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Investigation of the Influence Fillers on RMAL Properties of EPOXY Coatings

Madina Babakhanova, Kamila Negmatova

P.G. student, State unitary enterprise "Fan va taraqqiyot", Tashkent state technical university, Tashkent, Uzbekistan

Doctor of the technical sciences, State unitary enterprise "Fan va taraqqiyot", Tashkent state technical university, Tashkent, Uzbekistan

ABSTRACT. In the paper the process of heating in temperature 20-500^{o}S in composition on base modified epoxy resin with furfirol alcohol stilling with variety fillers as bentonite, kaolin, waste of gold extraction is shown.

It is shown that accounting filler as a component of chemical processes occurring during heating of filled polymers, can be some extent help to overcome the difficulties and contradictions that arise in the study of thermal stability of composite polymer systems.

KEYWORDS. Composites, coatings, filler, thermal stability, mechanical properties, corrosion, protection.

I. INTRODUCTION

For protection against from corrosion of equipment in the chemical, petrochemical industry and in engineering, various widely used corrosion resistant polymer coating. However, developments in the production and study of corrosion-resistant coatings, filled with a variety of siliceous fillers to protect metal surfaces from aggressive and abrasive environment is currently insufficient. It is known that compositions based on epoxy-ED 20 most widely used as coatings, lacquers and adhesives. However, the film-forming coating of unmodified epoxy resin characterized by low mechanical and thermal performance. Low heat resistance and impact resistance, as well as the lack of elasticity limits using of epoxy resins as anti-corrosion and insulating coatings. To eliminate these drawbacks of the epoxide compositions are administered modifiers containing different reactive functional groups (hydroxyl, carboxyl, carbonyl etc.) That improves the operating characteristics of epoxy coatings [1,2].

Improvement the performance properties of the coatings can be addressed by adjusting the structure: The optimal heterogeneity is achieved by the introduction of the particulate filler and plasticizer.

II. SIGNIFICANCE OF THE SYSTEM

In article is considered experimental results of researches of dependences of thermal stability of coverings on a type of fillers.

The research of the literary review is presented in the section III, the methodology is explained in the section IV, the section V covers results of an experiment of a research, and the section VI discusses future research and the conclusion.

III. LITERATURE SURVEY

For protection of metals and alloys against corrosion thermo reactive polymers, such as epoxy, phenol formaldehyde, polyester, furanovy and other oligomer are widely used [3-6]. Coverings on the basis of polymeric epoxy resins of a rack to alcohols, hydrocarbons, alkalis, solutions of salts and mineral acids, lubricant oils. Epoxy resins (ED-16, ED-20, ED-40) belong to thermo reactive structures. One of shortcomings of the cured epoxy compositions on the basis of dianovy pitches is their low thermal stability, fragility, leading to cracking of a compound, especially when filling designs with a large number of metal details and at cycles heating cooling. For improvement of these operational characteristics usually enter the modifying additives into structure of a compound. It is known that nonsaturated polyair is applied as the modifying agent in production of the filling compounds binding to filling and pressing plastics. Therefore in work [7,8] modification of epoksidianovy pitches with nonsaturated polyair is shown.

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The nonsaturated polyair synthesized by authors can be applied with success as modifiers of epoxy resins, and compositions of such look, according to literary data, have a valuable complex of the properties allowing to use them for creation of molding and pressing materials, glues, thermo reactive films.

Fillers differ from pigments in much lower covering ability and razbelivayushchy ability. Increases in chemical firmness and fullness of a paint and varnish film, i.e. for giving of any special properties are added to paints and varnishes, generally for reduction in cost of the last and also for giving to them of a teksotropnost, anticorrosive properties. Thanks to it fillers are often called functional pigments.

IV. METHODOLOGY

The objects of study are organic coatings based on bottoms of furfuryl alcohol with an epoxy oligomer ED-20, gossipol resin (HS), an amine hardener - polyethylene polyamine (PEPA), filled with a variety of silica filler - bentonite, kaolin, waste of gold extraction (OZIF).

The furan compounds are used in polymer materials. The furan compounds modified polymeric materials have new performance, better manufacturability, low toxicity, high mechanical and chemical stability, including corrosive environments.

Therefore, we used the bottoms of furfuryl alcohol (COFS) as a modifier for a epoxy resin.

The study of the processes of occurring during heating in the temperature range 20-5000S in compositions based on the Coffs epoxy resin with various fillers, held at the IOM derivatograph type 1 ML-102 system F.Paulik, I.Paulik, L.Erdey at a heating rate of 5^o / min.

V. EXPERIMENTAL RESULTS

The unique properties of composite polymer materials allowed to use them in a variety of industries and, in particular, to protect metals from corrosion. Introduction of the coatings based on bottoms of furfuryl alcohol with an epoxy resin ED-20 significantly influences fillers composite thermal degradation [9].

