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Anti-Corrosion Coatings for Large-Size Technological Equipment of Oil Refining and Cotton-Processing Production

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ABSTRACT: In this paper, considered the anticorrosion-protective properties of heterocomposite epoxy fillings and coatings from them. Studied the dependence of the polarization resistance on time in salt, acidic and aquatic environment in the presence of a two-component coating based on an epoxy binder filled with kaolin AKF-78, AKS-30, AKT-10. It has been established that the best protective properties of corrosion in saline environment opposes compositions filled with kaolin of the production mark ACT-10 and in an acid environment-compositions filled with kaolin of the production brand AKF-78. Proposed compositions for protection against corrosion in saline and acidic environments.

KEYWORDS: silicates, kaolin, aggressive environment, corrosion resistance, coatings, casting materials, composite materials, protective ability.

I. INTRODUCTION

Silicate-containing modifiers and mineral particles, subjected to functional modification, are widely used in modern composite materials science. At the same time, it is necessary to conduct systematic studies of physicochemical mechanisms, their influence on the structure and properties of matrices, both in the process of obtaining PCM and in creating products from them. Of particular interest are studies of the mechanisms of formation of composite materials by the technology of high-energy sputtering of a mechanical mixture of components. Such technology allows forming single-layer or multi-layer composite materials with various combinations of polymer, metal, mineral components, including multi-layer coatings on machine parts and mechanisms. Require a systematic study thermophysical processes in a heat transfer environment that determine the kinetics of heating, melting of components, thermolysis, thermo-oxidative destruction and the formation of a homogeneous composite layer on a solid substrate. This will allow the development of modern high-tech compositions of composite materials based on various combinations of components and resource-saving technologies for their production and processing into products [1-4].

II. SIGNIFICANCE OF THE SYSTEM

The paper mainly focuses on anti-corrosion coatings for large-size technological equipment of oil refining and cotton-processing production. The study of literature survey is presented in section III, Methodology is explained in section IV, section V covers the experimental results of the study, and section VI discusses the future study and Conclusion.

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III. LITERATURE SURVEY

Belarusian scientists Bely V.A., Sviridenok A.I., Struk V.A. et al. conducted studies on the effect of mechanical properties and osmolecular structures on metal-polymer systems and antifriction-carrozion properties.
Currently, scientific successes have been achieved by scientists of Uzbekistan such as academicians S.Negmatov, M. Askarov, S. Rashidova, candidates of technical sciences, professors A. Ibodullaev, Z.Tajikhodzhaev, A. Umarov, A. Riskulov, O. Yoriev who are studying the development of polymer composite materials science and optimizing the surface structure, academician R. Makhkamov, control of technological parameters, professor U.Ziyamuhamedova structural compatibility of composite polymer coatings in cotton, professor N.Abed t he use of composite materials and their physical modification, professor A. Juraev structural optimization of technological equipment, professor A.Dzhumabaev improving the abrasion resistance of composite polymer materials and their coatings, Professor Kh. Akhmedkhodjaev evaluation of the effectiveness of cotton pneumatic conveying from composite polymer materials also achieved scientific success.
At the same time, it should be noted that based on local materials under the guidance of Professor A.A. Riskulov conducted research on the effective use of thermoplastic polymers based on new composites, in particular the effective use of fluorine compounds. Under the leadership of U.Ziyamuhamedova extensive research is being carried out to obtain multifunctional coatings on the working surfaces of technological equipment for cotton processing and their structural conformity, in particular, a wide range of scientific research is underway on a new activation heliotechnology for the production of antifriction, antifriction-carrozion structures from heterocomposite polymeric materials (GCPM).

IV. METHODOLOGY

The protective ability of anticorrosive compositions was evaluated by comparing the densities of corrosive currents obtained by polarizing the electrode under study recommended in [2].
The compositions (No. 1, No. 2, No. 3, No. 4 of Table 1), deposited on metal plates, were investigated as an anticorrosion coating. It was found that composition No. 4 is the most promising, the proof of which was the comparison of the protective ability of the films, which was performed according to (state standardization – 380–71) on metal plates of steel Art – 3 (width 70 mm, length 150 mm, thickness 0.8 –0 , 9 mm) under the same conditions and methods of maintaining test modes.

Table 1
The compositions of use for tests for corrosion resistance

Composition №1	Composition №2	Composition №3	Composition №4
According to the technological regulations of production	ED–20 –100mass.part; DBP+HS–20 mass.part; PEPA–10 mass.part; AKS–30–30 mass.part.	ED-20 -100mass.part.; DBP+HS–20 mass.part; PEPA–10 mass.part.; AKF–78–30 mass.part.	ЭД–20 –100mass.part; DBP+ГС–20 mass.part; PEPA–10 mass.part; AKT–10-30 mass.part.

