

Patent alert September 2024

Textiles for energy harvesting

This month's selection in brief

This month's selection deals with textiles in energy harvesting applications. In these applications, textiles can be used thanks to their flexibility, tuneability and diversity going from filaments, yarns to 2D or 3D structures of woven, nonwoven or knitted fabrics. This selection highlights innovations not only from the prevalent piezo- and triboelectric textile energy harvesters or combination thereof, but also energy harvesters comprising textiles based on salinity gradient.

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Salinity gradient power generation device comprising activated carbon textile

Patent number: FR3145448

Publication date: 2024-08-02

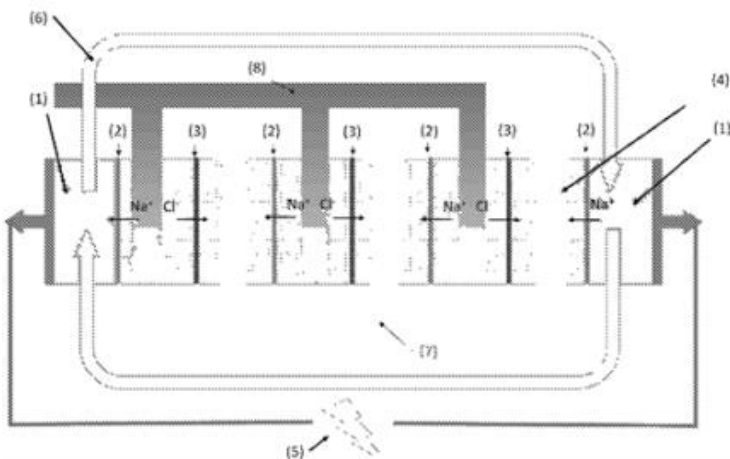
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Inventor(s): MOTTET BRUNO; SENE ASSANE; KECHADI MOHAMMED; BIZOT CHLOE

Summary

Devices involving ion exchange processes between compartments separated by ion exchange membranes can be used to generate energy by exploiting salinity gradients. Salinity gradient power generation is one of the most potentially renewable energy sources in the world. Among the various technologies currently envisaged, the reverse electrodialysis (RED) method relies on the conversion of the mixing energy into electrical energy. This technology is based on the use of membranes having a selective permeability to anions (anionic membranes) or cations (cationic membranes), the basic property of which is the selective transport of ions according to the sign of their charge.

The invention relates to a device for the production of energy comprising: - two electrodes (1), - a membrane stack (9), arranged between the two electrodes, comprising an alternation of cation-selectively permeable membranes (2) and anion-selectively permeable membranes (3), and such that each membrane is separated from an adjacent membrane by an intermembrane space in which an active carbon textile (4) is positioned, - a device (5) for harvesting the electrical energy generated by a potential differential existing between the 2 electrodes (1), the membrane stack (9) being intended to be supplied with an electrolytic solution (electrolytic solution) 7) of concentration CA in a solute and an electrolytic solution (8) of concentration CB in a same solute, CB being greater than CA, said solutions having to circulate alternately in the intermembrane spaces of said stack (9).



