

Morphology, thermal properties and crystallization kinetics of ternary blends of the polylactide and starch biopolymers and nanoclay: The role of nanoclay hydrophobicity

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Abstract

Poly(lactide)/butylated-starch/nanoclay (70/25.5/4.5 wt%) composites were prepared by melt blending with nanoclays of varying hydrophobicity. Electron microscopy studies indicated that the interphase boundary interaction was highest in the clay with intermediate hydrophobicity but decreased with clays of higher or lower hydrophobicity. Conventional and modulated differential scanning calorimetry studies showed that, in the case of composites, the change in the ratio of rigid and mobile amorphous fractions depends on the hydrophobicity of clays used for the preparation of blend composites. The mobile amorphous fraction related to the poly(lactide) phase decreases in the case of intermediate hydrophobic clay compared with less and more hydrophobic clays or neat blend samples. Avrami bulk crystallization analysis and polarized optical microscopic observation demonstrated that hydrophobic clays hindered the crystallization of the PLA phase into the formation of disc-shaped spherulites. On the basis of obtained results, we propose a general understanding on how the morphology and thermal properties of the blend composites are related to the hydrophobicity of the nanoclays.