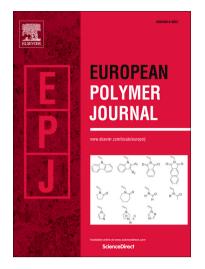
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Cellulose Nanocrystal in Poly (Lactic acid)/Polyamide11 Blends: Preparation, Morphology and Co-continuity

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## **ACCEPTED MANUSCRIPT**

### Cellulose Nanocrystal in Poly (Lactic acid)/Polyamide11 Blends: Preparation, Morphology and Co-continuity

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#### Abstract

In this work, for the first time, cellulose nanocrystal (CNC) is incorporated into poly (lactic acid)/bio-polyamide11 (PA11) blends at different loadings through a combination of solvent dissolution, casting and melt mixing. Atomic force microscopy (AFM) and rheology analysis demonstrate an exceptional level of CNC dispersion using this technique. CNC is fed into the blends through prepared PLA/CNC or PA11/CNC mixtures via melt mixing in an internal mixer. In the PLA/PA11/CNC system, the CNC particles perfectly segregate into the PA11 phase at all compositions, after mixing, irrespective of whether the PLA/CNC or the PA11/CNC mixture is used. These findings are supported by thermodynamic predictions based on interfacial energy. There is virtually no influence of CNC content on the PLA/PA11 morphology when it is in a matrix/dispersed phase form. This is attributed to the already low level of coalescence resulting from the low interfacial tension between PLA and PA11. However, when coalescence phenomena are fully maximized through the preparation of a co-continuous system (PLA/PA11 50/50), then CNC addition dramatically diminishes coalescence even at values as low as 1 wt% CNC. It is suggested that the retarded relaxation of the CNC filled PA11 domains is the main mechanism governing this coalescence reduction.

Key Words: Poly (lactic acid), Polyamide11, Cellulose nanocrystal, Localization, Morphology

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