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METHODS FOR OBTAINING OZONE-RESISTANT RUBBER BASED ON POLYVINYL CHLORIDE BUTADIENE STYRENE RUBBER

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ABSTRACT

Rubber technical products are one of the main products with the widest range of uses today. In order to expand the scope of RTM use, it is necessary to increase its varieties. The most demanded rubber products are rubber products with high mechanical strength in contact with ozone. In this work, several polymer mixtures were used to obtain ozone-resistant rubber products. For this purpose, ethylene propylene terpolymer, polyvinyl chloride and butadiene-nitrile rubber were used. First, a binary system was created based on these polymers, their flow index was determined, and most importantly, their ratios to each other were determined. In order to prepare a composition based on these three polymers, an optimal recipe was selected using the mathematical modeling method, and a rubber mixture was prepared in laboratory cylinders based on this recipe. The mixing mode and the sequence of adding components were determined, and it was confirmed that the mixing process should be carried out at a temperature of 90 ° C and for 12 minutes. The vulcanization mode and time were also determined, and it was possible to obtain ozone-resistant rubber that could meet all operating conditions with a vulcanization temperature of 155 ° C and a period of 21 minutes. The main properties of the vulcanization are the strength limit in dispersion of 19. MPa (Standard 17.6), 71.1k/Hm (Standard 64.3) in ozone dispersion. Since the results were obtained using only the most modern analysis methods, it is possible to produce new rubber technical products based on the results obtained in this work in the production of ozone-resistant rubber products.

KEYWORDS: Polymer. SREP-60, PVC, SRN-40, composition, vulcanization, ozone-resistant rubber.

INTRODUCTION

Among a number of branches of the rubber industry, the production of rubber technical products occupies a leading place, so the assortment of PTM by 2024 was more than 200. Due to the wide range of products produced, this production is characterized by the use of various materials, processing techniques, equipment and production processes.[1-5]

As is known, rubber and other components, which are the main raw materials, are needed to obtain rubber. From these components and the matrix, various vulcanizes are obtained, which are the main components of the rubber industry. That is, rubber is an artificial material obtained as a result of special processing of a rubber mixture, the component of which is the base rubber. Rubber is obtained by vulcanization of rubber, that is, in the process of vulcanization of rubber at high temperatures, a process that occurs in the presence of sulfur in vulcanization equipment.[6-7] In the vulcanization process, sulfur connects the thread-like rubber molecules and a spatial structure is formed. Depending on the amount of sulfur, the authors have conducted research to obtain rubber products for various purposes.[8-11] Most authors have succeeded in obtaining rubbers with different mechanical properties and chemical resistance to aggressive environments by applying 5% sulfur, soft rubbers with 5% sulfur and more.[12-13] Many scientific works are devoted to the production of special purpose rubbers.[14-15] These authors have succeeded in obtaining products that are mainly heat-resistant and frost-resistant, able to operate at temperatures up to 240...360 °C, resistant to oil and gasoline at temperatures up to -69 °C, resistant to gasoline, other fuels, oils and petroleum products, resistant to ozone, and resistant to strong oxidizing agents when operating in atmospheric conditions for several years. Recently, rubbers used for insulation of wires and cables have been purchased.[15-16]

The aim of this work is to purchase rubbers that can fully meet the requirements of ozone-related operation. Ozone-resistant rubbers must mainly meet the following requirements;
. high resistance to ozone;
· gas and water resistance;
· chemical resistance;
· low density, etc.

METHODOLOGY

. Rubber mixtures were prepared in a laboratory oven at 90°C. Vulcanization of rubber mixtures was carried out at 155°C for 15 minutes.

The composition of rubber mixtures is given in Table 1, and the physical and mechanical properties of vulcanizes are given in Table 2.

Table 1: Composition of rubber compounds.

PVC	-	-	10	6	6	6
SREPT-60	-	-	20	11	11	11
Fuel oil	4	-	-	-	-	-
DUEK-4 (bis-dihydrocyclopentadienyl capromate)	-	5	5	5	5	5
Sulfur	3	-	2	2,5	2,5	2,5
Captax	0,5	0,5	0,5	0,5	0,5	0,5
Altax	0,5	0,5	1,5	1,5	1,5	1,5
ZnO	4	4	4	5	5	5
Neozone -D	2	2	2	2	2	2
Technical stearin	1	1	1	1	1	1
Rosin	2	2	2	1,8	1,8	1,8
Technical carbon						
P-803	20	20	20	15	1515	20
P-234	50	50	50	35	3535	50
Restriping (hexameylenetetrasorcinol) [2]resin from cherry tree which is called kome	- -	- -	- -	6 8	6 8	6 8

[2]Note; components are taken with 100 mass part of the SKN-40 M+ PVC mixture. Various adhesives (modifiers) are widely used to increase the bonding strength between rubber and cord.

