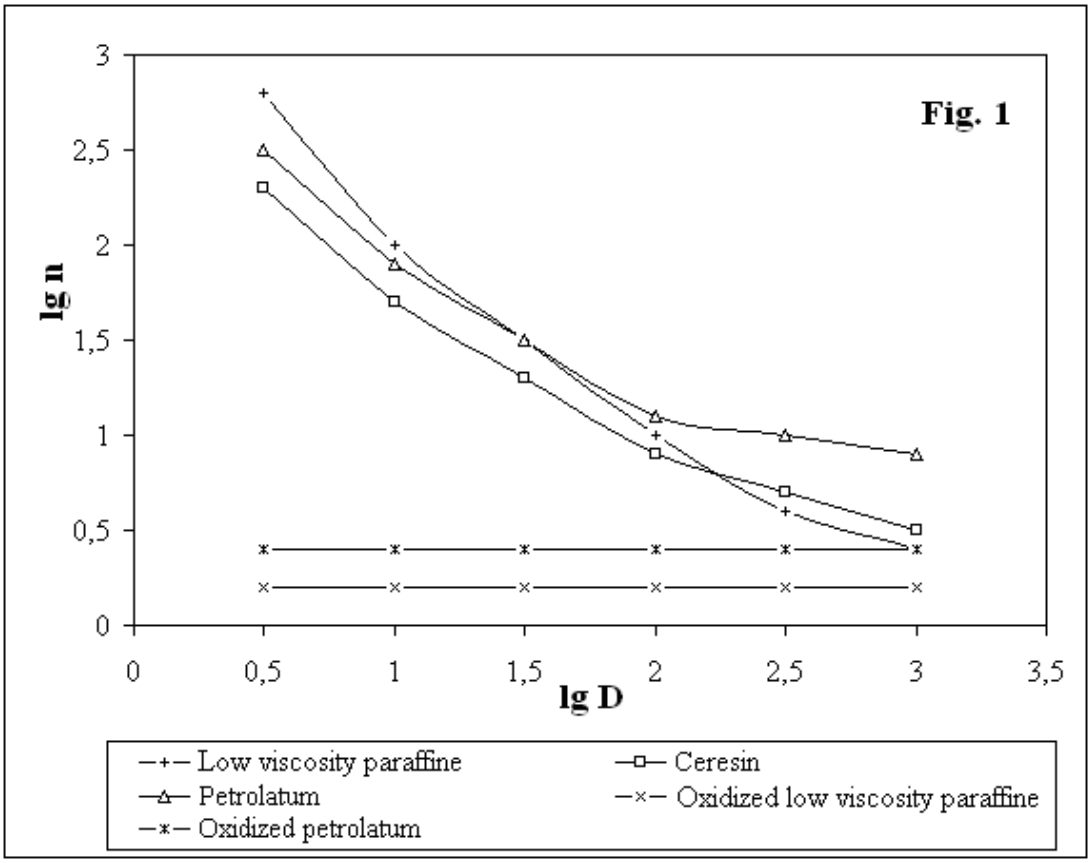

Figure 1. Dependence of logarithm of gradient of velocity of deformation (lg D) from logarithm of viscosity (lg n) of FAOC with different thickeners.

The investigations given in table 1 show that as usage as thickeners for FAOC of oxidized hydrocarbons are obtained products, which adhere to protected metal surfaces very well and they have strong water-displacement characteristics. It's due to the presence in them to polar groups, which are adsorbed on the limited surface of different phases and increase adhesion on FAOC under metal surfaces. At the same time their products create conditions for better homogenization of different compounds entering in composition of FAOC.

Untreated paraffin's, ceresin and petrolatum have thin affinity to the metal surfaces, penetrate a bit apertures and in products of corrosion hard. The dispersions in which are content bitumen, pyrolene and colophony due to contenting in them polar groups have good water-displacement and adhesion properties to the surfaces but because of its higher viscosity penetrate into products of corrosion hard.

The best protected properties at increased humidity and in corrosive mediums posses FAOC in which are contented oxidized paraffin's, petrolatum and other thickeners in which there are polar groups – bitumen, colophony and pyrolene (table 2).

Strong protected characteristics at all experiments posses FAOC in which are contented ceresin. It's due to of specific micro-crystal structures, which form ceresin under protected surfaces and chemical inertness which posses, it [16]. Defect of ceresin is that it thin removal from surfaces corrosive electrolytes e.g. obtained FAOC doesn't be effective with relation to their velocity of influence.

