

Accepted Manuscript

Aligned plasticized polylactic acid cellulose nanocomposite tapes: Effect of drawing conditions

Anshu Anjali Singh, Shiyu Geng, Natalia Herrera, Kristiina Oksman

PII: S1359-835X(17)30377-9
DOI: <https://doi.org/10.1016/j.compositesa.2017.10.019>
Reference: JCOMA 4808

To appear in: *Composites: Part A*

Received Date: 21 December 2016
Revised Date: 17 October 2017
Accepted Date: 18 October 2017

Please cite this article as: Singh, A.A., Geng, S., Herrera, N., Oksman, K., Aligned plasticized polylactic acid cellulose nanocomposite tapes: Effect of drawing conditions, *Composites: Part A* (2017), doi: <https://doi.org/10.1016/j.compositesa.2017.10.019>

This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.



Aligned plasticized polylactic acid cellulose nanocomposite tapes: Effect of drawing conditions

Anshu Anjali Singh,^a Shiyu Geng,^a Natalia Herrera^a and Kristiina Oksman^{a,b*}

^aDivision of Materials Science, Luleå University of Technology,
SE-971 87, Luleå, Sweden.

^bFibre and Particle Engineering, University of Oulu, FI-91400, Oulu, Finland.

*Corresponding author Email: kristiina.oksman@ltu.se

Tel: +46 920 49 33 71

Abstract

Aligned nanocomposite tapes based on plasticized polylactic acid (PLA) and 1 wt.% cellulose nanofibers (CNF) were prepared using uniaxial solid-state drawing, and the effects of drawing conditions including temperature, speed and draw ratio on the material were studied. Microscopy studies confirmed alignment and the formation of ‘shish-kebab’ morphology in the drawn tape. Mechanical properties demonstrate that the solid-state drawing is a very effective way to produce stronger and tougher PLA nanocomposites, and the toughness can be improved 60 times compared to the undrawn tape. Additionally, the thermal properties, i.e. storage modulus, glass transition temperature and degree of crystallinity were improved. These improvements are expected due to the synergistic effect of CNF in the nanocomposite and orientations induced by the solid-state drawing.

Keywords: A. Nanocomposites; B. Mechanical properties; B. Thermal properties; D. Microstructural analysis

1. Introduction

Research on the use of polylactic acid (PLA) has attracted great attention among scientists in the last decade. PLA is produced from the renewable resources, for example - corn and sugar beet, and possesses the required mechanical properties for several applications to compete with the conventional petroleum based polymers [1, 2]. PLA can be processed using conventional plastic processing techniques such as injection molding and thermoforming but blow molding and film extrusion are generally difficult because of its low melt strength, low elongation and high dead-fold property [1, 3]. Further, the inherent brittle behaviour, poor thermal resistance and low crystallization rate, limits its use in many applications and several efforts have been adopted to overcome these drawbacks [1, 2].

Download English Version:

<https://daneshyari.com/en/article/7889963>

Download Persian Version:

<https://daneshyari.com/article/7889963>

[Daneshyari.com](https://daneshyari.com)