2Rezotropin (hexamethylenetetramine) is a complex compound - a product of the interaction of resorcinol with urotropin. Thyrotropin was used in this work as a modifier and is a chemically active additive introduced to improve the quality of mixtures and vulcanite.

After preparing the rubber mixture, we vulcanized it in the optimal mode for the vulcanization process. The results of the vulcanite. are given in table 2

Table 2: Physical and mechanical properties of rubber mixtures and vulcanite.

No	The code of confusion	Name of indicators					
	Name of indicators	Known			Suggested		
	Number of samples	1	2	3	4	5	6
1	Tensile strength, MPa	16	15,9	16,9	19,5	19,9	17,4
2	Relative elongation, %	310	320	300	370	390	400
3	Relative residual deformation,%	11	12	13	9,1	10,1	11,4
4	Tear resistance, kN/m	66	65	67	67,4	70,1	68,9
5	Friction, cm^3/Wh	59	60	55	5,9	61	57,5
6	Bond strength to metal, Mpa: steel-3 brass	5,7	5,5	5,5	7,9	9,9	9,1

		-	-	3,9	5,1	6,9	6,1
7	Brittleness temperature, °C-	11	-	29	25	23	21
8	Strength on TM-2, conventional unit	81	82	75	83	84,6	82,8
9	Swelling rate at 25 °C for 24 hours, %: in isooctane-toluene mixture (70:30) in gasoline-benzene mixture (3:1)	12 -	14 -	11,5 22,3	9,1 11,9	11,2 12,9	11,9 15,1
10	Heat aging coefficients at 110 °C for 48 hours	0,88 0,64	0,89 0,62	1,0=33 0,88	0,7 0,83	0,84 0,86	0.85 0.90
11	Jumping elasticity, %	9	10	12	14,7	15	12.9
12	Ozone resistance at 25 °C for 48 hours (deformation 20%, ozone concentration 0.015%)	It's falling apart.	It's falling apart.	Does not fall apart	Does not fall apart	Does not fall apart	Does not fall apart

. Recently, the acquisition of ozone-resistant rubbers has become the most pressing problem in the rubber technical industry. Taking all this into account, before proposing the industrial use of the rubbers we have acquired, in order to determine their advantages over the currently used ozone-resistant rubbers, we prepared a standard rubber mixture used against ozone and compared the physical and mechanical properties of the vulcanite obtained with the rubber we proposed, and the results obtained are given in Table 3.

Table 3: Comparative results of the physical and mechanical properties of the vulcanite of the standard rubber and the proposed rubber to determine the ozone resistance of the proposed rubber.

	Name of indicators	Main indicators of ozone-resistant standard rubbers		Main indicators of the ozone-resistant rubbers we offer			
	Relative elongation, %						
3							
		12	14	12	12.0	12.2	12,5
4	Tear resistance, k/Nm	65	64	68	68.3	69,6	69,2
	Abrasion resistance 3/KW.4.						
5		59	60	56	60	59	58,5
6	Strength against metal, MPa: steel-3 copper Strength against metal, MPa: steel-3 copper	5,8 -	5,4 -	5,5 3,6	8,0 5,1	9,2 6,2	
							9.8
			-				6.9
7	Brittleness temperature, °C-	262	-	245	247	248	249
8	Hardness according to TM-2, conventional units	82	80	78	82	81.6	82.1
9	Swelling rate at 25 °C for 24 hours, %: in isooctane-toluene mixture (70:30) in gasoline-benzene mixture (3:1)	12	14,1	14,8	10,1	10,2	
		-	-	23,5	14,7	13,9	14.1
10	. Thermal expansion coefficients at 110°C for 48 hours. Thermal expansion coefficients at 110°C for 72 hours	0.85 0,64	0,88 0,62	1,04 0,88	0,93 0,83	0,91 0,86	
	Elasticity with bounce,%						
11		10	11	14	13.7	14.0	13,8

CONCLUSION

1. As a result of the study, we managed to modify polymer mixtures using resins obtained from cherry trees in rubber mixtures and thus we managed to obtain ozone-resistant rubbers.
2. The optimal formulation and vulcanization mode of the rubber mixture based on polymer mixtures were determined and the vulcanization process mode was determined to be 155 and time minutes.
3. As a result of comparing the standard ozone-resistant and other characteristics of the rubbers we offer, the high ozone resistance of the rubber we obtained from the standard was confirmed and therefore we recommend using these rubbers on an industrial scale.

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