International Journal of Science and Research (IJSR)
ISSN (Online): 2319-7064
Index Copernicus Value (2013): 6.14 | Impact Factor (2013): 4.438

Bio Nano Generator

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Abstract: ***A bio-nano generator is a nanoscale electrochemical device, like a fuel cell or galvanic cell, but drawing power from blood glucose in a living body, much the same as how the body generates energy from food. To achieve the effect, an enzyme is used that is capable of stripping glucose of its electrons, freeing them for use in electrical devices. The average person's body could, theoretically, generate 100 watts of electricity using a bio-nano generator. However, this estimate is only true if all food was converted to electricity, and the human body needs some energy consistently, so possible power generated is likely much lower. The electricity generated by such a device could power devices embedded in the body (such as pacemakers), or sugar-fed nanorobots. A similar technology was presented in the Matrix series of science fiction major motion pictures, with robots shown enslaving mankind for its bio-energy.***

Keywords: nanorobot , electrochemical, glucose , galvanic

1. Introduction

Developing new forms of highly efficient, flexible nanogenerator technology using the freely bendable piezoelectric ceramic thin film nano-materials that can convert tiny movements of the human body (such as heart beats and blood flow) into electrical energy. The piezoelectric effect refers to voltage generation when pressure or bending strength is applied to piezoelectric materials. The ceramics, containing a perovskite structure, have a high piezoelectric efficiency. Until now, it has been very difficult to use these ceramic materials to fabricate flexible electronic systems due to their brittle property. The Enery Production are Blood Flow : 0.16 watts, Exhaling: 0.17 watts, Inhaling: 0.14 watts, Walking: 11.4 watts, Mechanical Energy our body produces ,Blood Flow: 0.93 watts, Exhaling: 1.00 watts, Inhaling: 0.83 watts And Walking: 0.67 watts

2. Nanogenerators

Nanogenerator technology, a power generating system without wires or batteries, combines nanotechnology with piezoelectrics that can be used not only in personal mobile electronics but also in bio-implantable sensors or as an energy source for micro robots. [1]Energy sources in nature (wind, vibration, and sound) and biomechanical forces produced by the human body (heart beats, blood flow, and muscle contraction/relaxation) can infinitely produce nonpolluting energy. This nanogenerator technology, utilized the similar protocol of transferring ceramic thin film nano-materials on flexible substrates and produced voltage generation between electrodes. This technology can be used to turn on an LED by slightly modifying circuits and operate touchable flexible displays. In addition, thin film nano-materials ('barium titanate') of this research have the property of both high efficiency and lead-free bio compatibility, which can be used in future medical applications. The prototype could produce as much as 4 watts percubic centimeter. [2]This should be largely enough to power a broad range of nanoscale devices used for defense, environmental and biomedical applications, including biosensors implanted in the body or nano scale robots. Alternatively, nano wires can be defined as structures that have a thickness ordiameter constrained to tens of nanometersor less and an unconstrained length. At these scales, quantum mechanical effects are important — which coined the term "quantum wires". Unlike natural resources such as wood, nano wires are not naturally found and must be synthesized. [3]They can be fabricated from a wide variety of materials including germanium, metals, oxides, gallium nitrate, and silicon. Of course, there is no single standardized method for the fabrication

