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Fabrication and Characterization of Triboelectric Energy Harvester

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Battery has major drawbacks including its size and life expectancy, and environmental problem. As an alternative, energy harvesting is emerging as a potential solution to replace battery along with more energy-efficient IT devices. The idea of harnessing energy from our living environment is sustainable, semi-permanent, and eco-friendly. Also, unlike battery, energy harvester does not require much space to store energy. Therefore, energy harvesting can provide a better source of power for small, portable, and wireless devices. Among various ways of harvesting energy from our surroundings, triboelectricity is chosen due to its potential to be miniaturized, and efficient. Triboelectric effect occurs as two different materials with different polarity of charge separation come into contact through friction, and then become separated so that electric potential difference is achieved. In this research, such characteristic of triboelectricity is used as a way to convert ambient mechanical energy into electric energy.Series of recent researches have shown promising results that the triboelectric energy harvester can be simple and cost effective. However, sufficient electricity level required to operate mobile devices has not yet been achieved.In this research, our group focuses on the design and optimization of triboelectric energy harvesting device to enhance its output. By using maskless lithography to pattern Kapton film and silicon substrate, which is used as a mold for PDMS thin layer, and sputtering metal electrodes on each side, we fabricate and demonstrate different designs of triboelectric energy harvester that utilizes the contact electrification between a polymer thin film and a metal thin foil. In order to achieve optimized result, the output voltage and current are measured under diverse conditions, which include different surface structure and pattern, material, and the gap between layers.

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