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Mechanical performance and architecture of biocomposite honeycombs and foams from core-shell holocellulose nanofibers

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Abstract

CNFs (cellulose nanofibers) based on holocellulose have a pure cellulose fibril core, with a hemicellulose coating. The diameter is only around 6-8 nm and the hemicellulose surface coating has anionic charge. These CNFs are used to prepare honeycomb and foam structures by freeze-drying from dilute hydrocolloidal suspensions. The materials are compared with materials based on “conventional” cellulose CNFs from sulfite pulp with respect to mechanical properties in compression. Characterization methods include FE-SEM of cellular structure, and the analysis includes comparisons with similar materials from other types of CNFs and data in the literature. The honeycomb structures show superior out-of-plane properties compared with the more isotropic foam structures, as expected. Honeycombs based on holocellulose CNFs showed better properties than sulfite pulp CNF honeycombs, since the cellular structure contained less defects. This is related to better stability of holocellulose CNFs in colloidal suspension.

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