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Investigation of the Properties of a Composition Obtained on the Basis of Mixtures of Polyvinylchloride and Synthetic Rubber Ethylene Propylene Terpoliymer

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Kerem Shixaliyev
Academician of the European Academy of Natural Sciences Department of Organic substances and technology of macromolecular compounds Azerbaijan State Oil and Industry Azerbaijan State Oil and Industry University Baku, AZ1010, Azerbaijan, 20 Azadlig Avenue
orchid 0000-0001-5887-5721
kerem_shixaliyev@mail.ru

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Abstract:
The properties of mixtures and vulcanizes of polyvinyl chloride (PVC) and ethylene-propylene elastomers (SREPT-40) with functional group polymers have been studied and it appears that the effectiveness of the application of functional group polymers (FQP) is characterized by the improvement of the complex properties of vulcanizes. As shown, among the FQP, the industrial scale production of PVC and the low cost of its use in the purchase of rubber mixtures based on SREPT have been developed. In this regard, new composition mixtures were obtained by replacing the main polymers in rubber mixtures with 5÷30 mass parts of PVC based on SREPT. The physical and mechanical properties of their technological and vulcanizes were studied. Experiments show that the sol-fraction and durability of vulcanization in gasoline, gasoline-benzene (3:1) mixture, and metaxylol decrease with the increase of PVC content. The reduction of the sol-fraction of the vulcanization can be explained by the low swelling of PVC in the above-mentioned solvents. Therefore, the vulcanization based on the SREPT PVC mixture has a higher resistance to oil and gasoline than the vulcanizate based on unmodified SREPT. It is learned that 10 mass. h to SREPT. When PVC is included, the degree of swelling of the vulcanization is reduced by 20% in gasoline, in the mixture of gasoline-benzene (3:1), M-xylene, and ", Avtol" oil, compared to the vulcanization based on SREPT. 30 c.h. and when included, the degree of swelling of the vulcanization decreases by 2.7 times in gasoline, 2.3 times in gasoline-benzene (3:1) mixture, and 3.2 times in "Avtol-10" oil

1. Introduction

Preparation of rubbers based on polyvinyl chloride (PVC) and ethylene- propylene elastomers (SREPT-40) is of great industrial importance today [1-3].Compositions based on elastomers with high unsaturation have low durability against atmospheric and ozone effects. A large amount of anti-aging agents are added to these mixtures to increase the stability of the compositions to the atmosphere and ozone[5-7]. These chemicals have a high cost and harmful effect and do not fully protect composite materials from atmospheric and ozone effects during operation[8- 10]. remains Instead of PVC, some authors used butyl rubber modified with chlorinated polymers and :SREPT-40-based rubber mixture for vulcanization in the preparation of diaphragms. The service life of diaphragms made of polymer mixtures is 25-26% longer than diaphragms made of butyl rubber [11-13].

SKN-40M:SREPT-60:PXP, SKN-40M:SREP-50:PVX, SKN-40M:SREP-40:XSPE, SKN-40M:SREPT:PVX compositions based on mixtures were used in the production of technical rubber products. Compared to vulcanizes based on SKN-40M and PXP, these compositions are characterized by high resistance to heat aging, abrasion, swelling in isooctane-toluene environment, and low density and brittleness temperature. Obtained from compositions based on the above-mentioned polymer mixtures; technical specifications of piston drilling pumps used in drilling oil and gas exploitation and exploration wells (injection pressure 15-20MPa, density 1550-1600 kg/m3, abrasive water-clay solution with traces of oil, operating in the temperature range of 0-80°C)

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the service life of rubber products: rubber-metal pistons, stock, cylindrical heart, cuffs and pneumonia compensators, compared to the products purchased on the basis of the original SKN-40M:PXP, is 70-75 hours. The service life of the curing rings made from compositions based on SKN-40M:SREP:PVC mixtures at a temperature of 160-190°C for formators-vulcanizers has increased by 120 hours [14-16]

2. Methodologyogya

To determine the nature of the interaction of the polymer components in the SKEPT PVC mixture, the IR spectrum of the model mixture was studied. It has been shown that extracting a mechanical mixture of SKEPT with PVC with dichloromethane completely washes out the PVC added to the mixture. It has been proven that. Only after the thermal effect, the connection of SREPT with PVC is established. Therefore, SKEPT is subjected to temperature effects according to the vulcanization mode of thePVC model system (at 153°C for 30 and 60 minutes). This mixture is extracted with a selective solvent, dichloromethane, to determine the extent of SREPT interaction with PVC. At this point, PVC that is not in contact with SREPT is removed. An IR spectrum study of the kept keptixture after extraction showed the following:

a) 860, 1210, 1250, 1620, 1710, 3200-3600 cm-1 absorption fields are observed;

b) 980, 1050, 1100, and m-1 absorption areas are strengthened;

v) Weakening of the 720 cm-1 absorption area The disappearance of the SREPT absorption area indicates the loss of (including) end groups in SREPT.

