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THE RESISTANCE OF RUBBERS WHICH CONTAIN SHODDY AND ARE BASED ON FLUORINE-ELASTOMERS IN ORGANOCHLORINE LIQUIDS

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Introduction of fillers to thermoplastics not only decreases cost of goods but conduces to simultaneous increasing their physical mechanical characteristics. Investigations on modification of thermoplastics on the base of mixture of polypropylene and polyamide 6 armored by basalt fibres have been carried out. Dressing of basalt fibres (alkoxy))acrylatacyloxy) by titanates and titanoxanates allowed to increase durability at stretching composites till 68.0 MPa that will allow to goods from them to be used for a longer term and in a wider range of loads and temperatures. The biggest significances of physical and mechanical characteristics of basalt plastics have been reached at ploying dressings of the range of 0.75–1.00 mas.% on fibre and mechanical indices have been increased twice at using tetra(acrylatacyloxy) of titanium. Further increasing quantity of dressing on basalt fibres isn't reasonable because it lets to falling physical and mechanical characteristics of composites. Goods made of developed basalt plastics in which simple and cheaper raw materials are used will be able to meet competition at using in different mechanisms and constructions.

Halogenated hydrocarbons are widely used in industry as heat transfer fluids, thermal and electrical insulating and separating fluids. To seal the various connectors, joints, etc. the action of these compounds are commonly used elastic materials

It is known that the most resistant to organochlorine environments are rubber-based fluoroelastomers [1]. However, this class of elastomers is costly. To reduce the cost of production of rubber parts is advisable to use recycled waste products [2,3], in particular, waste of rubber-based fluoroelastomers.

Technology developed by the authors of thermo-mechanical and chemical modifications of this type of waste allows them to return to the process of manufacturing rubber parts [4]. However, the literature contains no information about modifying rubber properties reclaim-containing fluoroelastomers in terms of the impact of chlorinated hydrocarbons. Is of practical interest to study the impact of chlorinated hydrocarbons on the properties of rubbers containing modified production waste rubbers based fluoroelastomers in these conditions.

The objects of study parameters are selected based rubber SKF-26, obtained by using a bisphenol, and an amine curing systems, but also on the SCF-32 based rubber obtained with the amine and radical nonperoxidic vulcanization systems [5].

Rubber mixtures based on SCF-26 (amine curative) were cured in two stages: first at 151^{0}C for 30 min, the second – at 200^{0}C for 24 h (thermostating). Rubber compounds based GFR-32 (amine curatives) not thermostated. Rubber mixtures based on rubber, SCF-26 (bisphenol curatives) and based on the SCF-32 (type radical nonperoxidic curatives) and cured in two stages: first – if 170^{0}C for 20 min, the second – at 200^{0}C for 24 hrs.

Working environments are used in industry mix pentachlorbiphenyl 1 (PCB) and trichlorobenzene (TCB) in a weight ratio of 90:10.

As a modifier in the preparation of the production waste reclaim rubbers based fluoroelastomers used polyfluoroakrilat – low viscosity polymer 1,1,7-trihydroperfluorogeptil akrilat

The choice of this compound is due to the following. The saturated rubbery polymers of acrylic esters, fluorine-containing alcohols – the low viscosity polyfluoroakrilat [6] can be used to create elastomeric compositions. These rubber-based polymers have a conditional strength of a 8.0 MPa, elongation at break ~400%, they have very little swelling in organic solvents, have high resistance to oxidants, ester type hydraulic fluids.

Modified regenerate injected in the respective rubber compositions in an amount of 50 phr.

Rubber resistance to the effects of organochlorine fluids was determined by the change in the mass of samples in a relaxed state, in accordance with GOST 9.030-74, as well as to change the com-

