P-18

Evidence of the β-nucleating activity of montmorillonite during the formation of PP/MMT composite fibers

Cz. Ślusarczyk[1]*, J. Fabia[1]

[1]*Institute of Textile Engineering and Polymer Materials, University of Bielsko-Biala, Willowa 2, 43-309 Bielsko-Biala, Poland*

Keywords: WAXS, montmorillonite, polypropylene fibers

*e-mail: cslusarczyk@ath.bielsko.pl

Isotactic polypropylene (PP) is of polymorphic composition, having at least four modifications: α, β, γ, and smectic. The chain conformation of each modifications is the classical 3_1 helix. The difference in the crystallography is the manner in which the chains are packed in the unit cell. Among all the crystal forms of iPP, the β one has many performance characteristics, such as improved elongation at break and impact strength, so much attention has been paid to investigate the β phase of iPP during the past few decades. The β form is thermodynamically metastable and difficult to obtain under normal processing conditions. It can only be obtained through special crystallization procedures, such as in temperature gradient, shear-induced crystallization, or adding nucleating agents.

The structure of fibers formed during spinning is the result of the processes of orientation and crystallization occurring by solidifying the polymer stream. During the formation of a fiber, the process of crystallization occurs under non-isothermal conditions and different types of flow fields (shear, extension, mixed). It is known that these flow conditions strongly influence the process of crystallization and the resulting crystalline morphology. The addition of nanoclay particles into sheared polymer melts complicate the crystallization process and the morphology that subsequently forms.

In this study, we have observed for the first time, in our opinion, the appearance of the metastable β phase during the formation of nanocomposite fibers of isotactic polypropylene (PP) and an organically modified montmorillonite (MMT), Cloisite 15A (Fig. 1). Fibers were formed from the melt and spun at different take-up velocities.

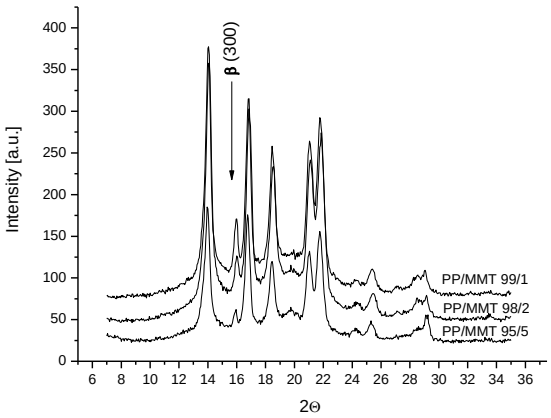

Figure 1. WAXS patterns of composite fibers prepared with different amounts of Cloisite 15A.

We have observed the β-form of iPP only in nanocomposite fibers spun at the lowest take up velocity. The β-form crystals are sensitive to the level of shear, so for fibers spun at higher take-up velocity this polymorphic form disappears.

The purpose of this paper is to present some detailed experimental results about the effect of the nucleating activity of MMT on the crystallization behavior of PP.