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Effect of cellulose nanocrystals on crystallization kinetics of polycaprolactone KALMAN MIGLER, DEBJANI ROY, ANTHONY KOTULA, BHARATH NATARAJAN, JEFFREY GILMAN, NIST, DOUGLAS FOX, American University — The development of biocompatible polymer composites that enhance mechanical properties while maintaining thermoplastic processability is a longstanding goal in sustainable materials. Here we compatibilize a crystallizable polymer and a nano-fiber via surface modification and study the properties and crystallization kinetics of the resulting composite. First we demonstrate that polycaprolactone (PCL) and cellulose nanocrystals (CNCs) can be well-compatibilized by replacing the Na+ of sulfated cellulose nanocrystals (Na-CNCs) with tertiary butyl ammonium cations and then melt mixing via twin-screw extrusion. Transmission electron microscope and high temperature melt rheology show that the modified CNCs were dispersed in the polymer matrix. We find the crystallization kinetics are substantially affected by the CNC as indicated by the simultaneous measures of modulus and conformational states; higher loadings of CNCs accelerated the kinetics. We further correlate the crystallization kinetics, mechanical properties and stability.

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