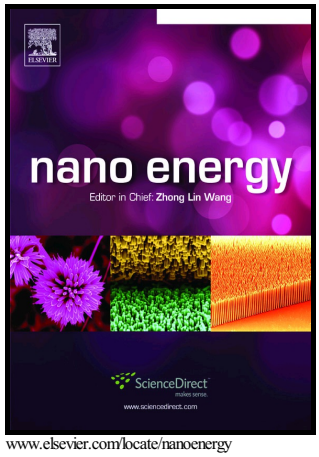

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Flexible fiber-based hybrid nanogenerator for biomechanical energy harvesting and physiological monitoring

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Abstract

With the rapid development of wearable electronics like artificial e-skins and smart patch, harvesting biomechanical energy and realizing self-powered sensing are of essential importance for achieving sustainable and efficient function of the system. Here we report a flexible hybrid device that can be conformally attached on soft surface like human skin to harvest diversity touch energies based on electrospun nanofiber mat. Facilitated by the working mechanisms of triboeletric and piezoelectric, the device can generate maximum peak power up to 84 $\mu W/cm^2$ and 0.11 $\mu W/cm^2$ for the TENG and PENG part when stimulated by a compressive stress, which can enhance the energy harvesting efficiency and expand its application areas. By virtue of the high sensitivity of the piezoelectric nanomaterial, the device can also be attached on different parts of body for real-time monitoring the human physiological signals such as respiratory information and radial artery pulse, which shows potential value in self-powered e-skins and healthcare monitoring systems.

Graphical Abstract

(a) Photo of the device attached on the surface of a balloon. (b) Schematic diagram of the device. (c) Output voltage and when the device is attached on the skin. (d) Respiratory signal recorded by the device in one breath cycle.

Keywords: hybrid nanogenerator, piezoelectric, triboelectric, electrospinnig, healthcare monitoring

Introduction

Flexible and wearable electronics, including artificial electronic skins, wearable light-emitting diodes, health monitoring and motion tracking, are rapidly rising fields in today's technologies [1-6]. Although significant progress has been made in increasing the capacity of batteries and reducing the power consumption of the devices, these systems still need rigid lithium ion batteries (LIBs) with frequent