Macromolecular Materials and Engineering, vol. 303: https://onlinelibrary.wiley.com/doi/full/10.1002/mame.201800134

Influence of nanoclay localization on structure–property relationships of polylactide-based biodegradable blend nanocomposites

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ABSTRACT:

This article highlights the recent research achievements regarding the development of nanoclay-containing biodegradable composites of polylactide (PLA)-based immiscible blends. The structure–property relationships of particular blends, namely, PLA/poly(e-caprolactone), PLA/poly(butylene succinate), and PLA/poly[(butylene succinate)-adipate], are studied with respect to the nanoclay incorporations. For different nanoclay types and concentrations, the morphologies of these nanocomposites are probed and correlated to their viscoelastic, mechanical, and thermal properties, along with their crystallization behavior and kinetics and gas permeability. The nanoclay dispersion and distribution characteristics are found to be key parameters influencing the final properties. In particular, nanocomposites with a higher degree of nanoclay dispersion exhibit significant enhancement in their mechanical, thermal, and barrier properties, and some agglomerations are effective as regards favorable crystallization behavior. In terms of the clay localization, the positioning of nanoclays at the interface reduces the minor phase size remarkably, because of the droplet encapsulation that counteracts coalescence. However, for improved understanding of the influence of nanoclay localization on the structure–property relationships of these blends, further systematic study is required. That is, nanocomposites with different localizations but the same nanoclay loads should be compared. This can be achieved by tuning the processing protocols and the nanoclay inclusion orders in the blends.