ABSTRACT

Flexible Energy Harvesters for Transduction of Mechanical Energy by Human Motion

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In this lecture, high-performance triboelectric energy harvesters are presented by structural and material modification of mechanical contacts. The modification of fabric-based triboelectric energy harvesters is demonstrated and they showed improved performances by the structural and material modification of mechanical contacts.

Fabric-based wearable triboelectric energy harvester with the high humidity-resistance by treatment of various SAMs including FOTS, TFPS and OTS was developed. By applying hydrophobic SAM coating onto conventional fabrics, the harvester owned the outstanding humidity-resistant nature as well as the proper triboelectric characteristic. The original breathability of fabrics could be maintained after the SAM coating. Though the small thickness of SAMs, the coated SAM was enough durable to maintain the mechanical stability over 50 thousand cycles. Furthermore, the coated SAMs can be maintained with respect to the several washing processes. We also demonstrated the harvester could generate electrical output by various human motions with mounted on human body and generated output could be stored for operation of small electronic equipment, which provided the applicability of the developed harvester as a supplemental power source of portable electronics. The coating process to fabricate the harvester has the merit of high simplicity and applicability to substrates with various materials and morphology. With this advantage, our technique could

be possible to be utilized to production of the fabric-based, wearable triboelectric harvester for converting energy from real human motion effectively by minimizing the deterioration of power generation performance even in highly humid condition.

Method using rough-textured surface by embroidered fiber as triboelectric harvester to enhance the electrical output of fabric-based wearable triboelectric harvester is also demonstrated. By integrating rough-textured fibers onto fabrics using embroidery, it is able to increase the total area of triboelectrification. This method is so simple and applicable to real clothes because the modification process is based on real clothing fabrication method. We expect the developed triboelectric energy harvester using wearable fabric may be applied to human body for harvesting energy induced by human motion, as a more effective auxiliary power supply to various mobile appliances. We also demonstrate the electrical output by real human motions and provide an example of application.

By resolving the fabric-based triboelectric energy harvesters-related issues through structural and material modification of mechanical contacts, it is expected that the performance of the fabric-based triboelectric energy harvesters can be enhanced. Consequently, the high-performance fabric-based triboelectric energy harvesters developed by this research can contribute to the enlargement of real application and usage of the triboelectric energy harvesters.