Cellulose Based Light weight and flexible Energy Storage Device

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Abstract:

Lightweight, flexible and freestanding composite for Energy and Environmental applications have recently attracted great interests. Here, we have 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 conductive polymers to construct a robust and high-efficiency material for various Energy 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 water purification, Anti-bacterial and Energy storage applications like flexible supercapacitors.

There has recently been a major thrust toward advanced research in the area of hierarchical carbon nanostructured electrodes derived from cellulosic resources, such as cellulose nanofibers (CNFs), which are accessible from natural cellulose and bacterial cellulose (BC). This research is providing a firm scientific basis for recognizing the inherent mechanical and electrochemical properties of those composite carbon materials that are suitable for carbon-electrode applications, where they represent obvious alternatives to replace the current monopoly of carbon materials (carbon nanotubes, reduced graphene oxide, and their derivatives). Significant promising developments in this area are strengthened by the one dimensional (1D) nanostructures and excellent hydrophobicity of the CNFs, the interconnected pore networks of carbon aerogels, and the biodegradable and flexible nature of cellulose paper and graphenic fibers. Outstanding electrode materials with different dimensions (1D, 3D) are derivable by the strategic choice of cellulose sources. This development requires special attention in terms of understanding the significant impact of the cellulose morphology on the final electrochemical performance.

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