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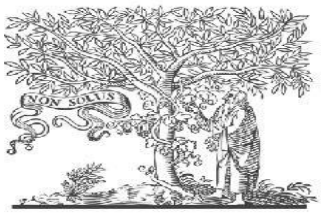

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Title: **INFLUENCE OF ULTRASONIC VIBRATIONS ON RHEOLOGICAL PROPERTIES OF POLYOLEFIN COMPOSITIONS**

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INFLUENCE OF ULTRASONIC VIBRATIONS ON RHEOLOGICAL PROPERTIES OF POLYOLEFIN COMPOSITIONS

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Abstract: Such systems are prone to delamination due to poor adhesion, which leads to a deterioration in the performance of the mixture as a whole. Therefore, it is more expedient to consider the issue of compatibility from the point of view of the concept of "technological compatibility" of polymers, which is characterized by the creation of a polymer mixture with a certain set of properties that meets all the necessary requirements in the process of further processing and operation.
Keywords: delamination, technological compatibility, process, weight, viscosity, size.

Introduction

Currently, polymer composite materials are actively investigated and widely used, in the formation of the properties of which their thermodynamic compatibility plays an important role. In turn, the compatibility of polymers is determined by the presence of the following factors: the close polarity and structure of the components of the system, the presence of functional groups capable of interacting with each other, forming donor-acceptor bonds. But even the fulfillment of these conditions is not always enough. This is especially true for non-polar polymers such as polyolefins: HDPE and LDPE are poorly combined, and PE and PP do not mix at the molecular level.

In most cases, polymers, when processed together, cannot form a single-phase system due to their thermodynamic incompatibility. Such systems are prone to delamination due to poor adhesion, which leads to a deterioration in the performance of the mixture as a whole. Therefore, it is more expedient to consider the issue of compatibility from the point of view of the concept of "technological compatibility" of polymers, which is characterized by the creation of a polymer mixture with a certain set of properties that meets all the necessary requirements in the process of further processing and operation.

An important role in the creation of a composite based on several polymers is played by the type of the resulting phase structure. The process of formation of a particular structure is multifactorial and depends on the following parameters: the ratio of the components in the mixture, the nature of the polymers, molecular weight, viscosity, size and shape of particles in the dispersed phase, interactions of particles in the interphase layer, processing conditions, etc. [1-4]. A change in any of these parameters can lead to the formation of a different type of structure, which in turn will affect the properties of the system as a whole. This fact complicates the use of polymer mixtures in processing industries. To solve this problem, it is necessary to derive the dependences of changes in the properties of the "polymer-polymer" system on the type of structure. The most important technological parameter in polymer processing is viscosity. To establish the dependence of the change in the phase structure of a polymer system, it is necessary to simulate the processing process using polymers with different viscosities.

The processing temperature of the mixture corresponds to the processing temperature of the polymer with a higher T_m, i.e. PP. This temperature regime is not typical for PE. Figures 1-2 show the dependence of PE viscosity on temperature.

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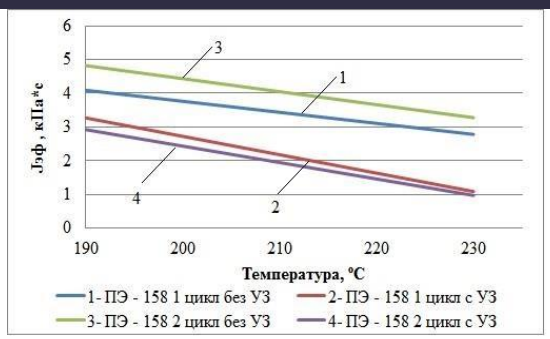
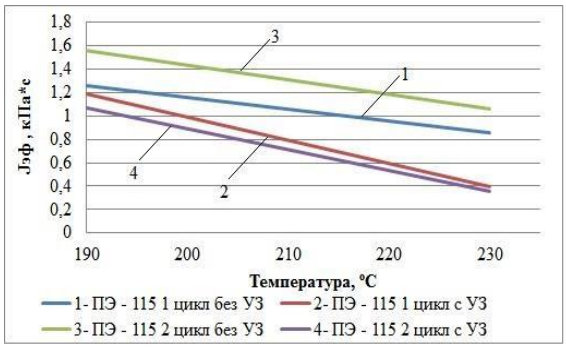


Picture 1 - Dependence of the effective viscosity of PE - 158 on temperature



Picture 2 - Dependence of the effective viscosity of PE - 115 on temperature

With an increase in temperature, the viscosity of PE decreases, and, for the samples obtained using ultrasonic exposure, a more intense decrease in this indicator is observed. It is also worth noting that for samples without ultrasound, the viscosity values in the second processing cycle are higher than in the first. This correlates with the results of studying the rheological properties of individual polymers at T = 190 ° C (Figure 3).

Figures 3-4 and 5-6 show the dependences of the viscosity of the mixtures on the processing rate and on the ratio of the components in the mixture, respectively.

