

Flexible Design of Triboelectric Nanogenerators for Efficient Vibration Energy Harvesting

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Abstract : In recent years, many studies have focused on the harvesting of the vibrations energy to produce electrical energy using contact separation (CS) triboelectric nanogenerators (TENG). The simplest design for a TENG consists of a capacitor comprising a single moving electrode. The conversion efficiency of vibration energy into electrical energy can, in principle, reach 100%. But to actually achieve this objective, it is necessary to optimize the parameters of the TENG, such as the dielectric constant and the thickness of the insulator, the load resistance, etc. In particular, the use of a switch which is actioned at optimal times within the TENG cycle is essential. Using numerical modeling and experimental design, we applied a methodology to find the TENG parameters which optimize the energy transfer efficiency (ETE) to almost 100% for any vibration frequency and amplitude. The rather simple design of a TENG is promising as an environment friendly device. It opens the doors for harvesting acoustic vibrations from the environment and to design effective protection against environmental noise.

Keywords : vibrations, CS TENG, efficiency, design of experiments

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