

자가발전활용을 위한 마찰전기 나노발전소자의 제작 Fabrication of triboelectric nanogenerator for self-sufficient power source application

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Abstract

The fast development of electronic devices towards wireless, portable and multi-functionality desperately needs the self-powered and low maintenance power sources. The possibility to coupling the nanogenerator to wearable and portable electronic device facilitates the self powered device with independent and self sustained power source. Nanogenerator has ability to convert the low frequency mechanical vibration to electrical energy which is utilized to drive the electronic device [1]. The self powered power source has the ability to generate the power from environment and human activity has attracted much interest because of place and time independent. The human body motion based energy harvesting has created huge impact for future self powered electronics device applications. The power generated from the human body motion is enough to operate the future electronic devices. The energy harvesting from human body motion based on triboelectric effect has simple, cost-effective method [2, 3] and meet the required power density of devices. However, its output is still insufficient to driving electronic devices in continues manner so new technology and new device architecture required to meet required power. In the present work, we have fabricated the triboelectric nanogenerator using PDMS polymer. We have studied detail about the power output of the device with respect to different polymer thickness and varied separation distance.

1. Introduction

With the threat of global warming and energy crises, searching for renewable and green energy resources is one of the most urgent challenges to the sustainable development of human civilization. On the larger scale, besides the well-known energy resources that power the world today, such as petroleum, coal, hydroelectric, natural gas, and nuclear, active research and development are taking place into exploring alternative energy resources such as solar, geo-thermal, biomass, nuclear, wind, and hydrogen. At a much smaller scale, energy and technologies are desperately needed for independent, sustainable, maintenance-free, and continuous operation of implantable biosensors, ultrasensitive chemical and biomolecular sensors, nanorobotics, micro-electromechanical systems (MEMS), remote and mobile environmental sensors, security applications, and even portable/wearable personal electronics.

Piezoelectric nanogenerators and triboelectric nanogenerators have been developed to harvest irregular mechanical energy with variable frequency and amplitude in our environment based on the piezoelectric effect and triboelectric effect, and they have been demonstrated to power small electronic devices. In the present work, we have fabricated the triboelectric nanogenerator using PDMS polymer. We have studied detail about the power output of the device with respect to different polymer thickness and varied separation distance. The fig.1 represents

the schematic representation of triboelectric nanogenerator.

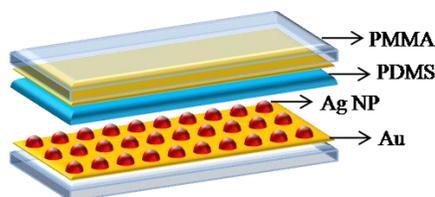


Fig. 1 Schematic of fabricated triboelectric nanogenerator

2. Experimental

Fabrication of Triboelectric Nanogenerator :

The Triboelectric nanogenerator consists of two layer which is PDMS coated on Au/ITO layer and Ag nanoparticle coated ITO layer. The PDMS solution was prepared by mixing the Sylgard 184 elastomer was mixed with curing agent in 10:1 proportion. Further to dilute we added 1 ml of methyl chloride solution and mixed well. The PDMS layer was coated on the Au coated ITO substrate by spin coating method. The thickness of the PDMS layer was controlled by spin coating speed and the viscosity of the PDMS. The downside of the nanogenerator consists of Ag nanoparticle coated on ITO substrate to work as an electrode as well as create more roughness on the contact area. The Ag nanoparticle was prepared by polyol synthesis method. The size of prepared Ag nanoparticle was around 30 nm with uniform shape. The two layer was joined with different spacing distance using scotch tape separator. The separation of two layer was 0.25, 0.5, 0.75, 1 mm. the device was rapped with scotch tape to prevent the peel off problem.

3. Results and discussion

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