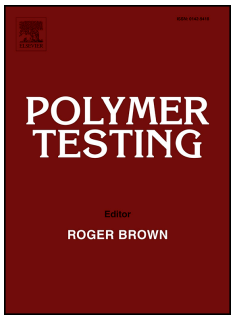
Accepted Manuscript



Highly toughened polylactide (PLA) by reactive blending with novel polycaprolactone-based polyurethane (PCLU) blends

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PII: S0142-9418(18)30970-X

DOI: 10.1016/j.polymertesting.2018.07.023

Reference: POTE 5556

To appear in: *Polymer Testing*

Received Date: 20 June 2018

Accepted Date: 25 July 2018

Please cite this article as: H. Chen, X. Yu, W. Zhou, S. Peng, X. Zhao, Highly toughened polylactide (PLA) by reactive blending with novel polycaprolactone-based polyurethane (PCLU) blends, *Polymer Testing* (2018), doi: 10.1016/j.polymertesting.2018.07.023.

Material Properties

Highly toughened polylactide (PLA) by reactive blending with novel polycaprolactone-based polyurethane (PCLU) blends

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Abstract: Polylactide (PLA)/polycaprolactone-based polyurethane (PCLU) blends were prepared by reactive blending of PLA with poly(caprolactone) triol (PCL-polyols) and isophorone diisocyanate (IPDI). The interfacial compatibility was markedly improved by the reaction of the terminal hydroxyl groups of PLA and the N=C=O groups of IPDI, as confirmed by Fourier transform infrared spectroscopy. Results of tensile testing and a notched impact test suggest that the elongation at break and impact strength of PLA/PCLU blends increased to more than 20 and 5 times those of neat PLA, respectively. Moreover, the tensile strength of PLA/PCLU blends slightly decreased. Excellent interfacial adhesion enabled the dispersed polyurethane elastomeric particles to act as effective stress concentration areas. The shearing yielding of PLA matrix triggered by internal cavitation was the main mechanical toughening mechanism.

Keywords: Polylactide (PLA); Polycaprolactone-based polyurethane (PCLU); Reactive blending; Interfacial compatibility

1. Introduction

Biobased and biodegradable polymers have attracted increasing attention in both scientific research and industrial applications[1,2]. Polylactide (PLA) is one of the most valuable biobased, biodegradable polymers due to its excellent biocompatibility, mechanical properties and processability[3]. PLA can be widely used in numerous applications, such as biomedical devices, disposable tableware and industrial materials. However, its inherent brittleness with short elongation at break and low