To conduct a comparative analysis, we conducted comparative experiments (Table 2).
When comparing the obtained values with a standard film produced according to the technological regulations of production, it was revealed that:
-Anti-corrosion coating composition number 4 is not inferior in its performance standard film according to state standardization.
-Significant reserves and low cost of raw materials
-determine the economic efficiency of production when using composite materials.

V. EXPERIMENTAL RESULTS

Table 2, 3 presents the anticorrosion properties of composite polymeric materials in various environment, and table 4–6 shows the effect of polarization resistance in various environment on time.

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Table2
Anticorrosive properties of composite polymer materials and coatings of them, depending on the type of kaolin grades in salt environment 3% NaCl

Coatings	$E_{см}$,B Stationary potential	I, mA corrosion rate	γ,coefficient braking	Z %, Power of protection
Without cover	0,78	893	–	–
PCM without filling	0,65	45,3	2,19	84,00
PCM+kaolin	0,50	16,59	53,82	89,00
PCM+AKT-10	0,44	3,89	22,90	99,00
PCM+AKS-30	0,45	13,98	224,30	93,00
PCM+AKF-78	0,48	15,40	5,63	81,00

Table3
Degree of protection and coefficient of braking of kaolin-based compositions in acidic environment of 3% H2SO4

Coatings	Eсм, B Stationary potential	I, мA corrosion rate	γ,coefficient braking	Z %, degree of protection
Without cover	0,28	1584	–	–
Compound without filling	0,35	876,3	21,19	80,00
PCM+kaolin	0,32	616,59	5,82	83,00
PCM+AKT–10	0,29	36,89	2,90	95,00
PCM+AKS–30	0,31	130,98	4,30	91,00
PCM+AKF–78	0,34	155,40	5,63	86,00

Table4
The dependence of the polarization resistance of compositions filled with kaolin on time in a solution of 3% NaCl

Coatings	Time in days				
	5 day	25day	55day	75day	100day
	R, Om				
Without cover	157	125	125	110	110
PCM+AKT–10	158	167	168	170	171
PCM+AKS–30	157	161	161	160	160
PCM+AKF–78	159	165	165	166	166

Table5
The dependence of the polarization resistance of compositions filled with kaolin on time in a solution of 3% H2SO4

Coatings	Time in days				
	5 day	25day	55day	75day	100day
	R, Om				
Without cover	110	45	40	30	30
PCM+AKT–10	137	161	160	160	156
PCM+AKS–30	161	154	139	138	137
PCM+AKF–78	140	149	154	154	152

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Table 6
The dependence of the polarization resistance of kaolin-based compositions on time in the aquatic environment

Coatings	Time in days				
	5 day	10 day	15 day	20 day	25 day
	R, Om				
Without cover	1310	710	130	69	68
PCM+AKT–10	1410	1270	220	135	134
PCM+AKS–30	1370	1290	300	272	270
PCM+AKF–78	1370	980	400	320	318

The dependence of polarization resistance on time in saline, acidic and aqueous environment was studied in the presence of a two-component coating (Tables 4–6, Figure 1–3) based on epoxy binder filled with kaolin AKF – 78, AKS – 30, AKT – 10.
It can be seen that the polarization resistance of a steel probe in aqueous environment uncoated based on gossypol resin compositions is more than an order of magnitude higher than in acidic and saline environments. In aquatic environment, the polarization resistance in the presence of the coating changes insignificantly after 10 days, which indicates its effectiveness. When the probe is held for up to 15 days and further, the polarization resistance decreases, but the presence of the coating in this case also has a noticeable effect. This effect is especially noticeable in acidic and saline environments, that is, after even 25 days, the values of polarization resistance remain almost unchanged.
Lately, much attention has been paid to the preparation and usage of combined coatings. Of great interest for usage in anti-corrosion technology is gossypol resin [5-10] waste oil and fat production.

