TECHNOLOGY FOR CREATING POLYMER BLENDS WITH THE PROPERTIES OF THERMOPLASTIC ELASTOMERS

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Annotation: In this article, the composition of polymer compositions with the properties of thermoplastic elastomers has been studied. Polymer compositions, which are multicomponent systems, consisting of both polymer and non-polymer components, have also been studied.

Keywords: mixtures of polymers, thermodynamically incompatible, heterogeneity of the system, thermodynamic equilibrium state, operational stability, two-phase mixture, single-phase systems, mutually soluble polymers, development of polymeric materials.

ТЕХНОЛОГИЯ СОЗДАНИЯ ПОЛИМЕРНЫХ СМЕСЕЙ СО СВОЙСТВАМИ ТЕРМОЭЛАСТОПЛАСТОВ

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Аннотация: В этой статье изучены состав полимерных композиций со свойствами термоэластопластов. Также изучены полимерные композиции представляющие собой многокомпонентных систем, состоящие как из полимерных, так и неполимерных компонентов.

Ключевые слова: смеси полимеров, термодинамический несовместимы, неоднородности системы, термодинамический равновесный состояния,

эксплуатационная устойчивость, двухфазный смесь, однофазной системы, взаиморастворимые полимеры, разработке полимерных материалов.

Polymer compositions with desired properties can be obtained not only by synthesizing new ones, but also by combining mixtures of different polymers.

The state of polymer mixtures is usually characterized by the concept of "compatibility". The compatibility of polymers is understood as their ability to form under specific conditions (temperature, pressure, concentration) a thermodynamically stable system consisting of molecularly dispersed components [1].

In most cases, polymer mixtures that form the basis of polymer compositions turn out to be thermodynamically incompatible. However, often the optimal performance properties of the material (for example, strength) are achieved not with mixing to a molecular state, but with some inhomogeneity of the system.

If the system is thermodynamically unstable, then it eventually tends to a thermodynamic equilibrium state, i.e., it changes with time. This change can be accelerated by external influences during operation - an increase in temperature, cyclic deformations, etc. However, in most cases, the change in the complex of system properties proceeds so slowly that the material exhausts its operating time for other reasons. A convenient characteristic of assessing the stability of a mixture of various components is the concept of "operational stability". By this is meant the time during which the change in the parameters of the properties of the system due to its transition from a thermodynamically unstable to an equilibrium state does not go beyond the values allowed by the operating conditions.

In relatively rare cases, polymers can be mixed with each other indefinitely, that is, in any ratio. Of the widely used composite materials, thermodynamically compatible pairs of polymers make up approximately only 2% [2, 3].

Usually, the mechanical properties of two-phase mixtures are higher than those of single-phase ones. However, obtaining a single-phase system in some cases is a necessary condition for the processing of polymer compositions, for example, for the production of products with desired optical characteristics, which are achieved only when using single-phase polymer mixtures. Therefore, an important task at present is to obtain mixtures of mutually soluble polymers, to determine the boundaries of their mutual solubility and the relationship of these limits with the chemical nature of the components.

Obviously, the basis of the polymer composition is the base polymer or a mixture of polymers. The correct choice of the polymeric component (or components) determines all the properties of the composed composition. So, to create a frost-resistant sole material intended for use in the range from -30 to -35 ° C, it does not make sense to use polyvinyl chloride as a polymer base, since no combination of ingredients will make it possible to obtain an economically viable material that meets the specified operating conditions.

Modern technical capabilities make it possible to mix thermodynamically incompatible polymers and other additives almost to the level of molecular mixing. However, such systems tend to delaminate over time. At the same time, during the operation of thermodynamically compatible but poorly mixed polymers and additives, their further mutual diffusion and further mixing take place. The characteristic that determines the suitability of a polymer mixture for given operating conditions is not the thermodynamic compatibility of the components, but the dynamics of changes in the performance characteristics of the material during the transition of the system to an equilibrium state. From this point of view, the division of the system into thermodynamically compatible and incompatible ones is of little practical importance. In this case, it is important to evaluate the operational stability of the system, the concept of which was given above.

When choosing the composition of the polymer composition, the criteria for its optimization are determined. In most cases, such criteria are strength characteristics, as well as the operating time of the developed material, during which its characteristics remain within acceptable values, and other indicators. In this case, it is often necessary to take into account the operational stability not by one, but by several indicators of operational properties [4–6].

The main task in the development of polymer compositions is the choice of the main polymer or mixture of polymers. This choice is determined by the requirements for the operating conditions of products, the methods of processing compositions and the economic feasibility of their molding methods.

When designing products and developing polymeric materials for their manufacture, it is necessary to know what loads they will experience and under what conditions they will be used. It should be taken into account that an increase in temperature worsens the strength properties of polymeric materials. Some polymers are capable of absorbing moisture during operation, which changes their mechanical properties and product dimensions. A number of polymeric materials are adversely affected by various oils, acids and other substances. Under dynamic loads, the dependence of the strength of the material on the rate of its loading, the presence and size of the notch, etc., is essential [7, 8].

The reference literature contains the characteristics of polymers, non-polymer components of compositions and general recommendations for the development of composite materials and the manufacture of products for various purposes. It should be added to this that when choosing a polymer base for compositions, it is necessary to take into account not only the physical and mechanical properties of the polymer, but also its ability to combine with non-polymer components to form a mixture with the desired properties.

Thus, polymer compositions are multicomponent systems consisting of both polymer and non-polymer components. Each of the components plays a certain role in the formation of a set of material properties necessary to meet the requirements for products under operating conditions. Therefore, the development of the composition of the polymer composition begins with an analysis of the indicators of material properties necessary for the successful operation of the product. The set of indicators obtained as a result of such an analysis is most conveniently presented as a ***generalized optimization parameter***. The use of a generalized optimization parameter enables the developer of a polymer composition to obtain a single quantitative characteristic that determines the behavior of the material in terms of several performance indicators [9–12].

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