<https://www.sweetch.energy/inod-technology>

Adaptive fabrics for energy harvesting and filtering

Patent number: EP4314400

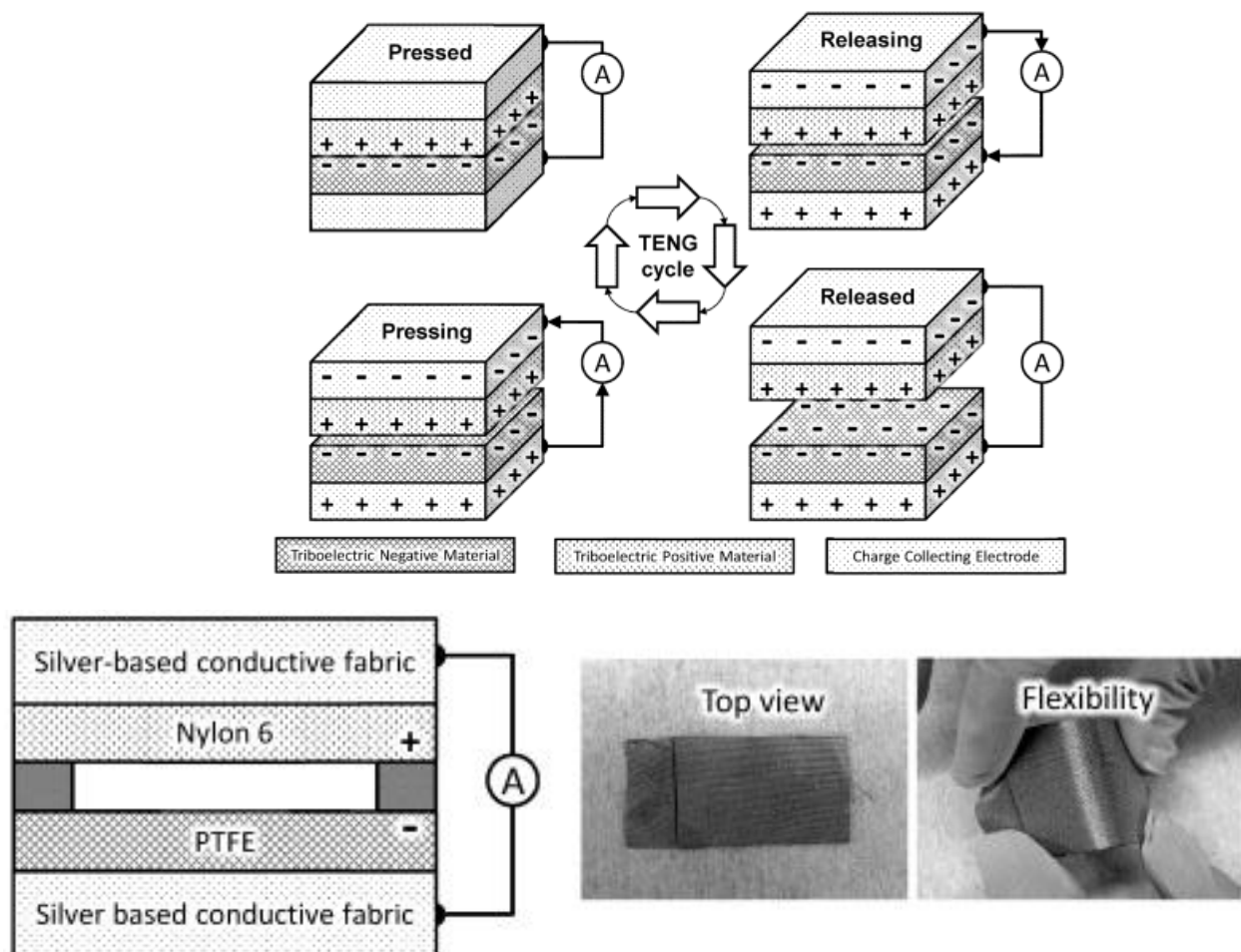
Publication date: 2024-02-07

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Inventor(s): ROSSELLI SILVIA; KHODABAKHSHI SHALAMZARI ELHAM; HENNIG DIANA; ROBERTS ANTHONY; CHERCKA DENNIS; DEICHMANN VITOR ANGELO FONSECA; STAHL SIMON; NELLES GABRIELE; HENNING SIMON; TAKUMA TOMOAKI; SUZUKI SHIGEAKI; YAGIHASHI TATSUYA; SHIBUKAWA KENTARO

Summary

The field of the disclosure lies in adaptive materials for implementation in textiles, wearables and smart clothing. The present disclosure relates to functional fabrics or devices, comprising energy-harvesting fabrics or fiber-based materials which change characteristics upon stimulation with at least one stimulus selected from touch, pressure, friction or light. The present disclosure also relates to the use of said functional fabrics or devices, in particular as pressure or friction or touch sensor or in fabrics being in contact with body parts during walking or running. The present disclosure also relates to the use of said functional fabrics or devices as photo-voltaic or light sensors. The present disclosure also relates to electrostatic boost filter devices comprising said functional fabrics or devices, and their uses to filter particulate matter and/or to filter and clean air.



