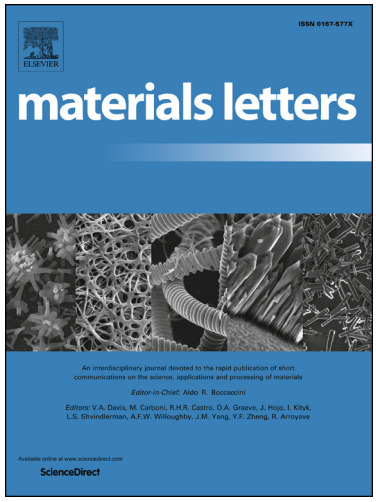

Mechanically flexible electrospun carbon nanofiber mats derived from biochar and polyacrylonitrile

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Mechanically flexible electrospun carbon nanofiber mats derived from biochar and polyacrylonitrile

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Abstract: Mechanically flexible electrospun carbon nanofiber (ECNF) mats were prepared by electrospinning mixtures containing hydrothermal liquefaction (HTL) derived biochar and polyacrylonitrile (PAN) into precursor nanofiber mats followed by stabilization in air and then carbonization in argon. The resulting ECNF mats well retained the overall morphological structures of their precursors (*i.e.*, biochar/PAN composite nanofiber mats), and the carbon nanofibers showed the enlarged specific surface area upon the increase of biochar loading amount in precursor nanofibers. The ECNFs (4/10), which were derived from composite nanofibers with the biochar/PAN weight ratio being 4/10, had the fiber diameters of ~350 nm and the BET specific surface area of 30.12 $m^2 \cdot g^{-1}$; and these ECNF mats exhibited the highest gravimetric capacitance of 37.60 $F \cdot g^{-1}$ at the current density of 500 $mA \cdot g^{-1}$. Hence, the prepared ECNF mats could potentially be utilized for energy related (*e.g.*, supercapacitor) applications.

Keywords: Biochar; Electrospinning; Carbon Nanofibers; Supercapacitor

1. Introduction

Through thermochemical and/or biochemical processes, biomass can be gasified or liquefied to produce biogas, bio-oil, and biochar. Biochar is primarily acquired from lignin fraction of lignocellulosic biomass, and it is a porous solid with at least 50 wt.% carbon [1]. In contrast to solid residue generated from hydrothermal liquefaction (HTL) process, pyrolysis (or gasification) char is produced at higher temperature (*i.e.*, >500 °C). As a result, most volatile compounds are lost, leading to the char with large specific surface area (*e.g.*, 500 $m^2 \cdot g^{-1}$). Unlike pyrolysis char, HTL char has lower adsorption capacity due to smaller specific surface area and pore volume. In general, the carbon-rich HTL char is considered as waste byproduct, which is often used for heat generation in a continuous HTL process. In this study, a high-value application of HTL derived biochar has been explored.