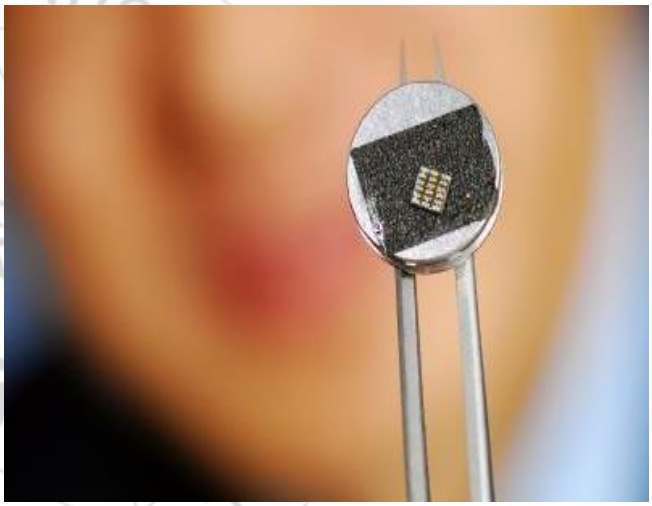

Figure 1: Nano biogenerator

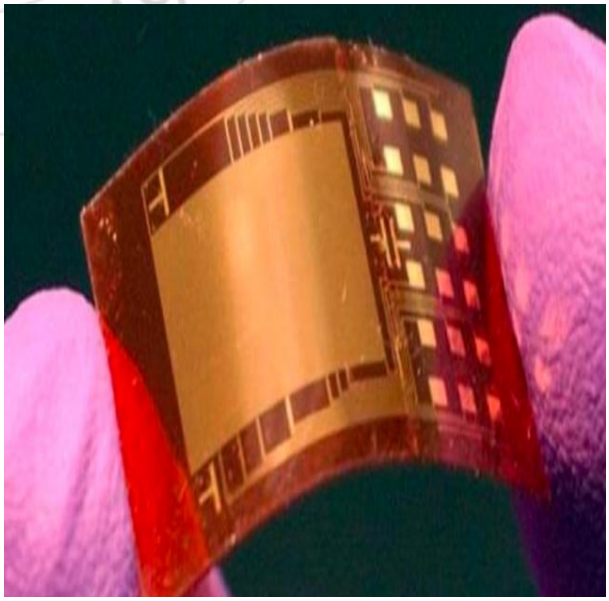

Figure 2: Nanogenerator

3. Methods

However, the methods can be classified into either one of two categories top down method include nanolithography via an election beam and a relatively recent expensive method known as Molecular Beam Epitaxy (MBE) bottom up method deals with direct chemical synthesis in a lab such as the Vapor-Liquid-Solid (VLS) synthesis method.[4] There are many applications where nano wires may become important in electronic, opto-electronic and nano electromechanical devices, as additives in advanced composites, for metallic interconnects in nanoscale quantum devices, as field-emitters and as leads for biomolecular nano sensors. Nanogeneratoris a technology that converts mechanical/thermal energy as produced by small-scale physical change into electricity. Nanogenerator has three typical approaches: piezoelectric, triboelectric, and pyroelectric nanogenerators. Both the piezoelectric and triboelectric nanogenerators can convert the mechanical energy into electricity. [5]However, the pyroelectric nanogenertors can be used to harvest thermal energy from a time-dependent temperature fluctuation.

4. Synthesis

Nanogenerator is expected to be applied for various applications where the periodic kinetic energy exists, such as wind and ocean waves in a large scale to the muscle movement by the beat of a heart or inhalation of lung in a small scale. [6,7]The further feasible applications are as follows. *Self-powered nano/micro devices*. One of the feasible applications of nanogenerator is an independent or a supplementary energy source to nano/micro devices consuming relatively low amount of energy in a condition where the kinetic energy is supplied continuously. **Smart Wearable Systems**. The outfit integrated or made of the textiles with the piezoelectric fiber is one of the feasible applications of the nanogenerator **Transparent and Flexible Devices**. Some of the piezoelectric nanostructure can be formed in various kinds of substrates, such as flexible and transparent organic substrate. **Implantable Telemetric Energy Receiver.** The nanogenerator based on ZnO nanowire can be applied for implantable devices since ZnO not only is bio-compatible but also can be synthesized upon the organic substrate, rendering the nanogenerator bio-compatible in overall.

