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CELLULOSE NANOFIBER NETWORKS FOR STRUCTURAL NANOMATERIALS

AND BIOCOMPOSITES WITH MULTIPLE FUNCTIONS

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Cellulose-based composites offer interesting potential as environmentally friendly materials. Wood nanocellulose disintegrated from chemical pulp is an interesting component, which can be used in materials of increased structural, sophistication, extended property range and new functions [1]. The network forming character of cellulose nanofibers (CNF) makes it possible to form other types of nanomaterials than biocomposites such as nanopaper, aerogels, hydrogels, foams and honeycombs. The CNF can also be combined with inorganic nanoparticles to prepare organic/inorganic hybrid materials.

The structure of CNF is discussed and routes to improve the properties of the CNF are suggested. For the purpose of nanomaterials preparation, structural control is essential. The processing of colloidal suspensions offers many advantages in terms of controlled particle dispersion, possibilities for orientation and the combination of multiple functionalization strategies. The core-shell nanofiber approach is particularly interesting [2]. It allows the possibility to tailor the distribution of the polymer matrix, and also to improve the moisture stability of the nanocomposite system. Both interface and interphase regions can be better controlled by this approach.

Thermoset biocomposites have also been studied, and CNF combined with epoxy (EP) is particularly promising [3]. The epoxide can react with surface hydroxyls on CNF so that covalent polymer matrix-nanofiber interactions results. This interface is characterized by excellent hygromechanical stability. The CNF/EP composites are also very ductile, due to the characteristics of the CNF network.

CNF can also have specific and favorable interactions with unmodified carbon nanotubes (CNT). The stability of the suspension is improved so that no surface modification is required for the CNT. The suspension can be filtered so that a nanofiber paper or nanocomposite is obtained [4]. Since no surfactants are required for the CNT, the electrical conductivity of the material is exceptionally good. The mechanical properties are also favorable..

1. Berglund, L.; Peijs, T., Cellulose Biocomposites-From Bulk Moldings to Nanostructured Systems. *Mrs Bulletin* **2010,** *35* (3), 201-207.
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