In the figure 1-4 derivatograms original samples and filled with various fillers (bentonite, kaolin, OZIF) are shown.

On derivatograms (DTA) for all samples is observed most endothermic peaks in the temperature range from 280-500^{o}C that, apparently due to resistance of the filled to high temperatures. At the same time the existence of two exothermic cycles in 405-500^{o}C have filled samples indicates the occurrence of deeper processes occurring during the formation of coatings.

The fillers of coatings efficiently protected from oxidation, which in turn is "automatically" causes an increase in the thermal stability of the composite.

According to the results of thermogravimetric analysis the dependence of the weight loss of the samples filled with the temperature have been built and shown in figure 5.

As seen in figure 5, the thermal stability is superior to the sample composition filled with OZIF and bentonite.

The comparison of the curves DTGA and TGP raw and filled with samples shows that filled samples onset decomposition temperature increases the speed of degradation decreases and shifts towards to higher temperatures.

As seen from the results of investigations, the introduction in the fillers significantly increases the induction period.

The introduction of mineral fillers in the polymers with specific chemical properties of the surface can lead to accelerate or inhibition of different stages of the destruction process and change the chemistry of these reactions. It is becoming increasingly apparent that the particulate mineral fillers act as heterogeneous components of high-temperature chemical processes of polymer degradation occurring at the interface between the polymer-filler.

The thermal and thermo-oxidative degradation of filled polymers are considered in light of the influence of the chemical structure and composition of the polymers as well as surface chemistry and thermal properties of dispersed inorganic fillers.

Among the inorganic fillers dispersed polymers, this group is the largest and most widely used for a practical purpose. The vast majority of silica and silicate fillers is silica, having more than 20 different modifications. Surface chemistry of silica is studied well enough. It is found that the average concentration of OH groups on the silica surface is 7.0 – 9.5 mmol / m^2 or 4.2 - 5.7 groups / nm^2. Approximately the same concentration of OH groups on the silica surface.

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Accounting filler as a component of chemical processes occurring during heating of filled polymers, can be some extent help to overcome the difficulties and contradictions that arise in the study of thermal stability of composite polymer systems.

The picture is further complicated, if the processes of degradation of filled polymers were tested in the presence of oxygen, as in this case we are dealing with a multi-component system (polymer, filler, oxygen, thermal oxidative degradation products), the composition and properties of which are changing rapidly in the course of the experiment at high temperatures.

It is given the complexity of the chemical processes occurring in the destruction of filled polymers, and the importance of their understanding of the thermal behavior of the individual components, consider the thermal stability of the major components of polymeric composite materials (polymers and inorganic fillers) and the influence of the structure and composition of both polymers and fillers. The introduction of fillers into the composition not containing the adsorbed water and oxygen, and other impurities that contribute to polymer degradation and increases the thermal stability of the filled samples. Preliminary surface modification of fillers, by mechanical activation, with a view to hydrophobing, prohibition the active surface groupings of impurities that reduce the stability of the polymer improves the stability of the system.

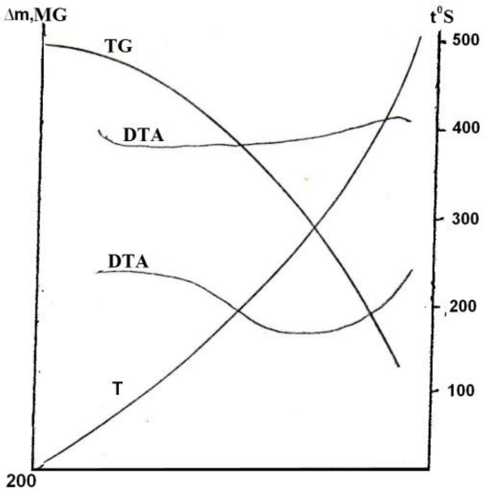

Figure 1. The derivation of the initial oligomer (COFS)