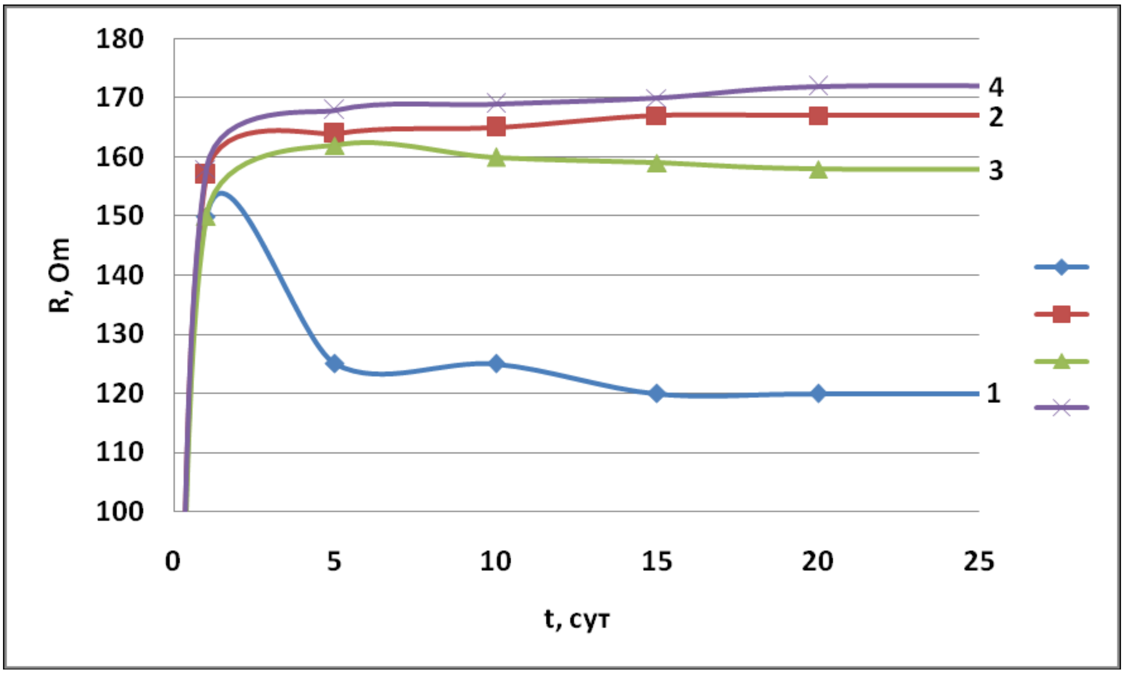

Figure. 1. Dependence of polymerization resistance on time in 3% NaCl in the presence of a coating:
1 - uncoated; 2– composition filled with kaolin AKS – 30; 3 - composition filled with AKF – 78 kaolin; 4 – composition filled with AKT – 10 kaolin.

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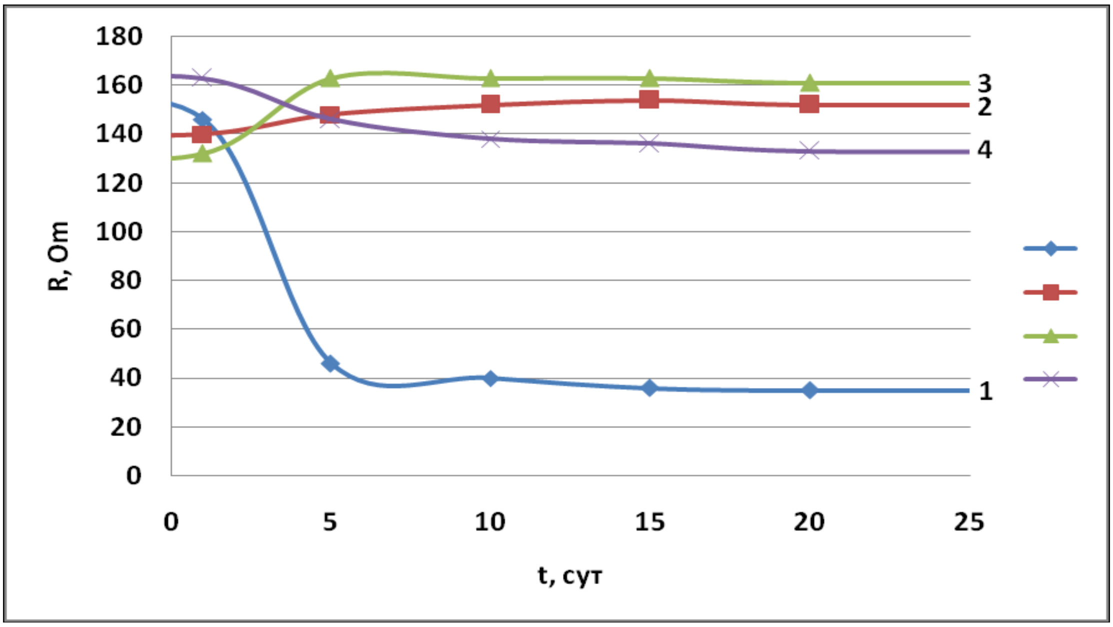

Figure-2. The dependence of the polarization resistance on time in a solution of 3% H2SO4 in the presence of a coating.

1 - uncoated; 2 - composition filled with kaolin AKS – 30; 3 - composition filled with AKF – 78 kaolin; 4– composition filled with AKT – 10 kaolin.

