CRYSTALLIZATION MECHANISM OF POLYPROPYLENE RANDOM COPOLYMER / MALEIC ANHYDRIDE FUNCTIONALIZED HOMOPOLYPROPYLENE / ALUMINUM HYDROXIDE BASED NANOCOMPOSITES

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Filler particles can increase or decrease the rate of crystallization of a semicrystalline polymer, affect the growth of crystals of polymer matrices, and the effect of nucleation in the melt. From a practical point of view, the study of the kinetic regularities of the crystallization process of polymer composite materials is important when selecting the cooling mode for composites. A number of works have proven the applicability of Avrami's theory to the study of the crystallization process in polymeric materials in the region of the first-order phase transition [1–3]. The presented work provides information on the crystallization mechanism of polymer composite materials based on polypropylene random copolymer / maleic anhydride functionalized homopolypropylene / aluminum hydroxide (PP-R/PPH-*g*-MAH/$Al(OH)_3$), which was studied using the dilatometric method. Dilatometric studies were conducted in an apparatus based on the IIRT-1 device by gradually cooling the composites from 180 °C to room temperature. According to the data received, it was established that the filler content has a significant effect on the mechanism of formation of the crystalline structure of nanocomposites. For example, if the value of *n* for the PP-R/2 wt. % PPH-*g*-MAH and the sample with 1.0 wt. % $Al(OH)_3$ content is 3.1, this fact indicates that during the crystallization process, “three-dimensional spherulitic” structures are formed with the continuous formation of nucleation centers. With the introduction of 5 wt. %, 10 wt. % and 20 wt. % $Al(OH)_3$, the *n* value changes within 2–3, which corresponds to the formation of “two-dimensional disc-shaped” structures. With an $Al(OH)_3$ content of 30–50 wt. %, the value of *n* changes within the range of 1–2, which confirms the formation of the simplest “one-dimensional rod-shaped” structures with the continuous formation of heterogeneous and homogeneous nucleation centers. Thus, based on the above, it can be said that the study of the kinetic regularities of the crystallization process in Avrami coordinates made it possible to identify differences in the mechanism of formation of the crystalline structure of composite materials that differ in the concentration of aluminum hydroxide.

References

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