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Renewable chiral nematic liquid crystal template for highly ordered semiconducting polymers BAILEY RISTEEN, ALYSSA BLAKE, MICHAEL MCBRIDE, CORNELIA ROSU, JUNG OK PARK, MOHAN SRINIVASARAO, PAUL RUSSO, ELSA REICHMANIS, Georgia Institute of Technology
— The future of organic electronics relies on the ability to facilitate intra- and interchain ordering of semiconducting polymers (SPs). In this work, cellulose nanocrystals (CNCs), a material derived from biomass, was used to enhance the alignment of semiconducting polymer poly[3-(potassium-4-butanoate) thiophene-2,5-diyl] or PPBT through liquid crystal ordering. CNCs are rod-like particles that form a chiral nematic liquid crystal phase. The inclusion of these renewable particles in PPBT solutions resulted in highly birefringent domains under polarized optical microscopy, demonstrating the ability of CNCs to "template" PPBT into liquid crystal phases. The presence of PPBT π-π stacks was confirmed by both a bathochromic shift as well as the position and intensity of 0-0 and 0-1 vibrational peaks in UV-Vis spectroscopy. Circular dichroism (CD) spectroscopy showed that the PPBT/CNC blends were chiral and had a pronounced negative CD peak at the π-π stacking wavelength (578 nm), providing evidence that these stacking interactions had a helicoidal twist.

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