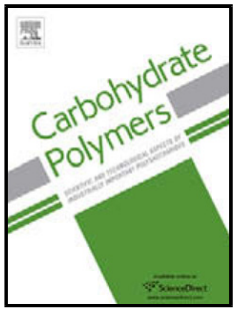

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PII: S0144-8617(16)31388-1
DOI: http://dx.doi.org/doi:10.1016/j.carbpol.2016.12.019
Reference: CARP 11826

To appear in:

Received date: 11-8-2016
Revised date: 3-12-2016
Accepted date: 7-12-2016

Please cite this article as: Lee, Minwoo., Heo, Min Haeng., Lee, Hwi-Hui., Kim, Young-Wun., & Shin, Jihoon., Tunable Softening and Toughening of Individualized Cellulose Nanofibers-Polyurethane Urea Elastomer Composites.*Carbohydrate Polymers* http://dx.doi.org/10.1016/j.carbpol.2016.12.019

Tunable Softening and Toughening of Individualized Cellulose Nanofibers-Polyurethane Urea Elastomer Composites

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ABSTRACT

A series of elastomeric nanocomposites with superior tensile strength and extensibility, simultaneously exhibiting softening, was prepared using in situ polymerization by homogeneously dispersing TEMPO-oxidized cellulose individualized nanofibers (TOCNs) in a polyurethane urea (PUU) matrix. The structure of these PUU composites covalently cross-linked with the TOCNs was characterized. It was interesting to find that the amount and size of the hard domains in the composites gradually decreased by introducing crosslinkable TOCNs. With only 2 wt % of TOCNs incorporated, a 10.4-fold increase in tensile strength, 5.5-fold increase in strain-to-failure, and a decrease of 35% in the coefficient of thermal expansion were achieved, compared with those of neat PUU. However, the elastic modulus of the nanocomposites gradually decreased with up to 1 wt % of TOCNs. Conversely, with 2 wt % of TOCNs, the stiffness of the elastomers again increased, due to filler-filler interaction over the CNFs percolation in the nanocomposites.