After extraction, it shows that the amount of groups in the mixture decreases, and the number of groups increases. PVC alloy has a very high ehighlytive coating and considerable activation energy of flow (figures 1 and 2). The effective viscosity of PVC is an order of magnitude higher than that of SREPT alloy. When PVC is added to the mixture in the form of plplasticatingthe viscosity of the SKEPT-PVC mixture decreases by one order of magnitude according to the viscosity of SREPT, and two orders of magnitude according to the viscosity of PVC (figures 3 and 4).

Incorporation of PVC plplasticsnto SREPT significantly improves the rheological properties of these blends, indicating improved miscibility of SKEPT with PVC, which is generally based on blends.

leads to the improvement of the physical and mechanical properties of the compositions. The activation energy KC/mol of the viscous flow of the above-mentioned mixtures can be taken into account: for PVC-204; SKEPT-40; SREPT: PVC (70:30)-55.6; For SREPT:PVX: DBF (60:26:14) it is equal to 66.

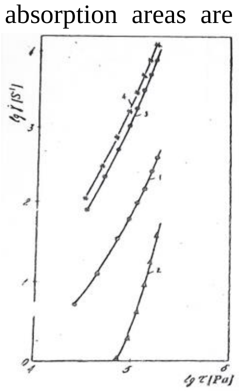

Figure 1. Flow curves: 1- SREP; 2-

PVC; 3- SREP-PVX-DBF (60:26:14)

joint; 4-REP-PVC-DBF (58:25:17).

Temperature, 180°C.

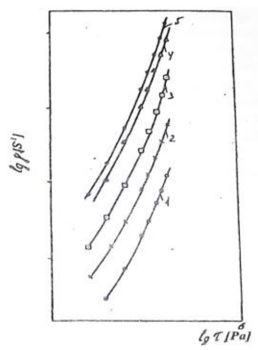

Figure 2. Flow curves of SREP-PVX-DBF (60:26:14 wt%) mixture.

Temperature °C. 1-100; 2-130; 3-150; 4-

180; 5-200.

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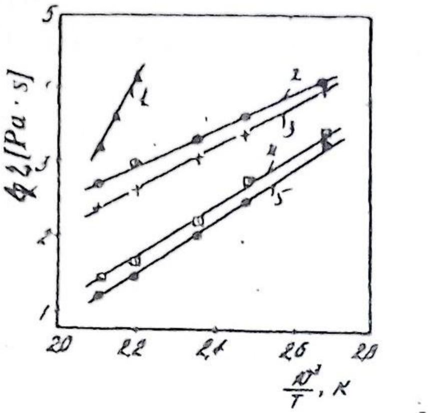
Based on SREPT, compositions are resistant to oil, gasoline, etc. to improve its properties, 40% by mass of PVC plastic (PVX-65, DBF-35% by mass) is added to SREPT.

Oligotetraacrylates are poorly mixed in the indicated mixtures, which is explained by their chemical structure and low similarity to the polymers of the mixture. DBF and DOF are selective plasticizers for PVC, so they ensure a more uniform distribution of it in the elastomeric phase of the mixture [16] .

Multi-component SREPT, a mixture of technical carbon and PVC, was developed at a temperature range of 100÷170°C. The decrease in the durability indicators of the compositions prepared at 100°C is explained by the agglomeration of the PVC particles in the mixture, due to the different softening temperatures of SREPT and PVC.



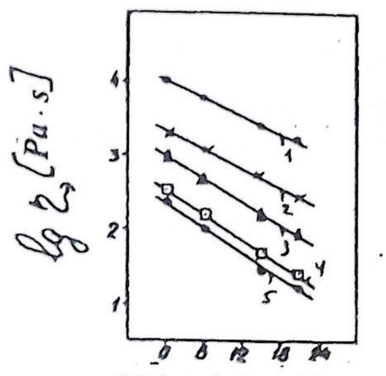


Figure. 3 Temperature dependence of theeffective viscosity of alloy alloys:

1 - PVC; 2 - SREPT; 3 - SKEPT-PVC

(70:30); 4 - SREPT-PVC-DBF (60:26:14);

5 - SREPT-PVX-DBF (58:25:17); .

Figure 4. Dependence of the effectiveviscosity of the SREPT-PVC (70:30)mixture on the amount of DBF. Shearstress - τ=1.35·105 Pa, Temperature, °C

1-373; 2-403; 3 - 423; 4-453; 5-473

therefore, it was proposed to prepare the filled compositions based on SREPT-PVC mixture at temperatures above 130°C. The choice of vulcanization temperature of forest compositions is also very important. During vulcanization at temperatures higher than 153°C, the release of hydrogen chloride is observed, the porosity of products made from these compositions increases, and their properties deteriorate. As a result of increasing the amount of PVC in the mixture from 5 to 30%

by mass, i.e. by 6 times, the amount of chlorine combined with the elastomer increases by 2 times. Therefore, it is suggested that the amount of PVC in SREPT- PVC mixtures should be 5-10% by mass.