Energy harvesting fabric

Patent number: US10270271

Publication date: 2019-04-23

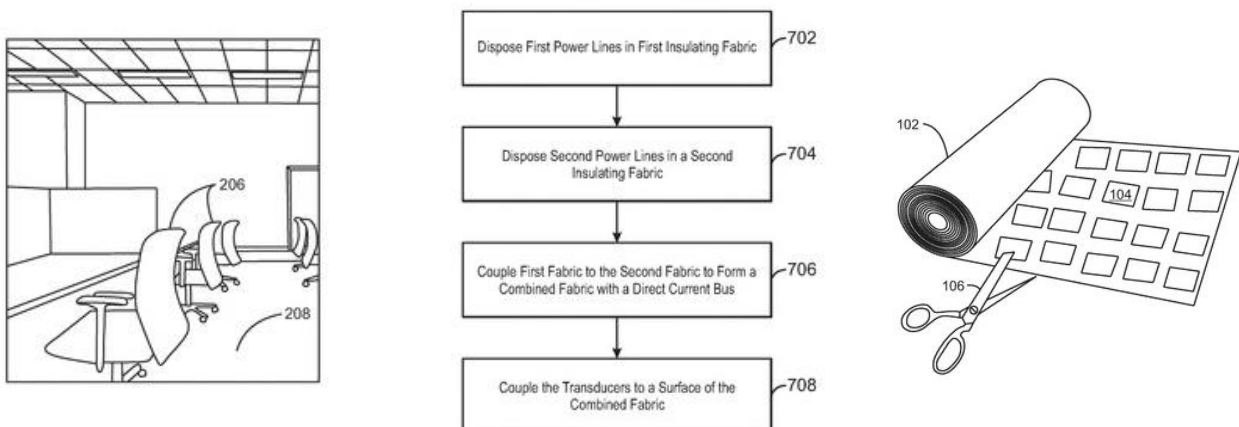
Applicant(s): Intel Corporation

Inventor(s): CAMACHO PEREZ JOSE R.; CORDOURIER MARURI HECTOR A.; LOPEZ MEYER PAULO; ZAMORA ESQUIVEL JULIO C.; MIX JASON A.

Summary

Energy harvesting involves collecting a form of energy, such as solar or thermal energy, and converting the collected energy into electricity. Energy may be harvested using transducers, which may include photovoltaic panels for solar energy, and thermoelectric generators for thermal. However, increasing the amount of energy harvested by transducers is challenging.

The apparatus includes an apparatus for harvesting energy. The apparatus includes a textile having an insulating substrate, a direct current (DC) power bus structure disposed in the insulating substrate, and multiple transducers. The DC power bus includes a positive conductor and a ground conductor. The transducers are secured to the insulating substrate and in electrical contact with the positive conductor and the ground conductor. Additionally, the DC bus remains conductively coupled to the transducers remaining in the textile after the textile is cut. The roll 102 is useful for harvesting energy. The roll 102 includes multiple rectennas 104 arranged in an example rectenna array. A rectenna is a rectifying antenna used to convert electromagnetic energy into DC electricity. Because electromagnetic energy is distributed in space, energy harvesting techniques may use rectenna arrays to increase the range over which energy may be harvested by a single fabric, and the amount of energy harvested. Rectenna arrays may be groups of rectennas 104, physically disposed in proximity with, and electrically connected with, each other. Example energy harvesting fabrics may be used for various kinds of products, such as clothing, carpeting, rugs, curtains, furniture upholstery, and the like.



