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Manipulating Interactions in Cellulose Nanocrystal/Waterborne Epoxy Composites through Physical Mixing[1] MEISHA L. SHOFNER, School of Materials Science and Engineering, Georgia Institute of Technology, NATALIE M. GIROUARD, J. CARSON MEREDITH, School of Chemical and Biomolecular Engineering, Georgia Institute of Technology, GREGORY T. SCHUENEMAN, Forest Products Laboratory, USDA Forest Service — The objective of this research is to more fully understand the relationships between component interactions and processing pathways in cellulose nanocrystal (CNC)/polymer composite materials. Specifically, wood-derived CNC/waterborne epoxy composites with CNC loadings up to 15 wt.% were produced using two different protocols. Through relatively simple changes in processing, significant differences in CNC dispersion and composite physical properties were seen, and these changes were attributed to an association between the CNCs and the epoxy emulsion, similar in nature to colloidal haloing. Considering literature results available for CNC nanocomposites, as well as other types of polymer nanocomposites, these results support the assertion that the processing-structure-property relationships in such nanocomposites are diverse and can be used to design materials for a range of applications. Additionally, these results put into context the properties that can be expected in composites containing wood-based CNCs produced at a pilot scale facility as opposed to CNCs from other cellulose sources produced a few grams at a time, making these results relevant to the production of CNC-based composites at larger volumes.

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