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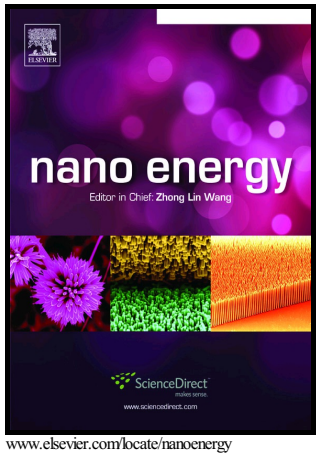

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High performance human-induced vibration driven hybrid energy harvester for powering portable electronics

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Keywords

Electromagnetic, triboelectric nanogenerator, dual Halbach magnet array, hybrid energy harvester, human-induced vibration

Abstract

In this work, we demonstrated theoretically and experimentally the use of a dual Halbach magnet array and combined with a magnetically floated electromagnetic–triboelectric energy harvester to convert the mechanical energy of human induced motion into electrical energy. To achieve very high generated powers, the proposed hybrid energy harvester included a Halbach magnet array, nanostructured polytetrafluoroethylene (PTFE), Al nano–grass, and magnetic springs. A prototype of the hybrid energy harvester was fabricated and tested, with either a vibration exciter or human induced motion. Under a vibration exciter test, the fabricated hybrid energy harvester delivered a high output current of 3.74 mA and a power of 10.07 mW, corresponding to a volume power density of 344 W/m^3 under a loading resistance of 710 Ω at 4.5 Hz resonant frequency and 0.6 g acceleration. In addition, the hybrid harvester was able to generate output powers of 5.8 mW, 2.6 mW, and 3.4 mW from human induced vibration of handshaking, walking, and slow running, respectively. The fabricated hybrid electromagnetic–triboelectric harvester exhibits a much higher power density than recently reported in similar works. This work takes a significant step toward

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