Fiber based triboelectric textile structure and method for manufacturing energy generator and sensor

Patent number: EP4213367

Publication date: 2023-07-19

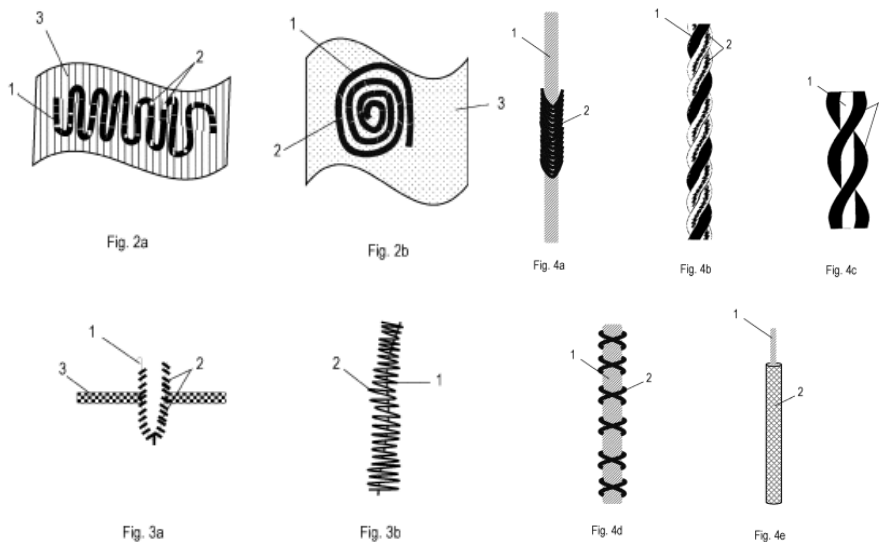
Applicant(s): V-Trion GmbH; Grabher Group

Inventor(s): HOSSAIN GAFFAR; GRABHER GÜNTER

Summary

The object of the present invention is to improve wearable electronics by providing a triboelectric textile structure which can be easily manufactured with all existing machineries and infrastructures, is light-weight, flexible, breathable, washable and can have any structure and thus, can be easily integrated into any textile.

The invention relates to a bicomponent structure for a smart textile energy harvester comprising: an electrically conductive yarn or thread (1), and at least one nonconductive or triboelectric yarn or thread (2), wherein the at least one nonconductive or triboelectric yarn or thread (2) partially or completely covers the electrically conductive yarn or thread (1), wherein the at least one nonconductive or triboelectric yarn or thread (2) and the electrically conductive yarn or thread (1) are attached to a supporting fabric (3) or the at least one nonconductive or triboelectric yarn or thread (2) is wrapped around the electrically conductive yarn or thread (1). The inventive bicomponent structure can generate voltage, current, charges etc. and can be used as a energy generator and an energy autonomous power supply for wearable electronics. Via the triboelectric effect, the bicomponent structure generates energy when it encounters other textile or non-textile surfaces by touching, tapping, contacting, friction, movement with body parts etc. The electrically conductive yarn or thread can be out of the group of metal threads comprising silver, copper, stainless steel, carbon or carbon nanotube coated threads. The at least one nonconductive or triboelectric yarn or thread can be out of the group of natural or synthetic fibers comprising wool, cotton, silk, Polyester (PES), Polyamide (PA), Polytetrafluoroethylene (PTFE), Nylon, Polyacrylonitrile (PAN) and Polyurethane (PU).