The change in mass containing reclaimed rubber (%) in a mixture of PCB and TCB

Number rubber	Type of rubber and cure	Contents regenerate, phr.	Temperature, ^{0}C	The exposure time, day		
				10	20	30
1	SKF-26, amine system	0	90	2,0	3,5	3,7
			130	2,8	3,6	4,6
2	SKF-26, amine system	50,0	90	1,5	2,5	3,1
			130	2,7	3,5	4,0
3	SKF-26, bisphenol system	0	90	2,1	3,3	3,5
			130	2,5	3,7	4,0
4	SKF-26, bisphenol system	50,0	90	1,5	2,0	2,3
			130	1,9	2,4	2,8
5	SKF-32, amine system	0	90	3,3	4,5	5,5
			130	4,3	5,1	5,6
6	SKF-32, amine system	50,0	90	2,3	2,7	2,8
			130	2,7	2,8	2,8
7	SKF-32, nonperoxidic radical system	0	90	3,0	3,5	4,1
			130	3,2	3,8	4,3
8	СКФ-32, nonperoxidic radical system	50,0	90	2,2	2,8	3,0
			130	2,4	2,9	3,1

pression set in aggressive environments in accordance with GOST 9.070-76.

Table shows the weight change results when swollen rubbers investigated in a mixture of PCB and TCB at various time-temperature conditions.

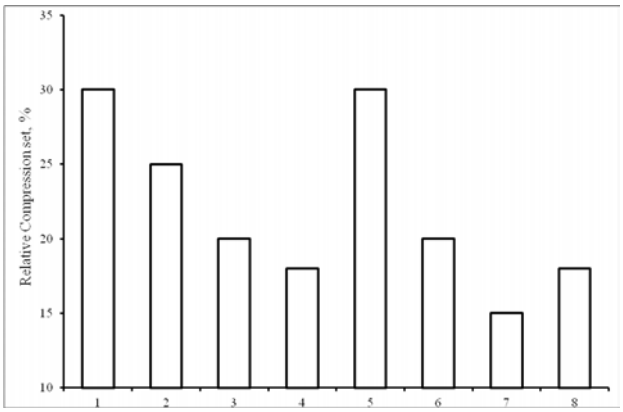
Analysis of the results showed that the magnitude and rate of change of mass vulcanizates depend on the chemical nature of rubber formulations, and process fluid temperature.

The most resistant to this medium were such rubber: bisphenol serial (3 Rubber) and experienced containing reclaimed rubber (4 Rubber) rubber-based SKF-26, and serial (Rubber 7) and experienced containing reclaimed rubber (8 Rubber) rubber-based SKF-32 obtained using nonperoxidic radical type cure system. However, it should be noted that the amine-based fluoroelastomers vulcanizates are also highly resistant to said medium.

Found that when exposed for 30 days in a mixture of PCB and TCB strength properties of the investigated rubbers vary slightly. So, within 30 days of exposure in the environment at 150^{0}C and experienced serial containing reclaim rubber rubber-based SKF-26 (bisphenol curing) and the serial and experienced containing reclaim rubber rubber-based SKF-32 obtained using nonperoxidic radical vulcanizing system, retained 98% of original strength, the rest condition – 95% of the initial strength. It should be noted that under these conditions nearly all rubber hardness hardly changes.

A figure shows the relative Compression set (RCS) when exposed to a mixture of PCB and TCB. This figure is a key in determining the performance of rubbers as seals in fixed joints.

Studied rubber-based fluoroelastomers speed and magnitude of the relative accumulation of residual compressive strain can be arranged in the following order: 1 and 5 rubber>Rubber 2>3 and 6 Rubber>Rubber 4 and 8>7 Rubber.



Relative Compression Set (%) rubber when exposed to a mixture of PCB and TCB for 30 days at 150^{0}C (the numbers correspond to the table of rubbers)

Amine vulcanizates based fluoroelastomers at 150^{0}C have greater relative speed accumulate compression set than bisphenol and nonperoxidic radical type. Importantly, the reclaimed rubber -containing (bisphenol and amine cure systems), are less as compared with the RCS serial rubbers. This attests to the effectiveness of the modified regenerates rubber products based on fluoroelastomers, as the cost of products is reduced and resistance to organochlorine liquids increases.

Thus, it can be recommended for the manufacture of rubber products used for a long time under the action of a mixture pentachlorodiphenyl and trichlorobenzene, rubber-based fluoroelastomers curable using amines (bifurgin) for SKF-26, salitsilalimine copper for SKF-32, as well as bisphenol (SCF 26) and nonperoxidic radical (SCF-32) vulcanizing systems in which the composition

contains up to 50 phr modified regenerate.

Selecting the recommended types of rubbers depends on additional specific requirements for rubber goods consisting of nodes or units.

