Annealing and saponification of electrospun cellulose-acetate nanofibers used as reinforcement materials for composites

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Abstract

To enhance the mechanical properties of regenerated cellulose nanofibers (RC-NF), the annealing and the saponification of electrospun cellulose-acetate nanofibers (CA-NF) have been investigated. It was found that, by increasing the annealing time of CA-NF at 50 ˚C from 0 to 12 h, the crystallinity of RC-NF increased from 37 to 41%, which became constant after 12 h. By applying the theory proposed by Tsai, the Young's modulus of RC-NF was found to increase from 11.2 to 28.0 GPa by increasing the annealing time from 0 to 12 h, which also became constant after 12 h. The optimized annealing time for the maximum crystallinity and Young's modulus became shorter by increasing the annealing temperature, indicating that the crystallinity and the Young's modulus of RC-NF were strongly correlated. Eventually, the Young's modulus of RC-NF/PVA increased from 2.1 to 3.0 GPa at the maximum, while that of pure PVA was 1.5 GPa.

Keywords

A. Cellulose; A. Natural fibers; A. Polymer-matrix composites (PMCs); B. Mechanical