Harnessing Energy from Random Vibrations Using the Triboelectric Effect: A Novel Approach

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The ongoing resource shortage has left the world alarmed. Leaving behind polluting and wasteful sources, the turn to non-conventional energy sources has begun. Triboelectricity, the phenomenon of contact electrification, has emerged as a potential approach for ameliorating the issue. Recent developments give high outputs but either fail to harness a broadband of frequencies or only harness energy from forces in specific directions, making them inefficient. This project is a novel approach for efficiently harnessing energy from random vibrations. The aim was to utilise the Freestanding Layer Triboelectric effect and electrostatic induction to construct a non-polluting, low-cost design using commonly available materials, sans the aforementioned shortcomings. A simple design consisting of a small, flat cylindrical box with circular faces of PTFE of diameter 70 mm was made, with a light aluminium slider inside which moves easily over the PTFE when exposed to random vibrations. Electrodes were drawn on the flat faces of the cylinder. When vibrated randomly, the design exhibited a maximum voltage of 22 V and current of magnitudes as high as 0.16 microamperes. Thus, the maximum power output observed using the aluminium slider was 3.5 microwatts. A change in the material or the diameter of the slider resulted in a change in output. The device can be used in many real-life scenarios involving random vibrations, such as in automobiles, air conditioners, and water bodies. Results can be enhanced by integrating multiple units, performing surface modifications on the slider or on the PTFE surfaces. In light of depleting resources and dearth of efficacious solutions, this design of the triboelectric generator can be used to ergonomically harvest energy from ambient vibrations.

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