Rear tray for vehicle having energy harvesting elements

Patent number: US10109783

Publication date: 2018-10-23

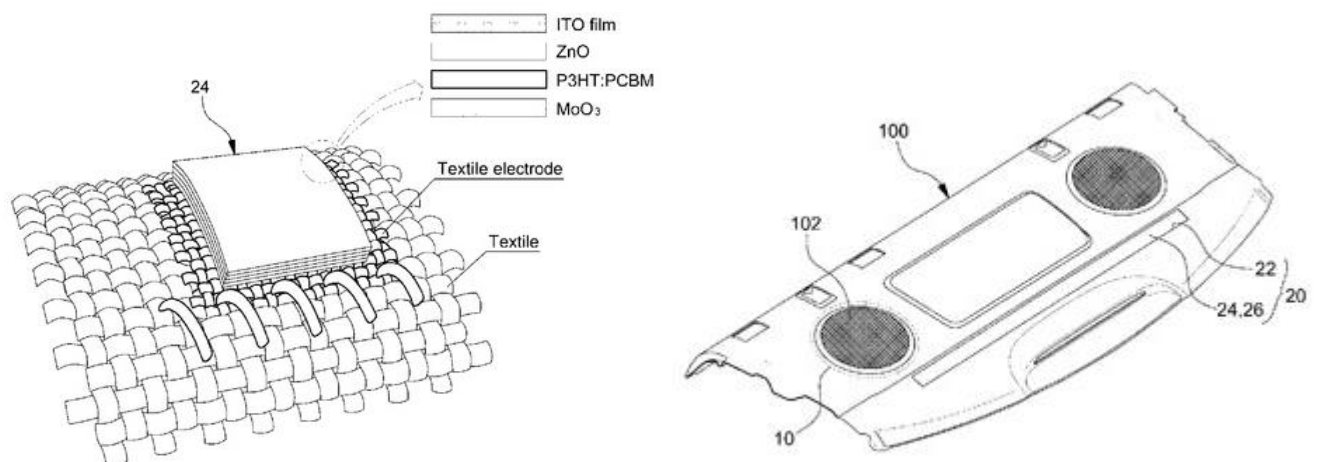
Applicant(s): Hyundai Motor Company; University-Industry Cooperation Group of Kyung Hee University

Inventor(s): HWANG JIN HO; CHOI DUK HYUN; LEE YOUNG HOON

Summary

In an eco-friendly vehicle such as a hybrid vehicle, an electric vehicle, and a fuel-cell vehicle, a high-voltage battery is mounted as a driving power source of a motor which is a driving power source. In addition, an auxiliary battery for supplying power to various electrical equipment and a controller is mounted. In the case of the high-voltage battery and the auxiliary battery which are used in the eco-friendly vehicle, an optimal charging amount is always managed to be stored. To this end, various types of battery charging control strategies such as regenerative braking control have been used. Further, energy harvesting elements which charge a battery of the eco-friendly vehicle and generate separate electric energy to be used as the power for various electrical equipment have been applied to the vehicle. The present inventions disclose an improved structure which may easily mount the energy harvesting element which converts the vibration and friction energy into the electric energy and the energy harvesting element which converts the solar light energy into the electric energy when a rear tray structure of the vehicle which may obtain vibration energy of a vehicle body while solar light energy flows/transmits best.

In a preferred embodiment, the first energy harvesting element structure includes: a support frame fixedly installed to a vehicle body around the speaker at a bottom of the rear tray; a first tribo element installed at a speaker edge of the rear tray and vibrating when the speaker operates; a second tribo element disposed to friction-contact an outer diameter of the first tribo element while contacting the support frame and the bottom of the rear tray to transfer vibration; and a spring connected between the second tribo element and the support frame. The second energy harvesting element structure includes: a mounting hole formed at a rear portion of the rear tray in a width direction of the vehicle; a textile solar cell or a piezoelectric energy harvesting element inserted into the mounting hole to generate electric energy from the solar light or the driving vibration of the vehicle; and a support plate coupled with a bottom of the rear tray while supporting a lower portion of the textile solar cell or the piezoelectric energy harvesting element.



Energy harvesters, energy storage, and related systems and methods

Patent number: EP3268992

Publication date: 2018-01-17

Applicant(s): The North Face Apparel Corp.

Inventor(s): GLADISH JUSTIN LEE; SMITH MARY-ELLEN

Summary

An effective approach for overcoming limited battery life is to recharge a battery using energy converted from available environmental energy. Many environmental (also referred to as “ambient”) sources of energy are available: solar energy, wind energy, thermal energy, hydroelectricity, human or animal movement, and mechanical (e.g., kinetic or mechanical potential) energy. In context of apparel and fabric applications, solar and mechanical (wind, rain, movement) energy is typically available, but conventional harvesters of such energy have been inadequate for consumer goods.

