Electronic Supplementary Information

Effect of Cellulose Nanocrystal Polymorphs on Mechanical, Barrier and Thermal Properties of Poly(lactic acid) based bionanocomposites

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Figure S1: (a) XRD spectra of the pretreated bamboo pulp at 5-25wt % NaOH concentration. (b) FTIR spectra of the pretreated bamboo pulp at 5-25wt % of NaOH concentrations.

Figure S2: AFM micrographs for (a) CNC I, (b) CNC II and (c) CNC: I→II. Height profile along the z-axis (x 25 times) corresponding to (a') CNC I (b') CNC II and (c') CNC: I→II
Table S1: Properties of the different CNC polymorphs CNC I, CNC II and CNC: I→II.

<table>
<thead>
<tr>
<th>Cellulose Polymorph Type</th>
<th>CNC I</th>
<th>CNC II</th>
<th>CNC: I→II</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dimension (Length/Dia.) (nm)</td>
<td>610/19</td>
<td>824/34</td>
<td>583/100</td>
</tr>
<tr>
<td>Aspect Ratio</td>
<td>~33</td>
<td>~25</td>
<td>~6</td>
</tr>
<tr>
<td>Onset Degradation Temperature (°C)</td>
<td>123</td>
<td>191</td>
<td>175</td>
</tr>
<tr>
<td>Peak Degradation Temperature (°C)</td>
<td>481</td>
<td>471</td>
<td>196</td>
</tr>
<tr>
<td>Residual Mass (%)</td>
<td>2.226</td>
<td>4.595</td>
<td>2.470</td>
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<tr>
<td>Alpha (%)</td>
<td>88.5</td>
<td>83.0</td>
<td>12.5</td>
</tr>
<tr>
<td>Crystallinity Index (C.I.)</td>
<td>81%</td>
<td>77%</td>
<td>70%</td>
</tr>
<tr>
<td>d-spacing for the plane (200) (nm)</td>
<td>0.409</td>
<td>0.403</td>
<td>0.394</td>
</tr>
</tbody>
</table>

Figure S3: (a) Comparison of XRD spectra for different PLA/CNC polymorphs films at 1wt % CNC loading. (b) The percentage change in crystallinity of PLA/CNC composites at different wt % of CNC loadings.