Accepted Manuscript

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PII: S0266-3538(17)31565-8

DOI: 10.1016/j.compscitech.2017.11.031

Reference: CSTE 6986

To appear in: *Composites Science and Technology*

Received Date: 28 June 2017

Revised Date: 27 November 2017

Accepted Date: 27 November 2017

Please cite this article as: Rezaei B, Shoushtari AM, Rabiee M, Uzun L, Turner APF, Mak WC, Electrochemical performance of nanofibrous highly flexible electrodes enhanced by different structural configurations, *Composites Science and Technology* (2017), doi: 10.1016/j.compscitech.2017.11.031.

Electrochemical performance of nanofibrous highly flexible electrodes enhanced by different structural configurations

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ABSTRACT: Due to their unique physicomechanical properties, one dimensional (1D) nanostructured conductive materials offer remarkable potential as a flexible electroactive medium for developing miniaturized electronic devices such as supercapacitors, sensors and actuators. In this work, thin films composed of nanocomposite nanofibers with two different architectures, *i.e.* whiskered nanofibers (WNFs) and hierarchical-structured nanofibers (H-SNFs), were fabricated and their capability to serve as flexible and bendable electrodes were evaluated. The main difference of these two architectures is how the distributions of the nano-fillers (carboxylated multiwalled carbon nanotubes, CMWNTs) through the nanofibers, i.e. the isotropic and anisotropic arrangements, lead to WNFs and H-SNFs, respectively. The percolation threshold of conduction for the H-SNFs (composed of 0.5 wt% CMWCNTs) and the WNFs (composed of 5 wt% CMWCNTs) were 0.13 S cm^{-1} and 0.07 S cm^{-1}, respectively. Moreover, according to the electrochemical characterizations, although the WNFs had ten orders of magnitude higher nanotube content, the electroactivity and electron transfer rate of H-SNFs was considerably higher than those of WNFs, so that the cyclic voltammetric peak currents of H-SNFs was approximately 1.6 times higher than that of WNFs. As a proof-of-concept, our results indicate that the structural configuration is a major determinative factor,