Accepted Manuscript

Interfaces in polyethylene oxide modified cellulose nanocrystal - Polyethylene matrix composites

N.H. Inai, A.E. Lewandowska, O.R. Ghita, S.J. Eichhorn

PII: S0266-3538(17)31648-2

DOI: 10.1016/j.compscitech.2017.11.009

Reference: CSTE 6964

To appear in: *Composites Science and Technology*

Received Date: 7 July 2017

Revised Date: 31 October 2017

Accepted Date: 13 November 2017

Please cite this article as: Inai NH, Lewandowska AE, Ghita OR, Eichhorn SJ, Interfaces in polyethylene oxide modified cellulose nanocrystal - Polyethylene matrix composites, *Composites Science and Technology* (2017), doi: 10.1016/j.compscitech.2017.11.009.

Interfaces in Polyethylene Oxide Modified Cellulose Nanocrystal - Polyethylene Matrix Composites

N.H. Inai, A.E. Lewandowska, O.R. Ghita, S.J. Eichhorn[*†]

College of Engineering, Mathematics and Physical Sciences, University of Exeter, North Park Road, EX4 4QF, Exeter, UK.

Abstract The interface between cellulose nanocrystals (CNCs) in thermoplastic matrices is one of the most important issues in the development of CNC-based polymeric composites prepared via melt processing. In the present work, polyethylene oxide (PEO) was used as a compatibilizer to enhance the interface with a polyethylene matrix. It was found that the composites produced using a PEO compatibilizer possess better overall mechanical properties and a higher degree of crystallinity of polyethylene than the unmodified samples. An increase in both the tensile strength and modulus of the composites was observed for up to 1.5 wt.% of CNCs; beyond this point no significant increases were observed. When CNCs are added (up to 1.5 wt. %) to the matrix, the crystallization peak of the composites in the DSC thermograms is shifted to higher temperatures. The stress-transfer process in the composites was monitored using Raman spectroscopy. Higher Raman band shift rates with respect to tensile strain of a peak corresponding to main chain molecular deformation are observed for the composites produced using the PEO compatibilizer. This demonstrates that stress is transferred from the matrix to the fillers more effectively with the presence of PEO. The simple PEO-modification approach adopted in this study avoids the classical solvent

[*] Corresponding Author: Email: s.j.eichhorn@bristol.ac.uk; TEL: +44 (0) 117 33 15650.
[†] Present address: Bristol Composites Institute (ACCIS), University of Bristol, Queen's Building, University Walk, Bristol, BS8 1TR, UK.