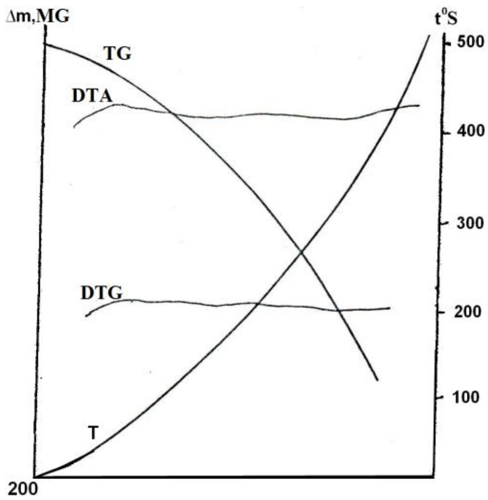

Figure. 2. Derivation of the composition filled with OZIF

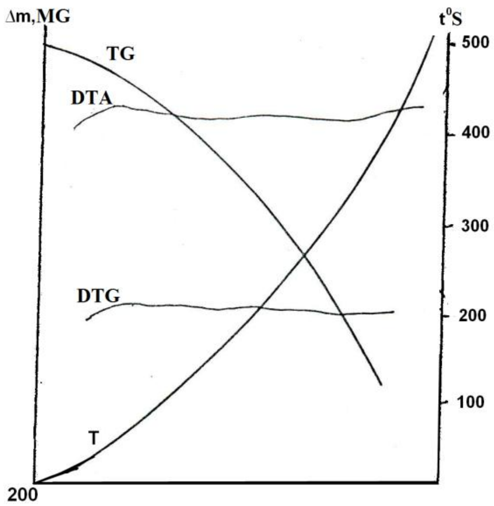

Figure. 3. Derivation of the composition filled with bentonite

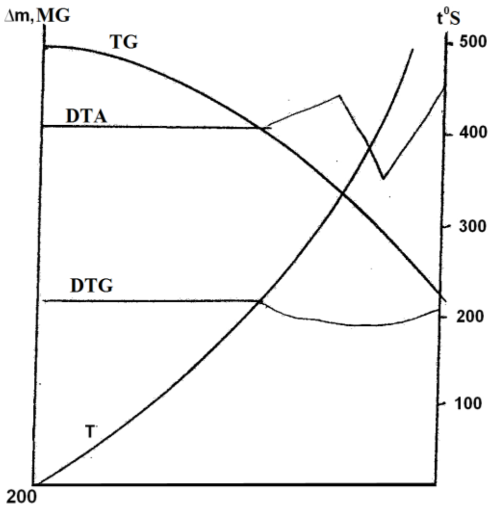

Figure. 4. Derivation of the composite filled with kaolin

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Directional surface modification of fillers for creation groups thereon, having capable of forming strong chemical bonds with macromolecules or stabilizers are polymers with relation to thermal and thermal-oxidative processes also lead to a marked improvement of the stability of filled composites.

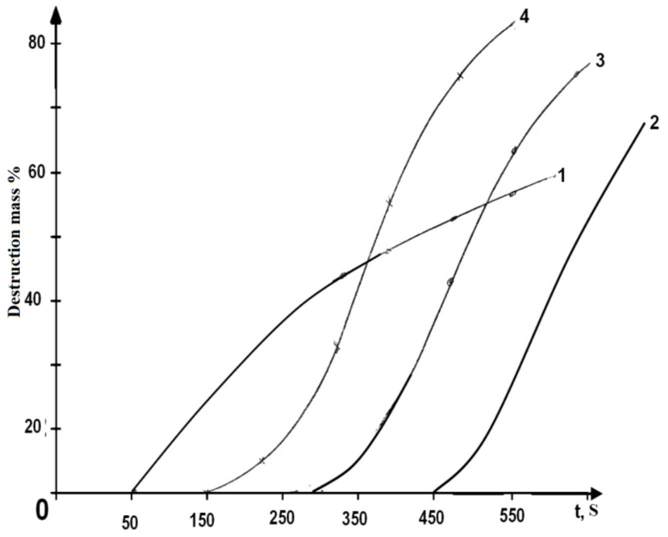

Figure. 5. Dependence of the weight loss studying composition by temperature. 1 - bottoms furfuryl alcohol; 2 - composition filled with OZIF; 3 - composition filled with bentonite; 4 - composition filled with kaolin

One of the main characteristics of the coatings is their mechanical strength. On the one hand, the ability to cover the resist degradation under load expressed in cracking and peeling of the film from the substrate, on the other hand, is the ability to resist the emergence of forced-elastic and plastic deformations.

In accordance with the methods for determining strength properties, samples were tested coatings derived from compositions containing a silicate with various excipients. Thus estimated value of the ratio of furfuryl alcohol distillation residue with an epoxy resin, which ranged from 0.5 to 2. The data obtained are presented in the table.

Table

The influence of the ratio and types of fillers on the strength characteristics of corrosion-resistant coatings

Samples	Durability							
	impact, kgs▪sm				bending, mm			
	in proportions COFS:ED-20							
	0,5	1,0	1,5	2,0	0,5	1,0	1,5	2,0
Unfilled	35	35	40	40	1	2	3	3
Filled bentonite	40	50	45	45	1	1	2	3
Filled with kaolin	40	45	35	40	1	2	3	5
Filled with OZIF	40	50	40	40	1	1	2	3

By the filling of the composite with an equal number COFS: ED-20 (1:1) the value of strength characteristics remain at the same level only for a composition comprising a filler and bentonite OZIF. In the experiments have shown

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that compositions filled with bentonite and OZIF have sufficiently high strength characteristics and make up 50 kg·sm impact strength and 1 mm in bending strength. Unfilled samples obtain fragile.

