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# Theoretical foundations of obtaining lining composite materials

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**ABSTRACT.** With the whole variety of compositions, structures and methods for the production of artificial leather and polymer film materials, there are general fundamental physicochemical regularities underlying their technology, operation and organization of production processes. The article describes the physicochemical processes leading to the production of materials of a given structure and structure, the difference in polymers depending on the aggregate state, a complex of technological operations for obtaining non-woven lining materials for the manufacture of leather products.

**KEYWORDS.** Shoes, polymer, polystyrene, porous polymer, lining, membrane, vulcanization, process, destruction, plasticizer.

## I. INTRODUCTION.

Currently, one of the main ways to produce materials with specified properties is to create compositions based on known high molecular weight compounds and various ingredients of synthetic or natural origin, i.e. creation of composite materials.

Compositional materials are those derived from two or more components and consisting of two or more phases. These are heterogeneous systems [1]. Such materials include most of the polymer systems used in the industry. In the production of leather products, compositions based on mixtures of various polymers such as filled elastomers, artificial and synthetic leathers, etc., as well as interlining type membrane materials are used.

Compositions based on high molecular compounds can be divided into two groups:

- Mixtures of polymers of different chemical nature; they are sometimes conditionally referred to as block and graft copolymers;

- Filled polymers - compositions of polymers with solid, liquid or gaseous substances - fillers, which are evenly distributed in the volume of the resulting system and have a clearly defined interface between the filler and the continuous polymer phase (matrix). Filled polymers are a particular case of disperse systems, where the dispersed medium is a polymer, and the dispersed phase is a filler [2].

Depending on the aggregate state of the fillers are distinguished:

-polymers with a solid (discrete) filler, which can be particles of a spatially symmetrical (spherical or planar) or sharply anisodiametric (fibrous) form, as well as solid structures formed by woven or non-woven mats (canvases); polymeric materials with fibrous filler are usually called reinforced;

- polymers with liquid filler - an example of them can serve casting systems, obtained by mechanical emulsification of water in a polyester resin; when these formulations are cured, the dispersion medium is transformed into a rigid matrix in which the structure of the original emulsion;

- polymers with gaseous filler (foams and porous polymeric materials), which are obtained with the help of various technological methods.

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The main factor representing the technological and operational properties of the composite mixture is the compatibility of polymers [1].

In the preparation of such compositions, two options are possible: either multilayer structures consisting of layers for various purposes and, respectively, of different structures are created, or single-layer materials, usually heterogeneous, consisting of various components and having a complex internal structure.

For the artificial leather industry and composite film materials, the main types of films are those (flat webs up to 0.5 mm thick) and multi-layer film-type compositions in which woven, knitted, nonwoven materials, paper, fiber compositions of various composition and m.

With all the variety of compositions, structures and methods for producing artificial leather and polymer film materials, there are general fundamental physicochemical regularities underlying their technology, operation and organization of production processes [3].

So, in all cases the actual process of obtaining the material is preceded by:

- Definition of a set of properties that this material must possess;

- Development (design) of the optimal rational design of the material;

- Selection of the optimal method for obtaining the material, the optimal technological regime and equipment ensuring the production of the material with the required parameters at the lowest cost;

- Development of a recipe for the composition most suitable for obtaining this material on the equipment used and subsequent operating conditions;

- Optimization of production modes of material carried out by mathematical methods of experiment planning, the results of which are higher the more clearly the criterion of optimality.

Actually, the process of obtaining artificial leather and gasket materials consists of a complex of technological operations;

- Preparation of initial ingredients, their pre-treatment and preparation for molding;

- molding the product in order to give it a predetermined shape;

- Heat treatment, orientation, vulcanization of rubbers in order to fix the shape and give the material the required internal structure to improve the complex of its physical and mechanical properties:

- finishing operations, the purpose of which is to improve the presentation of materials and products.

The choice of the method of obtaining each specific material and product (and they can be very different) and the technological regimes of the process are determined by a large number of factors, the most important of which are the structural features of the material, the properties and technological capabilities of the selected material, the operating conditions of the material and products and the requirements arising from them to their properties, the expected volume of their release, as well as the cost of equipment and rigging, their productivity and service life, labor costs and skills and so on. [4].

The study and scientific substantiation of various physicochemical processes that lead to the production of materials of a given structure and structure, and therefore, having a certain set of properties, constitute a common basis for the production technology of composite materials of various types and purposes [5].

The physicochemical processes leading to the production of materials of a given structure and structure are [6]:

- Transfer of polymers into various phase and relaxation states:

a) The viscous flow of the melt or solution required to form the article;

b) In a highly elastic or crystalline state to impart the desired set of technological and operational properties to the product;

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- the creation of mixtures and compositions of substances as a polymer, in particular using heterogeneous polymers (products from mixtures of polymers) and polymeric and low molecular weight nature, polymers and various fillers, plasticizers, modifying additives, stabilizers of various types, pigments and dyes, P.;

- deformation of polymers in various physical states - the flow of solutions and melts, the plasticization of rubber compounds associated with the occurrence of mechano-chemical and thermal destruction of macromolecules, the orientation of solid polymers, and the like.;

- Diffusion, sorption and adhesion phenomena, underlying the operations of gluing, impregnation of various matrices with liquid ingredients and determining the important performance characteristics of materials (permeability, complex of hygienic properties);

- The formation of a certain micro- and macrostructure of the material, including the porous structure of the most diverse structure;

- Physical and chemical processes that ensure the stability of the product during subsequent operation (vulcanization of the elastomers entering into its composition, rendering the materials resistant to thermooxidative destruction and other external influences).

The consideration of all these questions is the content of the theoretical foundations for the preparation of composite lining materials for the manufacture of leather products.

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