УДК 678.046-021.29:544.76
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INCOMPATIBILITY OF DISPERSED FILLERS OF DIFFERENT STRUCTURES WITH A NON-POLAR POLYMER MATRIX

Plastics have many positive qualities, which puts them in one of the leading positions among modern structural materials. However, polymer materials also have a number of significant disadvantages, such as fragility, aging, low thermal conductivity, sensitivity to ultraviolet radiation, insufficient surface rigidity and hardness, creep, flammability, and a tendency to accumulate static electricity. To improve certain characteristics, fillers, enhancers, stabilizers, antioxidants, and other additives are added to polymers. The introduction of certain fillers not only improves the properties of the final product, but also reduces the cost of raw materials and production processes, which leads to increased economic efficiency. In addition, the use of environmentally friendly fillers obtained from natural resources helps to reduce the negative impact on the environment.

Recently, there has been an increased interest in dispersed fillers for polymer materials. Dispersed fillers such as kaolin, titanium oxide, and various silicate minerals have an effect on the mechanical strength, adhesion, heat resistance, and UV resistance of polymers. These properties are especially relevant in the context of modern requirements for environmental friendliness, durability and functionality of materials.

Titanium oxide (TiO2) is one of the most common and studied inorganic fillers. Titanium oxide exists in several crystalline forms, including anatase, rutile, and brodmanite. The most common form used as a filler is rutile due to its high thermal stability, mechanical strength and low solubility. Its crystal structure is characterized by high refractive coefficients and good barrier properties, which makes rutile the preferred choice for UV-resistant polymer systems.

Despite the many positive properties, the use of titanium oxide in nonpolar polymers faces difficulties related to incompatibility. The main problems include: poor dispersion (the polarity of titanium oxide makes it difficult for it to be evenly distributed in a nonpolar matrix, which can lead to the formation of agglomerates and a decrease in mechanical characteristics) and interfacial interactions. To solve the compatibility issues of TiO2 with nonpolar polymers, for example, titanium oxide treatment using organic compounds or polymer coatings is used, which improves adhesion between the components. Also, the

introduction of film-forming agents or special compounds can help optimize the interaction between TiO2 and polymer, improving the mechanical properties and thermal stability of the composite.

In the study nanoparticles TiO2 were superficially modified with vinyltrimethoxysilane (VTMS). The formation of covalent bonds between the surface hydroxyl groups of TiO2 and hydrolyzed VTMS can be observed using IR-Fourier spectroscopy. The best dispersion of TiO2 in the polymer matrix was proved by the values of tensile strength (12,7 MPa compared to 12,3 MPa for modified TiO2 and unmodified TiO2) [1].

The interfacial adhesion between kaolin and polyethylene can be improved by chemical modification of the matrix or filler surface [4]. Stearic acid and polyethylene grafted with maleic anhydride were used as potential interfacial agents, and the effectiveness of kaolin treated with aminosilane was also considered. The improved interfacial adhesion of the filler and polymer gradually leads to a decrease in the melt index. This was clearly shown by comparing the effect of two polymer additives to the polymer matrix. Compared with low molecular weight additives such as stearic acid and aminosilane, grafted maleic anhydride has proven to be a very effective additive for improving the impact resistance of composites.

During the review, it can be concluded that in order to eliminate or reduce the incompatibility of the dispersed filler with the nonpolar polymer matrix, various filler modification methods and the use of plasticizing additives are used, which improve the compatibility between the filler and the polymer, providing a more uniform distribution and improved properties of the composite material. In the future, we plan to obtain nanocomposites with different contents of these fillers and study their physico-mechanical properties.

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