The comparison of the strength characteristics of coatings filled in the entire range of relations COFS: ED-20 has shown that the best properties of the coated, filled with bentonite and OZIF. The comparison of physical and mechanical properties of coatings obtained in the optimal mode at 80°C drying for 60 minutes and cured at PEPA (Fig. 6) has showed that in all ratios COFS:ED impact strength of the compositions hardened with PEPA above 20% on average. This indirectly confirms there is presence in the coatings of crosslinked structures.

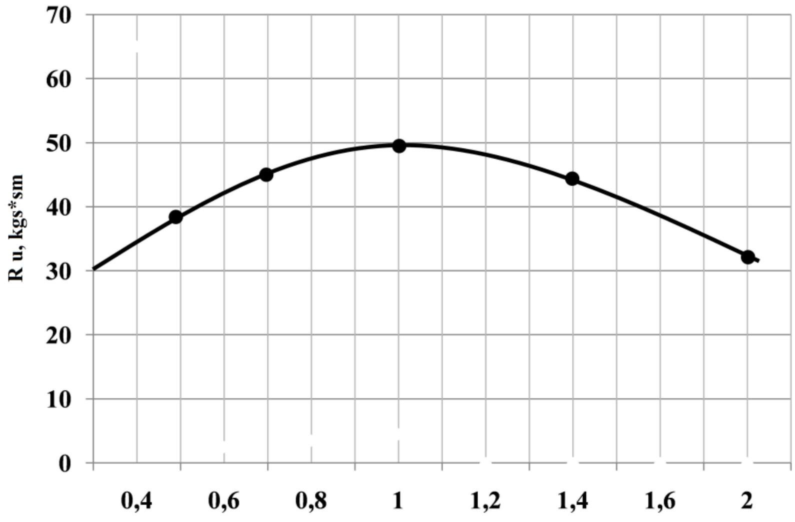

Figure 6. The dependence of the impact strength of the coatings filled with bentonite by component ratio

VI. CONCLUSION AND FUTURE WORK

Apparently from the provided data polymers are the main representatives of the thermoplastic and thermo reactive polymeric materials which are widely applied in many industries, and in particular to anticorrosive protection of metals. But, at the same time it is necessary to know character and degree of aggression of the environment, mechanical influences, temperature, moist and other service conditions.

Thus, in the paper developed a new composition of the organic anti-corrosion coatings based on bottoms of pentosane oligomer (COFS) with an epoxy resin ED-20 filled with a variety of silica fillers (bentonite, kaolin, waste OZIF).

As well as established that the optimum content of the filler is 25 parts by weight of the composite, which on curing forms a coating, having good adhesion to the metal substrate.

REFERENCES

[1]. Tulai O.I, Serdnitsky Y.A // Plastics. 2001, №12, 21-23 p.

[2]. Sumenkova O.D, Osenchik V.S // Plastics 2001, №12, 35-37p.

[3]. Li G., Nevill To. The reference guide on epoxy resins. The lane with анг. / under the editorship of N.V. Alexandrov. – M.: Energy, 1973. – 415 pages.

[4]. Chernin I.Z., Smekhov F.M., Zherdev Yu.V. Epoxy polymers and compositions. – M.:. Chemistry, 1982. – 232 pages.

[5]. Paquin A.M. Epoxy connections and epoxy resins. Per with him. / under the editorship of L.S. Efros. – L.: Goskhimizdat, 1962. – 963 pages.

[6]. Mamatov of Yu.M. Furanovye of pitch. Production and application. Review. – M.: Chemistry, 1974. – 99 pages.

ISSN: 2350-0328
International Journal of AdvancedResearch in Science, Engineering and Technology
Vol. 5, Issue 10 , October 2018

[7]. Guseynov I.A., Ishchenko N.Ya., Mustafayev S. G., Bektasha N.R., Karayeva A.M., Mustavayev A.M. Modification of epoksidianovy pitches with nonsaturated polyair//the Magazine plastics. – Moscow, 2008. - No. 11. – Page 11-9.

[8]. Sadygov Sh.F., Ishchenko N.Ya. Coverings on the basis of the modified ED-20 pitch//the Magazine plastics. – Moscow, 2006. - No. 6. – Page 34-36.

[9]. I.Foygt. The stabilization of synthetic polymers against the action of light and heat (under. Ed. Prof. B.M.Kovarskoy) L.Ximiya, 1972, 545p.