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# Functionalizing cellulose nanofibril films

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Cellulose nanofibrils (CNF), extracted from wood, are sustainable materials par excellence and used to fabricate high-strength materials. A promising route for fabricating porous CNF films on large scale is spray deposition using water-based technologies; the resulting porous CNF templates are excellent candidates to infiltrate conductive polymers and plasmon-active nanoparticles for functionalization. This functionalization is based on adding additional layers or depositing CNF-based dispersions using solvent-based methods; often, the solvent itself is water. With CNF being hygroscopic, it is therefore mandatory to understand the interaction of water with the CNF films. We employ in situ grazing incidence small-angle neutron scattering to study the morphological features within the ultra-smooth CNF thin films under as-prepared conditions as well as their rearrangement under humidification. In a next step, we used poly(3,4-ethylenedioxythiophene) polystyrene sulfonate (PEDOT:PSS), widely applied in organic photovoltaics and electronics, to functionalize the CNF template. We studied the infiltration, resulting structural rearrangement within the thin CNF template of, and their behavior under cyclic humidity changes by grazing incidence small-angle neutron scattering. Extending to plasmonic applications, we employ layer-by-layer deposition of laser-ablated silver nanoparticles to install a plasmon-active CNF-template.

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