

Photo-patternable Cellulose Nanofiber-Epoxy Composites for Transparent and Stretchable Electronics

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Efforts to develop alternative substrate materials beyond conventional plastic substrates have grown rapidly in recent years for demanding applications in flexible and wearable electronics. Abundant, bio-degradable, and sustainable cellulose nanofiber based substrates have attracted much interest as a promising alternative for flexible electronics due to their outstanding properties, such as high mechanical strength, optical transparency, and exceptionally low coefficient of thermal expansion. Here, we report an unconventional approach to realize a high performance CNF-epoxy composite substrate by simultaneous electrospinning and spraying process. The resulting CNF-epoxy composite substrate shows high transmittance (88% at 550 nm) and superb mechanical robustness (Young's modulus and tensile strength of 4.3 GPa and 160 MPa, respectively), as well as outstanding thermal stability (coefficient of thermal expansion as low as 10 ppm/K). A flexible touch-screen panel and a highly transparent organic light-emitting diode are demonstrated as potential applications adopting the CNF-epoxy composite substrate.