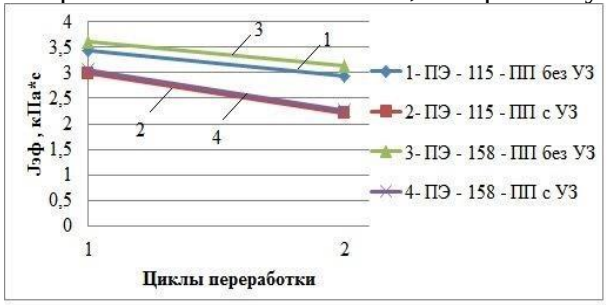


Figure 3– Dependence of the effective melt viscosity of the PP-PE mixture on the processing cycles of the composition. Composition of the composition: PP: PE – 70%:30%

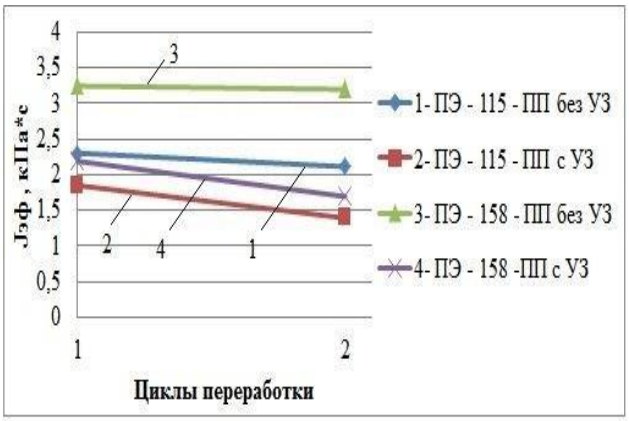


Figure 4– Dependence of the effective melt viscosity of the PP-PE mixture on the processing cycles of the composition. Composition of the composition: PP: PE – 30%:70%

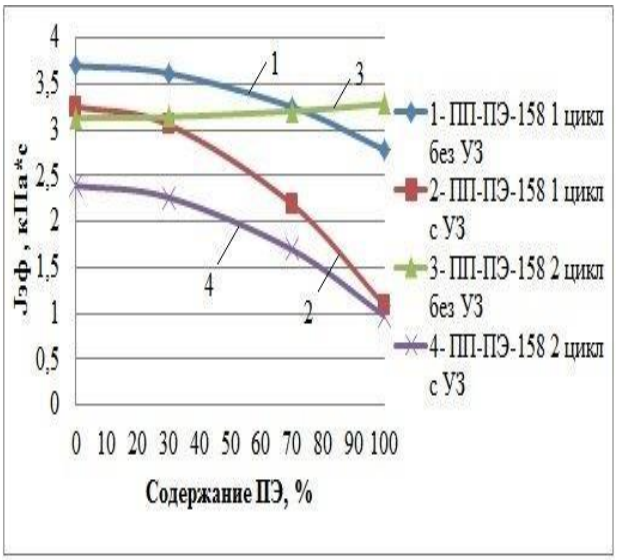


Figure 5 - Dependence of the effective melt viscosity on the content of PE - 158 in the polyolefin composition

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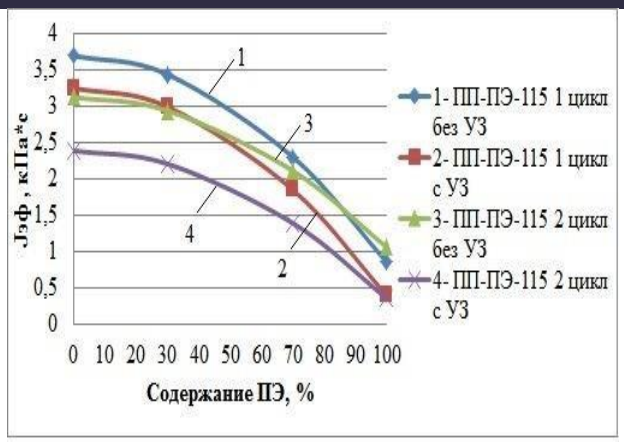

Figure 6 - Dependence of the effective melt viscosity on the content of PE - 115 in the polyolefin composition

With the reprocessing of the compositions, there is a clear tendency to a decrease in the viscosity index, which, like for individual polymers, decreases more intensively under ultrasonic exposure. It is also worth noting that blends with 70% PP are more susceptible to the influence of the processing rate, due to a more intense decrease in PP viscosity.

When studying the obtained curves "viscosity-composition", the following regularity can be deduced: as the amount of PE in the composition increases, the viscosity of the polymer system decreases, and ultrasonic action enhances this process. An exception is the composition without ultrasound of the second processing cycle with a content of 70% PE-158, the viscosity of which corresponded to higher values than for PP. Thus, ultrasonic action leads to a decrease in the viscosity of polyolefin mixtures.

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