This disclosure concerns energy harvesters, energy storage, systems configured to harvest energy and/or to store energy in a useable form, and related methods. More particularly, disclosed harvesters can be implemented in woven and non-woven (e.g., knitted, felt, etc.) textiles. Such textiles can be used in addition to, or can replace, conventional textiles in familiar products, including, for example, footwear, clothing, sporting goods, luggage, canopies, and other panelized textiles, to convert otherwise wasted or unusable ambient energy to one or more useable forms of energy. A textile construct has a first fiber configured to convert one or more forms of ambient energy to an electrical potential. A plurality of second fibers is mechanically coupled with the first fiber to define a textile. An electrical connector operatively couples to the first fiber to convey the electrical potential to a complementarily configured electrical device. An energy-harvesting platform can have such a textile construct. The complementarily configured electrical device can be a platform accessory.

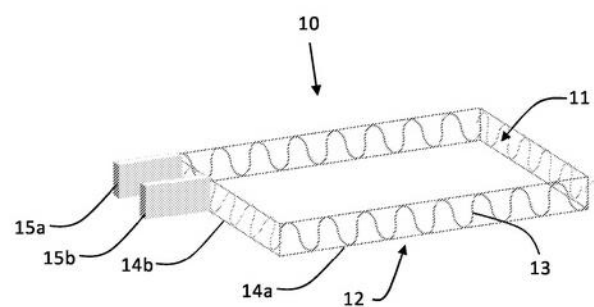


Figure 1 Spacer mesh incorporating an energy harvesting fiber

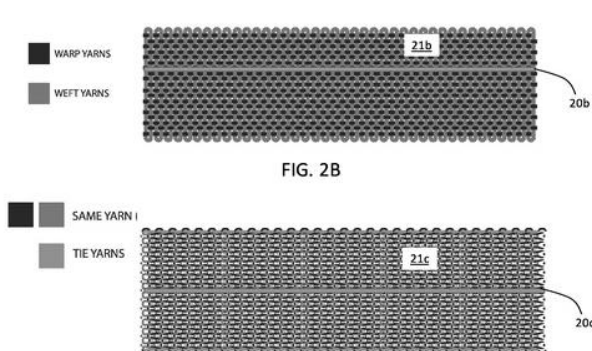


Figure 2 Textile structures incorporating an electrical conductor



FIG. 8A

FIG. 8B

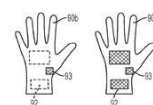


FIG. 8C

Biomimetic, nanofiber-based and directional moisture-wicking electronic skins and fabrication methods thereof

Patent number: US20240260899

Publication date: 2024-08-08

Applicant(s): City University of Hong Kong

Inventor(s): HU JINLIAN; ZHI CHUANWEI; SHI SHUO; SI YIFAN

Summary

The present invention provides a biomimetic, nanofiber-based and directional moisture-wicking wearable electronic fabric having an asymmetric heterostructure, and fabrication methods and applications thereof. A nanofiber-based directional moisture wicking electronic fabric and preparation methods thereof are provided. The electronic fabric includes hydrophobic fibrous layer, hydrophilic fibrous layer, and conductive functional coating layer. In the preparation method of the nanofiber-based electronic fabric, the hydrophobic nanofibers, the conductive coating layer, and the hydrophilic nanofibers are successively constructed by the combination of electrospinning and electrostatic spraying technology. Through the construction of hydrophilic and hydrophobic differences, the all-fibrous electronic fabric of the invention is enabled to transport sweat from the skin surface to hydrophilic nanofibers to maintain good comfort and has the merit of good electricity at the same time. The all-fibrous electronic fabric is easy to be fabricated and has a wide application prospect in the fields of waterproof and moisture permeable clothing and intelligent wearable electronics. The wearable electronic fabric is suitable for all-range health monitoring.

