THE TECHNOLOGICAL PROCESS OF PRODUCTION OF NANOCOMPOSITES

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Polymer nanocomposites are one of the most promising types of structural materials currently. The main difference between these materials from the macro and micro are in great specific surface area filler-matrix and small average distance between the particles of the filler. The improvement of physical and mechanical properties such as tensile strength, puncture impact, modulus, elongation are observed in such nanocomposites. But it is important not only get certain properties of nanomaterials and also reduce the cost of the final product for large-scale production. Unfortunately, at this stage innovation in polymer nanocomposites is price is quite high. This is primarily due to an innovative component of these products, the complexity of the stages of production. Therefore, the last decade of very active is the development direction of applied nanotechnology, namely the development and improvement of technologies for a variety of nanocomposite materials for consumer goods. Physical and mechanical properties of structural materials depend on each stage of the process. Getting a high physical and chemical characteristics uniformity depends on the uniform components distribution in the bulk polymer. Therefore, the mixing step is one of the most important in the processing of polymers.

A new promising direction for the implementation of this process is using of combined or screw-disc extruders that combine the advantages of both screw and disc machines, providing: high plasticizing and homogenizing power; high degree of mixing; high productivity; possibility of the complex profile products obtaining. Combined extruders provide intensive melt degassing and allow a high degree of mixing and homogenization of the molten polymer.

Model highly filled compositions based on low molecular weight rubber SKN-10Ktr and SKDM-80 were studied. NaCl formulation with following granulometric fractions was used as an excipient. Sunflower oil fatty acids, stearic and oleic acids were selected as surfactants. Worm-disc (combined) extruder was used. Its faced disc surface and body are inclined to the rotation axis normal and there is working gap between them. The minimum operating gap value is defined by the axis of rotation, constant for selected disc radius and depends on the angle values of end surfaces inclination to the axis rotation normal.

Due to this structure, there is a shift of the relative movement of the melt particles from one to another strain plane. It is caused by the tension-compression strains, which are determined by changes in the working gap in one disc revolution at a constant minimum operating gap. Screw and disc rotation (R = 0,055 m) was carried out using DC motor with adjustable speed in the range of ω = 50–200 rev/min. Test unit was equipped by the thermostatic cylinder system, screw, forming head with thermocouple and controlling devices for the coolant (water) temperature monitoring. Thermocouples were installed to the material cylinder for mixture temperature measuring.

Consequently, the quality of mixing disk extruder determined absolute value of deformation is not true. High quality mixing in these machines driven by circulation flows arising in the working gap, making the profile octahedral deformation shifts repeatedly changes its direction, causing an increase in the interface and change its orientation.

As a result of the research programs have been established, which can be used for determination the quality of polymer composition mixing. The experimental results support provided theoretical calculations (result convergence is near 96 %).