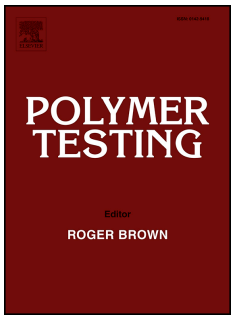
Accepted Manuscript



Morphology and thermal degradation studies of melt-mixed poly(lactic acid) (PLA)/ poly(ε-caprolactone) (PCL) biodegradable polymer blend nanocomposites with TiO_2 as filler

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PII: S0142-9418(15)00126-9

DOI: 10.1016/j.polymertesting.2015.05.007

Reference: POTE 4440

To appear in: *Polymer Testing*

Received Date: 25 March 2015

Revised Date: 20 May 2015

Accepted Date: 20 May 2015

Please cite this article as: J.P. Mofokeng, A.S. Luyt, Morphology and thermal degradation studies of melt-mixed poly(lactic acid) (PLA)/poly(ε-caprolactone) (PCL) biodegradable polymer blend nanocomposites with TiO_2 as filler, *Polymer Testing* (2015), doi: 10.1016/j.polymertesting.2015.05.007.

Material Behaviour

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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 TiO_2 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 TiO_2 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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