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FILLING A POLYMER COMPOSITION BASED ON POLYVINYL CHLORIDE AND ETHYLENE-VINYL ACETATE COPOLYMER

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Abstract: *The mechanism of action of fillers of various activity on the properties of polymer-sole compositions based on polyvinyl chloride and an ethylene-vinyl acetate copolymer (PVC-S / SEVA) has been investigated.*

Key words: *suspension polyvinyl chloride, ethylene-vinyl acetate copolymer, chalk, kaolin, talc, black soot, wood flour.*

Recently, much attention has been paid to the creation of new thermoplastic polymer compositions, the study of their properties and finding control parameters for the targeted creation of compositions with the required set of necessary values of consumer and technological properties.

Due to the peculiarities of the morphological structure, polymer compositions based on suspension polyvinyl chloride and ethylene-vinyl acetate copolymer have high values of elasticity and elasticity, increased frost resistance, heat resistance, abrasion resistance and good frictional properties, which ultimately characterizes the versatility of the properties of this material. At the same time, polymer compositions do not require reinforcement with fillers, like rubbers, but are well combined with them, which can be used to improve certain properties and reduce the cost of finished products.

In this work, the influence of fillers of various activities on the values of the deformation-strength and rheological properties of polymer-solar compositions was investigated. As the latter, widely used products were used in the work: chalk, kaolin, talc, carbon black (black soot), wood flour. The content of fillers in the polymer composition varied within 5-20%.

The choice of these fillers is due to their low cost, non-toxicity, harmlessness and low coloring, which makes it easy to adjust the color of the sole materials.

It should be noted that there is a real possibility of targeted distribution of fillers and plasticizers in a two-phase polymer matrix of a thermoplastic polymer composition (TPC) and thereby regulating the values of the properties of the polymer composition. The fundamental difference from plasticizers in the behavior of fillers is that they cannot spontaneously diffuse from one phase to another, and the distribution of plasticizers between phases occurs in accordance with their thermodynamic affinity for the components of the polymer mixture [1].

Polymer compositions based on polymer mixtures were obtained by thermomechanical mixing under certain conditions in the mixing chamber of a plastic corder from Brabender (Germany) model PLV-651. Technical characteristics of the plastic corder:

Load volume	60-600 см3
Front rotor speed	18-150 rev/min
Mixing chamber temperature	20-300 0C

Based on their influence on the values of the physical and mechanical properties of polymer compositions, active (reinforcing) and inactive (non-reinforcing) fillers are distinguished. In accordance with the enhancing effect, black carbon is classified as active fillers, and other studied fillers are classified as inactive. The strengthening effect of the filler is determined by its nature, i.e. compatibility with the polymer matrix and dispersibility. The dispersion of the studied series of fillers is different, microns: black soot 0.02-0.04, wood flour 150-350, chalk 0.4-20, kaolin 0.5-10, talc 0.5-20 [2].

When adding chalk and kaolin from 5 to 20 parts by mass. per 100 parts by mass TPC tensile strength decreases monotonically. Elongation at break and residual elongation after break increases with chalk and kaolin content from 5 to 15 parts by weight. per 100 parts by mass TPK, and at a content of 20 parts by mass. chalk and kaolin per 100 parts by mass. TPC relative elongation begins to decrease monotonically due to loosening of the boundary layer of the polymer composition.

This is explained by the fact that, when compounding TPC, the filler, initially entering the continuous thermoplastic matrix of polyvinyl chloride, moves to the SEVA particles and is retained in the boundary layer. Due to the high viscosity of TPC, there is no enhancement effect with all studied types of fillers except grade carbon black (carbon black). The decrease in the strength of the compositions occurs in proportion to the decrease in the activity of the filler and the increase in the average particle size.

To assess the qualitative and quantitative indicators of the properties of thermoplastic polymer compositions, standard and original research methods were used using modern equipment and devices. Tensile strength, relative elongation and residual elongation at break were determined according to GOST 7926 on a RMI-250 testing machine. The hardness of the polymer composition was determined according to GOST 263 using the Shore A method on an IT-5078 device. Density was determined by the hydrostatic method according to GOST 267. The results obtained for the deformation-strength properties of the thermoplastic polymer composition depending on the type and content of fillers are given in Table 1.

The influence of the type and amount of filler on the deformation-strength properties of the polymer composition

Table 1

№	Filler type	Quantity filler	The name of indicators				
			Tensile strength at break (MPa)	Elongation at break (%)	Permanent elongation at break (%)	Density (g/cm3)	Shore A hardness (arbitrary units)
1	Soot	5	13.7	325	20	1.25	75
		10	13.3	275	23	1.26	80
		15	12.9	240	26	1.26	82
		20	12.6	230	30	1.28	84
2	Kaolin	5	11.8	275	22	1.25	70
		10	11.4	330	25	1.28	74
		15	10.8	355	27	1.30	78
		20	10.4	325	30	1.30	78
3	Chalk	5	11.2	262	19	1.29	68
		10	10.7	302	22	1.30	69
		15	10.6	325	25	1.37	70
		20	9.8	275	35	1.31	72
4	Talc	5	10.5	255	21	1.20	76
		10	9.5	262	25	1.21	76
		15	8.9	274	30	1.24	78
		20	8.4	278	34	1.24	80
5	Древесная мука	5	10.2	278	25	1.28	61
		10	8.3	262	22	1.24	66
		15	7.0	200	18	1.20	70
		20	4.9	155	12	1.16	74

A sharp decrease in the strength of the compositions with the addition of a small amount (up to 5%) of talc and wood flour is explained by the loosening of the boundary layer between the continuous thermoplastic matrix and dispersed SEVA particles. A further decrease in strength indicators with increasing filler concentration occurs monotonically.

Loosening of the boundary layer of the TPC, i.e. An increase in the elasticity of SEVA macromolecules can explain the increase in the values of relative elongation in the initial phases of filling; a further increase in the volume of the filler leads to a decrease in the deformation values of the filled compositions.

It is natural that when filling the viscosity of the polymer composition increases, this is explained by the fact that the nature of the increase in the melt viscosity of the compositions does not correlate with the size of the filler particles, but is apparently determined by the compatibility of the TPC-filler composition.

Thus, the conducted studies showed the possibility of regulating the strength and deformation indicators by filling the polymer matrix with various types of fillers.

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