Galvanostatical experiments of water extracts (table 3) show that FAOC which content as thickener oxidized hydrocarbons decelerate anode and cathode processes of corrosion effectively. This universality of action allows using for protection from corrosion of metal surfaces in different corrosive mediums.

Table 1. Properties of FAOC, containing different thickeners.

Kind of the thickener	Θ, grad.		Surface tension, mN/m	High of increase in aperture, mm	Deepness of penetrate in Fe_2O_3, mm	Z_A	Relation force of tearing off, N/cm^2	Water replacing ability			Relation volume conductivity, x 10^{10} cm/m	Per mitti vity
	FAOC under St. 10	Drop of water under FAOC						d_1	d_2	d_3		
1. Low viscosity paraffine	49	45	33,7	140	25	0,18	45	50	50	50	4,5	1,99
2. Intermediate viscosity paraffine	52	47	34,5	130	20	0,16	52	52	52	52	4,5	2,02
3. Residual paraffine	55	50	34,9	125	17	0,11	77	55	55	55	5,1	2,15
4. Ceresin	47	46	31,5	115	1	0,87	125	52	52	52	1,5	2,17
5. Oxidized low viscosity paraffine	0	14	28,3	156	36	1,00	56	62	62	68	1200	2,12
6. Oxidized intermediate viscosity paraffine	0	17	29,7	148	36	1,00	63	65	65	65	1400	2,24
7. Oxidized residual paraffine	0	21	31,1	139	31	1,00	89	67	67	67	1550	2,30
8. Oxidized petrolatum	0	11	29,5	159	27	1,00	31	77	77	77	1850	2,31
9. Bitumen	9	25	31,6	90	0	0,99	32	69	69	69	1620	2,35
10. Colophony	4	61	29,2	97	15	0,98	35	56	56	56	19	2,20
11. Pyrolene	2	58	27,3	96	14	0,98	37	59	59	59	17	2,17
12. Petrolatum	6	10	32,2	148	20	0,72	25	60	60	60	7,2	1,95

Table 2. Protected properties of FAOC with different thickeners, at deepness of film 20 μm.

Kind of thickeners in FAOC	Protected properties under St. 10 % aggressive surface				
	Chamber of humidity (after 24h.)	In chamber "Salty fog" (after 20 h.)	In chamber "Sea water" (after 20 h.)	In chamber "Rain" (after 8 h.)	Removal of HBr (after 4 h.)
1. Low viscosity paraffine	27	0	35	98	56
2. Intermediate viscosity paraffine	25	0	31	90	50
3. Residual paraffine	23	0	30	81	45
4. Ceresin	0	0	2	8	43
5. Oxidized low viscosity paraffine	0	0	3	22	8
6. Oxidized intermediate viscosity paraffine	0	0	2	18	6
7. Oxidized residual paraffine	0	0	1	15	5
8. Oxidized petrolatum	0	0	1	15	4
9. Bitumen	0	0	1	4	70
10. Colophony	75	95	95	95	8
11. Pyrolene	70	83	80	80	5
12. Petrolatum	24	2	25	83	47

Table 3. Electrochemical characteristic of water extract of FAOC obtained with different thickeners.

Kind of thickeners in FAOC	Potentional at force of electricity $I = 2A/m^2$	
	Cathode	Anode
1. Low viscosity paraffine	– 890	– 350
2. Intermediate viscosity paraffine	– 850	– 320
3. Residual paraffine	– 830	– 300
4. Ceresin	– 800	– 280
5. Oxidized low viscosity paraffine	– 1040	– 220
6. Oxidized intermediate viscosity paraffine	– 1150	– 200
7. Oxidized residual paraffine	– 1200	– 190
8. Oxidized petrolatum	– 1300	– 180
9. Bitumen	– 800	– 120
10. Colophony	– 600	– 40
11. Pyrolene	– 900	– 220
12. Petrolatum	– 830	– 350

4. Conclusions

In conclude may assert that common effectiveness of FAOC beside used inhibitor of corrosion, it is of great importance is and surfaces and protected properties of used thickener. Fundamental influence at that exerts its viscosity-temperature characteristics and content of surface-activity groups. The last sensibly increase common adhesion properties of FAOC and support to form a stable film under protected metal surfaces.

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