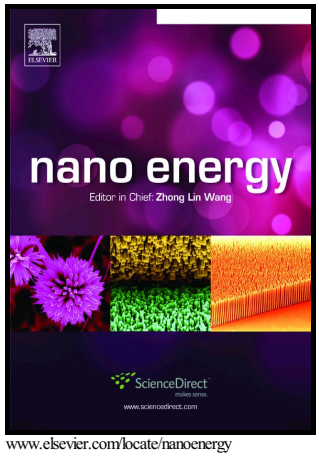

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PII: S2211-2855(18)30628-1
DOI: https://doi.org/10.1016/j.nanoen.2018.08.066
Reference: NANOEN2996

To appear in: *Nano Energy*

Received date: 30 May 2018
Revised date: 10 August 2018
Accepted date: 29 August 2018

Cite this article as: Ravi Kumar Cheedarala, Abu Naushad Parvez and Kyoung Kwan Ahn, Electric Impulse Spring-Assisted Contact Separation Mode Triboelectric Nanogenerator Fabricated from Polyaniline Emeraldine Salt and Woven Carbon Fibers, *Nano Energy,* https://doi.org/10.1016/j.nanoen.2018.08.066

Electric Impulse Spring-Assisted Contact Separation Mode Triboelectric Nanogenerator Fabricated from Polyaniline Emeraldine Salt and Woven Carbon Fibers

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Abstract

In this article, we used modified woven carbon fiber mat (wCF-COOH), as one of the contact-electrification Triboelectric Nanogenerator (TENG) friction layer to generate high open circuit voltage (V_{oc}) and short circuit current (I_{sc}). We designed the contact-separation mode TENG which is functional using spring structure. The oxidation of wCF into wCF-COOH by Piranha solution followed by coupling of aniline through electrostatic interactions and in-situ oxidative polymerization to get woven carbon fiber-polyaniline emeraldine salt (wCF.PANI.ES) composite is a novel approach. The wCF-PANI.ES composite displays the surface resistivity of 0.324 Ω.m and serves as a friction layer to generate charges by harvesting energy through vertical contact-separation mode TENG against PVDF membrane. The dynamic interactions of novel wCF-PANI.ES and PVDF membrane produced high V_{oc} of 95V, and I_{sc} of 180 μA, respectively. In particular, wCF-PANI.ES-TENG has shown an enhancement of 498% of V_{oc} with respect to wCF-COOH-TENG due to availability of PANI layer. In addition, it was observed that the proposed wCF-PANI.ES-TENG has shown the output power of 12.4 mW at 5Hz, and the rectified current upto 180 μA. The novel wCF-PANI.ES is the potential candidate for fulfilling the need of optimized energy harvesting device as an alternate material option for contact-separation mode TENGs.

Graphical Abstracts