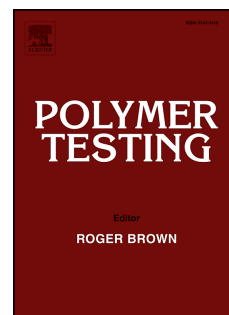


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Morphology and thermal degradation studies of melt-mixed poly(lactic acid) (PLA)/poly(ϵ -caprolactone) (PCL) biodegradable polymer blend nanocomposites with TiO₂ as filler

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Material Behaviour

Morphology and thermal degradation studies of melt-mixed poly(lactic acid) (PLA)/poly(ϵ -caprolactone) (PCL) biodegradable polymer blend nanocomposites with TiO₂ as fillerJ. P. Mofokeng¹, A. S. Luyt^{1,2*}

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Abstract

The morphology and thermal stability of melt-mixed poly(lactic acid) (PLA)/poly(ϵ -caprolactone) (PCL) blend nanocomposites with small amounts of TiO₂ nanoparticles were investigated. The nanoparticles were mostly located in the PLA phase, with good dispersion of individual particles, although significant aggregation was also visible. The thermal stability and degradation behaviour of the different samples were studied using thermogravimetric analysis (TGA) and TGA-Fourier-transform infrared (FTIR) spectroscopy. Neat PCL showed better thermal stability than PLA, but the degradation kinetics revealed that PLA had a higher activation energy of degradation than PCL, indicating its degradation rate more strongly depends on temperature, probably because of a more complex degradation mechanism based on chain scission and re-formation. Blending of PLA and PCL reduced the thermal stabilities of both polymers, but the presence of TiO₂ nanoparticles improved their thermal stability. The nanoparticles also influenced the volatilization of the degradation products from the blend, acted as degradation catalyst and/or retarded the escape of volatile degradation products.

Keywords: poly(lactic acid); polycaprolactone; titania; blends; morphology; thermal degradation

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