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Highly Reliable Triboelectric Rotational Energy Scavenger

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Triboelectric nanogenerators (TENG) can produce power from ambient mechanical sources and have strong points of high output performance, light weight, low cost, and easy manufacturing process. It is expected that TENG can be utilized in the fields of wireless electronics and self-powered devices in the world which pays attention to healthcare and the IoT. In this work, we focus on scavenging ambient rotational energy by using a durably designed TENG. In previous studies regarding harvesting rotation mode energy, the devices were based on sliding mechanism and durability was not considered as a major issue. However friction by rotation causes reliability problems due to wear and tear. Therefore, in this study, we convert rotary motion to linear motion utilizing a cam by which we can then utilize contact-mode TENG and improve device reliability. In order to increase output performance, bumper springs were used below the TENG and the optimum value for the bumper spring constant was analyzed theoretically. Furthermore, the inserting a soft substrate was proposed and its effect on high output was determined to be due to an increase in the contact area. By increasing the number of cam noses, the output frequency was shown to increase linearly. For the purpose of maximum power transfer, the input impedance of the device was determined. Finally, to demonstrate the use of the C-TENG as a direct power source, it was installed on a commercial bicycle wheel and connected to 180 LEDs. In conclusion we present a rotational motion TENG energy scavenger system designed for enhanced durability and optimized output by appropriate choice of spring constants and substrate.

Keywords: Triboelectric, Nanogenerator, Energy harvesting, Cam