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Short Communication

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Cellulose based green nanocomposites for energy, Electronic and Environmental Applications

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Abstract

Lightweight, flexible and freestanding composite for water purification have recently attracted great interests. Here, we have explain chemically modified cellulose nanofibers (CNFs) with carboxylic surface functional groups by TEMPO (2,2,6,6-tetramethylpiperidine-1-oxyl radical) oxidation and chemically bonded the modified CNFs with various metal pillars or metal organic frameworks to construct a robust and high-efficiency material for various Energy, Electronic and Environmental Applications. The functionalization of CNF proves to be an effective approach to control the porosity via the inter-fiber electrostatic interactions and to provide active functional groups for the chemical interaction with active components for composite film formation. As-prepared flexible film was used for Batteries, Supercapacitors, water purification and Anti-bacterial activity.

Cellulose is the most abundant natural polymer on earth, providing a sustainable green resource that is renewable, degradable, biocompatible and cost effective. Recently, nanocellulose-based mesoporous structure, flexible thin films, fibers, and networks are increasingly developed and used in photovoltaic devices, energy storage systems, mechanical energy harvesters, and catalysts components, showing tremendous materials science value and application potential in many energy-related fields. In this review article, we review the most recent advancements of processing, integration and application of cellulose nanomaterials in the areas of solar energy harvesting, energy storage, and mechanical energy harvesting. For solar energy harvesting, promising applications of cellulose-based nanostructures for both solar cells and photoelectrochemical electrodes development are reviewed, and their morphology-related merits are discussed. For energy storage, our discussion is primarily focused on the applications of cellulose-based nanomateriales in lithium ion batteries, including electrodes (e.g. active materials, binders and structural support), electrolytes, and separators. Applications of cellulose nanomaterials in supercapacitors are also overviewed briefly. For mechanical energy harvesting, we review the most recent technology evolution of cellulose-based triboelectric nanogenerators, from fundamental property tuning to practical implementations. At last, the future research potential and opportunities of cellulose nanomaterials as a new energy material are commented.

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