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# Technology of thermoplastic polymeric composite materials for the bottom of shoes

**Abstract:** In order to create a shoe polymer composition for the manufacture of synthetic material plantar analysis of sources of raw materials and components as well as products of large chemical companies. Grounded technological aspects of polymeric compositions, and then receiving their synthetic materilov to the bottom of the shoe.

**Keywords:** polyolefin, elastomeric, thermoplastic, adhesion, extrusion, macromolecule, a plasticizer, deformation.

**Introduction.** In the book [1], developed on the measures for restructuring the national economy, says decoupling from its own production imported from other CIS republics and imports of raw materials, finished products, which can be produced within the country. In this regard, the development and selection of technologies of manufacturing the material composition of the plantar searched and analysis possible use of raw materials and components manufactured by the chemical industry.

**Object research.** In order to manufacture a synthetic sole composite investigated and substantiated technological aspects of polymeric compositions, and then receiving their synthetic materials to the bottom of the shoe. Comparatively evaluated the physical and chemical, mechanical properties and performance characteristics of the composite materials of synthetic sole for shoes. Investigated the technological aspects of the use of synthetic polymer composite materials for the bottom of shoes.

Getting shoe thermoplastic polymer compositions and research of physical and mechanical properties, due to the development of new formulations of synthetic materials for the bottom of shoes, the need to select individual components of the mixture and the properties of Incorporation compatibility, ensuring high technical and economic indices of production. Valuable physic-chemical, mechanical and performance properties of light porous composites have contributed their wide application for the bottom of shoes, operated in different periods of seasons.

**Analysis.** The range of polymers of ethylene can be significantly extended give copolymers with other monomers, and also by preparing compositions in compounding. For example, based on *PE* and other polyolefin's (*PE* type with a different type of *PE*, *PP*, rubbers, and the like) can be prepared by numerous modifications active graft copolymers with functional groups by which improved paint ability, adhesion, reduced flammability [3]. Cross linking *PE* is that the molecules in the chain are connected not only in series but also formed lateral links that connect the chain with each other, thereby strongly enough physical change to a lesser extent the chemical properties of the products. With increasing density increases stiffness, tensile strength, surface

hardness, softening start temperature (80÷120 °C).

Laboratory studies to identify the molecular characteristics, structure, technology, physical and chemical, mechanical properties of the polymer compositions of shoe made by synthesized copolymers using *LDPE* production Shorten Gas Chemical Complex [4]. Feature *HDPE* is a relatively low density, low tear resistance, high ductility, a good solubility, compatibility with vinyl acetate. The Shorten MCC produces three types of polyethylene, the density of which is governed by the content of butene-1. For polymeric compositions used polyethylene with a maximum content of 1-butene.

Compatibility polyolefin's typified by *LDPE* with other polymers, particularly with *AN*, *VA*, *SKN* and giving good thermoplastic plantar compositions, have formed the basis of its use in the composition of the polymer compositions for shoe manufacturing synthetic materials footwear bottom.

LDPE as the thermoplastic material can be used for the production of footwear bottom, also because, in presence of its structure unbanked polymer chains containing no double bonds, and in this circuit there is very little lateral methylene groups and a small number of oxygen atoms (ethylene oxide) [2]. Preparation of composite foamed and *LDPE* give opportunity to implement use of this material for the manufacture of footwear bottom. The properties of high-molecular compounds are determined not only by the chemical nature, but also the structural parameters of the molecular chains: their size, spatial arrangement of monomer units, the presence of branched structures, etc.

Track *PAN* and *PVA* also obtained by mixing the homogeneous polymer mixtures. Mixtures of polyolefin's are of great practical interest [4]. Mixtures of polymers prepared by mixing the various components, the methods of which depends on the nature of polymers and for their intended purpose. The melt polymer particle size of the dispersed phase is 0,5÷10 microns; solution polymerization process is used when the polymers are subjected to thermal degradation in terms of mixing or melt the polymer mixture are obtained for a given material (adhesives, sealants). In the polymer mixture, the solvent or solvent mixture must not delaminate prior to solvent removal. The thermodynamic stability of solvents, a higher concentration at which the mixture begins delaminating due to the mutual insolubility of polymers. The particle size depends on the rate of removal of the solvent, and ranges 0,1÷200 microns; Aqueous dispersions of polymers (latexes) — mixture coagulated. The particle size of the dispersed phase 0,02÷0,2 microns (depending on the nature of the surfactant in the latex); polymer with a monomer or oligomer, oligomer two monomers — the homogeneous mixture is subjected to polymerization. The initial single-phase system, but it is stratified when the resulting homogeneous polymerization determine the concentration of the polymer and its molecular weight. The particle size determined by the viscosity of the system at the beginning of delimitation and can reach 0.05÷0.5 microns. Thus obtained polymer mixture is often called interpenetrating polymer network. It may also occur by polymerizing together to form graft and block copolymers.

The injection unit sole thermoplastic polymer composition at a high temperature is injected into the mold. After filling the mold and cooling of the mass ready plantar synthetic material in the form of webs 125h140 size 9 mm in thickness ±10 mm, for footwear, is removed from the mold. The heating time molds ranges from 6 to 10 minutes. The polymeric composite based shoe thermoplastics heated to a temperature of 170±200 °C. Then the mixture was cooled to a temperature of 40±50 °C to achieve fixation size gives shape. Plantar synthetic material based on polymer composite *PVA+LDPE* differed good heat resistance, residual strength and flex resistance at break, high frost resistance, abrasion resistance. When casting the mixture was heated in a heating cylinder and passing through the nozzle, so it is in the form of a viscous mass having a temperature of about 100 °C. For porous bottom of shoes of the polymer composite powder injected disintegrates (*CHHZ-21*) to yield the sole material for footwear bottom with microcellular structure with pore sizes compactness and 0.75±0.85 g/cm$^{3.}$ These materials contribute to give plantar shoe lightness, strength, wear resistance, durability, impact resistance, corrosive environments, as well as heat and thermal stability.

The cycle of production of injection-polymer composite for the bottom of shoes consisted of three phases — of mixing, mastication and granulated. When mixing pellets of *LDPE*-swell able, *DOP* plasticizer destruction powder agglomerates and their uniform distribution in the surface layer of PVA. Mixing was carried out in small laboratory mixers and casting-extrusion plant. At a temperature of 105±110 °C *LDPE* started intensely saturated DOP plasticizer. The temperature was then raised to 125±150 °C, adding *PVA* knouts mixing, the remaining ingredients were injected. The entire cycle of mixing and injection molding lasted 20±30 min. kneading the mixture was carried out on a mill, where she acquired a homogeneous structure. The cooled mixture was injected blowing. The resulting composite was granulated, and the granules had a size diameter of about 4 mm. In the composite molding machine was fed in granular form. Moreover, the introduction of *LDPE* and 30% by weight of the polymer composite does not affect the strength properties of the composite shoe sole material.

Conclusions: The experiment used the following mixture of polymers having the component ratio: *LDPE* PVA (20:80, 30:70) to increase the strength, toughness, and improved technological parameters of finished products. It was established that in order to achieve high strain-strength properties and technological parameters of processing shoe composition based on synthesized samples thermoplastic polymer framework should have a narrow *MWD* and a maximum average molecular weight.

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