REFERENCEC

1. *Зуев Ю.С., Дегтева Т.Г.* Стойкость эластомеров в эксплуатационных условиях. – М.: Химия, 1986. – 264 с.

2. *Микульонок І.О.* Основні методи використання гумовмісних відходів // Хімічна промисловість України. – 2001. – № 5. – С.53-58.

3. *Семенов Г.Д.* Властивості гум на основі фтореластомерів з модифікованим регенератом // Хімічна промисловість України. – 2001. – № 3(44). – С.21-24.

4. *Батурин В.В., Семенов Г.Д., Ващенко Ю.Н.* Особенности термо-, механо-, химической модификации регенератных композиций, получаемых из отходов резин на основе фторэластомеров // Вопр. химии и хим. технологии. – 2012. – № 4. – С.82-87.

5. *Нудельман З.Н.* Фторкаучуки: основы, переработка, применение. – М.: ООО «ПИФ РИАС», 2007. – 384 с

6. *Галил-Оглы Ф.А., Новиков А.С., Нудельман З.Н.* Фторкаучуки и резины на их основе. – М.: Химия, 1966. – 235с.

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The resistance of rubbers on the basis of fluorine-elastomers with various curing systems, including those containing modified shoddy from the waste rubber products containing fluorine-rubbers, was studied in organochlorine liquids, in pentachlorodifenyl and trichlorobenzene mixtures (90:10) in particular. The rubbers on the basis of elastomers SKF-26 and SKF-32 were considered. Amine and bisphenol curing systems were used for the rubber SKF-26. Amine and radical nonperoxidic curing systems were used for the rubber SKF-32. The treatment of waste rubbers was carried out by means of thermo-mechanical degradation in the presence of low molecular weight oligo-fluorin-acrylate. The modified shoddy was used in an amount of 50 wt.%. The variation of the mass of rubber at different temperature and the duration of exposure in chlorinated hydrocarbons was investigated. If the rubbers contain shoddy and were obtained using amine and bisphenol curing systems, then they have lesser value of relative residual compression strain (RCS) as compared with the RCS typical of serial rubbers. We gave some recommendations on the choice of the type of rubbers with high resistance to prolonged exposure in chlorinated hydrocarbons at elevated temperatures.

Keywords: fluorine-elastomers; modified shoddy; chlorinated liquid; resistance; application.

References

1. Zuev Yu.S., Degteva T.G., *Stoykost' elastomerov v ekspluatatsionnykh usloviyakh* [Resistance of resins in running test]. Khimiya, Moscow, 1986. 264p. *(in Russian).*

2. Mikulonok I.O. Osnovni metody vykorystannya gumovyh vidkhodiv [Basic procedures of the use of rubber waste]. *Khimichna Promislovist' Ukraiiny*, 2001, vol. 5, pp.53-58. (*in Ukrainian).*

3. Semenov G.D. Vlastyvosti gum na osnovi ftorelastomeriv z modifikovanym regeneratom [Properties of rubbers on the basis on fluorine-elastomers with modified shoddy]. *Khimichna Promislovist' Ukrayini*, 2001, vol. 3, pp. 21-24. (*in Ukrainian).*

4. Baturin V.V., Semenov G.D., Vashchenko Yu.N. Osobennosti termo-, mehano-, khimicheskoi modifikatsii regeneratnykh kompozitsii, poluchaemykh iz othodov rezin na osnove ftorelastomerov [Features of thermo-, mechanic-, and chemical modification of shoddy-containing composites obtained from the waste of rubbers based on fluorine-elastomers]. *Voprosy khimii i khimicheskoi technologii,* 2012, vol. 4, pp. 82-87. *(in Russian).*

5. Nudelman Z.N., *Ftorkauchuki: osnovy, pererabotka, primenenie* [Fluorine-containing elastomers: fundamentals, treatment, and application]. PIF RIAS, Moscow, 2007. 384 p. *(in Russian).*

6. Galil-Oglyi F.A., Novikov A.S., Nudelman Z.N., *Ftorkauchuki i rezinyi na ikh osnove* [Fluorine-containing elastomers and rubbers]. Khimiya, Moscow, 1966. 235 p. *(in Russian).*