3. Results and Discussion

The structural changes of PVC macromolecules during processing, the formation of the absorption area at 860 cm-1, and the strengthening of the area at 3030 cm-1 indicate the formation of a connection between PVC and SREPT. The physical and mechanical properties of SREPT/PVC mixtures were also studied and

the obtained results are given in Table 1

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Table 1 Physicphysico -mechanicalrties of SREPT/PVC blends

	SREPT section of the mixture, mass part.							
SREPT -40	100	95	95	95	90	90	90	70
PVC	-	5	5	5	10	10	10	30
MQF-9 modifier	-	-	0,5	-	-	1,0	-	-
Butyl phthalate	-	-	-	1,0	-	-	2	-
1	2	3	4	5	6	7	8	9
Breaking strength limit,MPa	20,0	20,6	20,4	20,2	19,9	19,4	19,3	15,1
Conditional stress at 100% elongation, MPa	3,1	3,6	3,4	3,5	3,7	3,3	3,2	-
Conditional stress at 300% elongation, MPa	12,9	13,6	13,2	13,5	14,0	13,4	13,3	-
Relative elongation,%	410	420	430	410	390	410	405	140
Relative residualdeformation,%	18.0	19,5	21,0	20,0	19,5	20,0	20,5	12,5
Tensile strength, kN/m	35,0	36,2	40,0	35,5	35,0	36,0	37,0	30,0
Elasticity, %	38,0	38,7	39,2	39,5	39,0	39,5	39,0	24,0
Conditional unit of hardness according toTM-2	66,0	66,0	64,0	65,0	66,5	65,7	65,0	78
Metal contact strength,MPa	1,10	1,48	1,55	1,50	1,65	1,60	1,58	2,3
nsile fatigue resistance(=200%)	1,35	1,570	2,980	2,520	1,250	2,020	1,920	-
=250 cycles/min	0,80	0,85	0,86	0,85	0,85	0,83	0,84	0,78
=20°C), thousand cycles	0,42	0,41	0,40	0,40	0,42	0,40	0,40	0,31
Resistance to burning,sec.	280	340	355	350	360	365	360	30

The onset temperature of decomposition of SREPT PVC (80:20) mixtures is -380°C, and that of SREPT alone is -360°C. The half-decomposition temperatures are -440°C and 425°C, respectively. The non-combustible residue of the SREPT-PVC (80:20) mixture at 500°C is (10-12)% by mass.

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Experiments show that as the amount of chlorine associated with SREPT increases, so does the amount of unburned residue. At this time, the thermal stability of the mixtures increases, and the rate of mass loss in these mixtures decreases (table 1).

The suggestion of PVC as the most suitable functional industrial polymer in polymer blends suggests that it is important to overcome several drawbacks of these blends.

As shown above, since PVC has a higher viscosity and molecular weight than rubbers, the vulcanizes of mixtures where it is used more than 5 mas . p. are hard, generate more heat, and have less flexibility than rubber vulcanizes.

Plastisol was obtained by pre-swelling polyvinyl chloride in a plasticizer - di- butyl phthalate (DBF) for 1-2 hours. 100 mas . p. PVC has been shown to dissolve in 20- 50 parts by mass of DBF.

Viscosity properties of the SREPT-PVC mixture with up to 40% PVC-plastisol inclusion were studied (Figures 1 and 2). It is shown that SREPT PVC mixtures are characterized by non-Newtonian flow at all ratios studied.

Research has shown that at 200°C, the structuring process begins in PVC. At 180°C, the structuring process does not occur and constant consumption rates are observed in the capillary-viscometer. The effective viscosity of alloys at different temperatures was studied depending on the amount of PVC in the mixture.

The dependence of the effective viscosity on the amount of PVC in themixture was studied.

It has been shown that because PVC is in the form of a separate dispersed phase in the SREPT -PVC mixture, these mixtures are observed to be in a state offlow viscosity even at 100-150°C.

However, PVC does not flow in this temperature range. In this regard, more homogeneous and technologically well-mixed SREPT -PVC mixtures can be preparedeven at 150°C.

4. Conclusion

The study of the physical and mechanical properties of vulcanizes of SREPT:PVX: DBF mixtures showed that their resistance to oil and gasoline is higher than the resistance of vulcanizes based on SREPT. The swelling of vulcanizes of the studied mixtures is 2.7 times lower in gasoline, 2.3 times lower in a gasoline-benzene mixture (3:1), and 3.2 times lower in "Avtol-10" oil.

One of the properties limiting the use of rubbers based on ethylene-propylene rubbers is related to their improved resistance to oil and gasoline.

Thus, it is shown that the improvement of the joint placement in the SREPT: PVC system also leads to the improvement of the basic properties of the mixture. The results obtained from the studies are shown in the flow curves with the dependence of

the speed of friction on the tension of friction. For comparison, the same characteristic indicators were obtained for PVC and SREPT at 100-150 °C.

Experience shows that when polyvinyl chloride plastisol is used, the viscosity of the SREPT- PVC mixture is reduced by one time compared to the viscosity of SREPT, and 2 times compared to the viscosity of PVC.

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