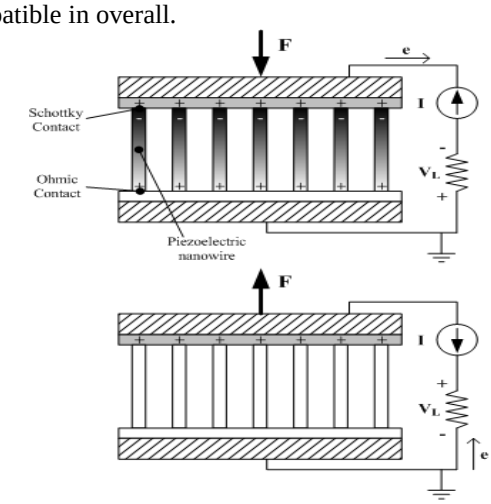

Figure 3: Working Principle

5. Geometrical Configuration

Depending on the configuration of piezoelectric nanostructure, the most of the nanogenerator can be categorized into 3 types: VING, LING and "NEG". Still, there is a configuration that do not fall into the aforementioned categories, as stated in other type.*Vertical nanowire Integrated Nanogenerator (VING).*VING is a 3-dimensional configuration consisting of a stack of 3 layers in general, which are the base electrode, the vertically grown piezoelectric nanostructure and the counter electrode.[8] The piezoelectric nanostructure is usually grown from the base electrode by various synthesizing techniques, which are then integrated with the counter electrode in full or partial mechanical contact with its tip.The other type of VING has been also suggested. While it shares the identical geometric configuration with the aforementioned, such a VING has full mechanical contact between the tips of the nanowires and the counter electrode.[9] This configuration is effective for application where the force is exerted in the vertical direction (toward the c axis of the piezoelectric nanowire), and it generates alternating current (AC) unlike VINGs with partial contact.

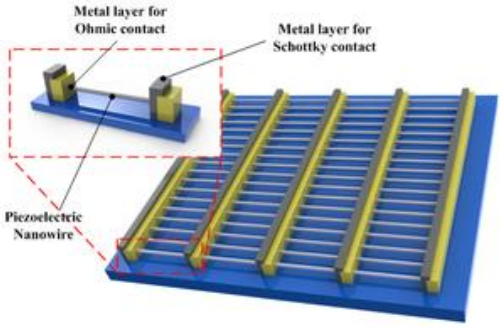

Figure 4: LING

Keywords: nanowires ,nanodevice

Lateral nanowire Integrated Nanogenerator (LING). LING is a 2-dimensional configuration consisting of three parts: the base electrode, the laterally grown piezoelectric nanostructure and the metal electrode for schottky contact. In most of cases, the thickness of the substrate film is much thicker than the diameter of the piezoelectric nanostructure, so the individual nanostructure is subjected to the pure tensile strain.LING is an expansion of single wire generator (SWG), where a laterally aligned nanowire is integrated on the flexible substrate. SWG is rather a scientific configuration used for verifying the capability of electrical energy generation of a piezoelectric material and is widely adopted in the early stage of the development.As of VINGs with full mechanical contact, LING generates AC electrical signal. The output voltage can be amplified by constructing an array of LING connected in series on the single substrate, leading the constructive addition of the output voltage. Such a configuration may lead to the practical application of LING for scavenging large-scale power, for example, wind or ocean waves.

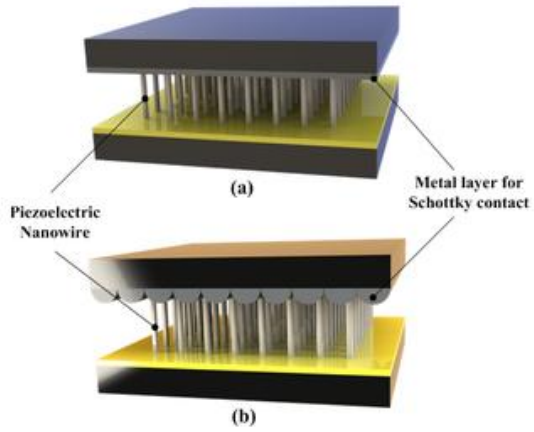

Figure 5: VING

Keywords: schottky , SWG

6. Conclusions

The nanogenerator gives a high output voltage, but the output current is small. It not only can be used as a potential power source, but also as an active sensor for measuring temperature variation. The inner surfaces of the two sheets are covered with two different materials respectively, which should have large difference in their abilities to attract electrons. Also, it is always needed to have an intrinsic gap existing between the two sheets at strain free condition. Expensive process and skilled person require to handle Still, the converted electrical energy is relatively small for operating nano/micro devices; therefore the range of its application is still bounded as a supplementary energy source to the battery. Effective for application where the force is exerted in the vertical direction (toward the c axis of the piezoelectric nanowire), and it generates alternating current (AC) unlike VINGs with partial contact. The other type of the counter electrode by using networked single-walled carbon-nanotube (SWNT) on the flexible substrate, which is not only effective for energy conversion but also transparent. Capability of generating direct current generation without any requirement for the external rectifier. Cost-effectiveness by substituting Indium-Tin-Oxide (ITO) electrode with a graphenelayer. Shown the possibility by generating AC voltage of up to 100 mV from the flexible SWG attached to the running hamster. This approach is expected to contribute to the development of the energy source suitable for the application where the independent operation is crucial, such as Smartdust.

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