COMPATIBILIZED POLYLACTIDE/POLYAMIDE 11 (PLA/PA11) BLENDS CONTAINING MULTIWALL CARBON NANOTUBES: MORPHOLOGY, RHEOLOGY, ELECTRICAL AND MECHANICAL PROPERTIES

Zeinab Mousavi, Marie-Claude Heuzey, Pierre J. Carreau

Centre for High performance Polymer and Composite Systems (CREPEC), Chemical Engineering Department, Polytechnique Montreal, Montreal, Quebec H3T 1J4, Canada

ABSTRACT

The effect of adding multiwall carbon nanotubes (CNTs) on the morphology and properties of reactively compatibilized polylactide/polyamide 11 (PLA/PA11) blends with a 75/25 wt% composition was evaluated. PLA/PA11 blends were compatibilized using an epoxy-based chain extender, Joncryl® ADR 4468. Blends and blend nanocomposites were prepared using an internal mixer. The effects of chain extender concentration, mixing strategy, PLA molecular weight and CNT concentration on the morphology was evaluated in light of rheological characterization as well as electrical and mechanical characterization. Changes in the blend morphology upon adding CNTs (pre-mixing with PLA) was observed in which the dispersed phase changed to connected non-spherical, non-coalescing (or partially coalescing) PA11 domains bridged by CNTs at the interface. A network-like structure was formed in the blend nanocomposites containing 2-3 wt.% of nanoparticles characterized by a transition from liquid- to solid-like behavior. The blend nanocomposites based on the lower molecular weight PLA exhibited more significant enhancements of the rheological properties relative to the neat blend. Despite the observed transition in the rheological behavior, the electrical conductivity remained in the insulating range, showing a 6 decade increase compared to the neat blend, largely due to inadequate interconnectivity of PA11-CNT domains. Also the blend nanocomposites based on the lower molecular weight PLA displayed larger relative increase of the Young modulus, compared to the neat blend, indicative of a better CNT dispersion and formation of a more interconnected PA11-CNT network. The blend nanocomposites based on the higher molecular weight PLA retained 80% of the elongation at break of the neat blend up to 2 wt.% CNTs while the blends based on the lower molecular weight PLA retained only 25% of the elongation at break.