## Abstract Submitted for the MAR17 Meeting of The American Physical Society

All-Cellulose Composites of Nanofibril and Molecular Cellulose DOUG HENDERSON, XIN ZHANG, Department of Materials Science and Engineering, University of Maryland-College Park, MD, YIMIN MAO, NCNR, NIST, Gaithersburg, MD, LIANGBING HU, ROBERT BRIBER, HOWARD WANG, Department of Materials Science and Engineering, University of Maryland-College Park, MD — Cellulose nanofibrils (CNFs) are the basic structural elements of most cellulosic materials; they show excellent mechanical characteristics due to a high crystallinity. Molecular solutions of cellulose (MSC) with no apparent aggregation are produced with an ionic liquid and dimethyl sulfoxide (DMSO) binary solvent mixture. Cellulose dissolution occurs by maintaining a 3:1 molar ratio of ionic liquid to cellulose sugar units. The use of DMSO minimizes the amount of ionic liquid used and allows control over viscosity. In this study, all-cellulose nanocomposites of CNFs and regenerated cellulose from MSC have been fabricated by co-precipitation. CNFs with average diameters of  $2.5 \pm -0.5$  nm and lengths of  $300 \pm -100$  nm were initially dispersed in water, then suspended in DMSO by solvent exchange and then mixed with MSC. The resultant mixtures were used to cast nanocomposite thin films. The microstructure of the films was studied using optical, atomic force, and electron microscopy which show an even dispersion of CNFs within the regenerated cellulose. Water-uptake behavior was investigated using small angle neutron scattering. The nanocomposite films show higher water resistance compared to neat NFC films and similar to that of cellulose regenerated from MSC.

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