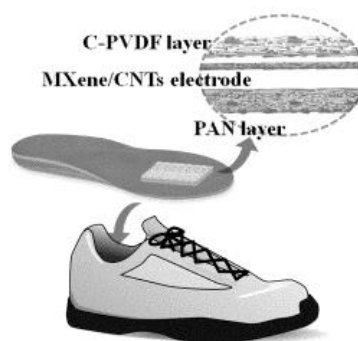
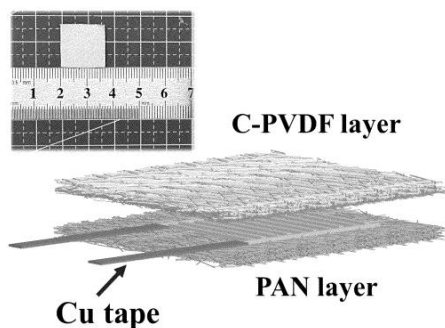


FIG. 5A

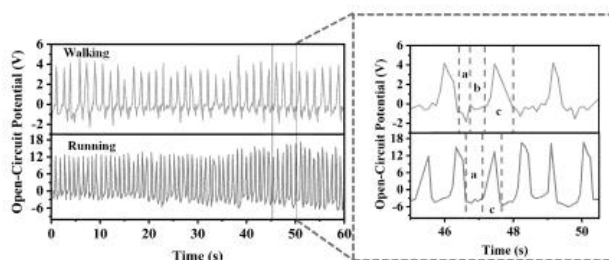
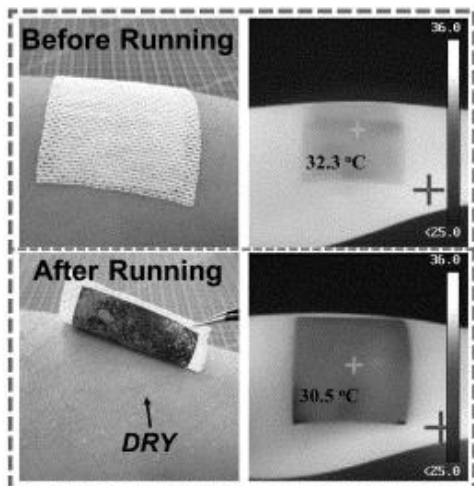


FIG. 5B

Electrical energy harvester using piezoelectricity and triboelectricity

Patent number: KR10-1733277

Publication date: 2017-05-08

Applicant(s): SOGANG UNIVERSITY INDUSTRY UNIVERSITY COOPERATION FOUNDATION

Inventor(s): YUN KWANG SEOK

Summary

With the development of portable electronic devices, there is increasing demand and research for human clothing or wearable electronic devices such as wearable computers, smart wear, and the like. If the electronic device is powered by an energy acquisition technology using energy generated from the movement of a human body, it is possible to contribute to solving the problems of existing power supply media as a continuous energy source which is not limited to time and space development. In addition, in the case of clothing or wearable energy harvesting device, there is an advantage of having high wettability and enabling unconscious energy harvesting.

Disclosed is an electric energy harvest device using piezoelectricity and triboelectricity. According to one embodiment, the electric energy harvest device includes a piezoelectric power generating element using a piezoelectric phenomenon to produce a first electric energy and a triboelectric power generating element using triboelectricity to produce a second electric energy. At least one portion of the piezoelectric power generating element is spaced apart from at least one portion of the triboelectric power generating element. The piezoelectric power generating element is transformed while at least one portion of the piezoelectric power generating element is contacting at least one portion of the triboelectric power generating element by external force, thereby producing the first electric energy. At least one portion of the piezoelectric power generating element makes friction with at least one portion of the triboelectric power generating element by the external force, so that the triboelectric power generating element produces the second electric energy. The electrical energy harvesting element includes a piezoelectric power generator that generates first electrical energy using a woven structure woven into a piezoelectric material and a structure having a plurality of holes therein, and a triboelectric power generator that generates second electrical energy using triboelectric power. The woven structure is woven across and across the structure having the plurality of holes by the piezoelectric material entering and exiting the plurality of holes. The curved surface of the piezoelectric material is formed in a process of weaving the textile by crossing the piezoelectric material and the structure having the plurality of holes.