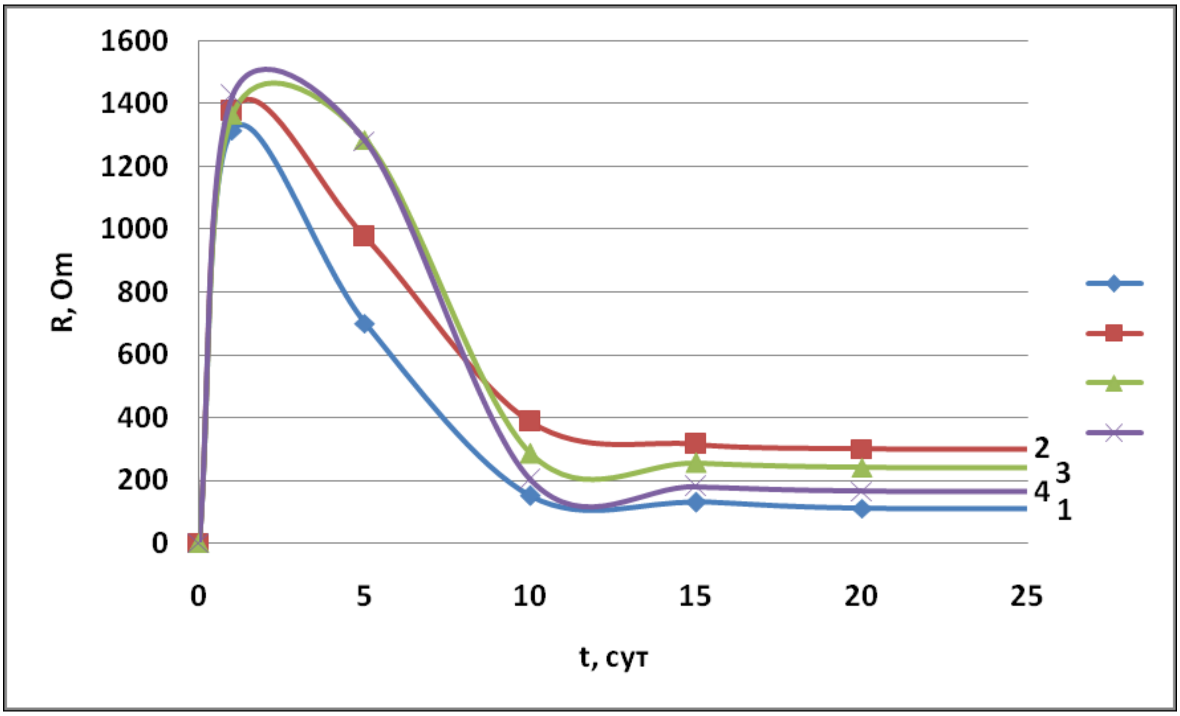

Figure 3. Dependence of the polymerization resistance on time in aquatic environment in the presence of a coating.

1 - uncoated; 2 - composition filled with kaolin AKS – 30; 3 - composition filled with AKF – 78 kaolin; 4– composition filled with AKT – 10 kaolin

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Lately, bitumen - oil waste (state standardization 5.2239-77) has been widely used as an anticorrosive paint and varnish product.

Table 7
Comparative indicators of the test and standard paint coating compositions

Indicators	The composition of the accepted paint	
	According to the technological regulations of production	ЭД–20 –100mass/h; ДБФ+ГС–20 mass/h; ПЭПА–10 mass/h; АКТ–10–30 mass/h
The appearance of the film	The color is black, glitters, the surface is smooth.	The color is black, glitters, the surface is smooth.
Viscometerextension20-25^{0}C	18–35	30
Mass fraction of nonvolatile substances,%	39 ± 2	40
Drying time of the film to degree 3 at 20 ± 2^o C.h. no more at 100-1100 ° C min. No more (minutes)	20	20
Film hardness by pendulum device M – 3 conventional units	0,20	0,20
Bending elasticity of the film, mm	1,0	1,0
Resistance of a film to static influence of water at a temperature 20^0 ± 2^0 C, h, no less	48	48
Resistance of the film to the static effect of 3% NaCl solution at a temperature of 20^0 ± 2^0 C, h, no less (points)	3	3

VI. CONCLUSIONS

An analysis of the results of the study comparing the evaluation of the anticorrosive ability of the compositions showed (Table 7) that the best protective properties against corrosion in saline environment are compositions filled with kaolin of the AKT-10 production brand and in acidic environment — compositions filled with kaolin of the AKF-78 production brand. Such differences in the properties of coatings filled with kaolin are explained by their chemical composition and particle size. Due to the fact that kaolin AKT – 10 compared to AKF – 78 oxides: iron oxide, silicon dioxide is greater, the predominance of aluminum oxide in AKF – 78 gives an advantage to the coating based on it to predominate anticorrosive properties to aggressively acidic environment. The content of these elements makes it possible to suggest the formation of nanocomplex compounds during mechanical – chemical modification upon their preparation, to which further studies will be devoted.

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