Electronics

Fabric generates electricity from movement

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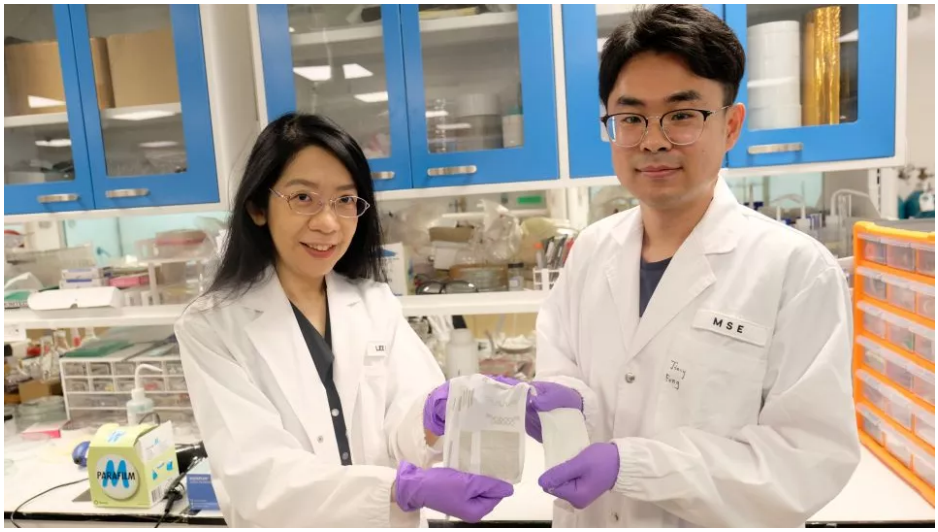
06 Jun 2022

Scientists have developed a stretchable and waterproof 'fabric' that turns energy generated from body movements into electrical energy.



NTU scientists have developed a stretchable and waterproof 'fabric' that turns energy generated from body movements into electrical energy - *NTU Singapore*

Developed by a team at Nanyang Technological University, Singapore (NTU Singapore), the fabric contains a polymer that converts mechanical stress into electrical energy. It is also made with stretchable spandex as a base layer and integrated with a rubber-like material to keep it strong, flexible, and waterproof.

In a proof-of-concept experiment reported in *Advanced Materials*, the NTU Singapore team showed that tapping a 3cm x 4cm piece of the new fabric generated enough electrical energy to light up 100 LEDs.

According to the team, washing, folding, and crumpling the fabric did not cause any performance degradation, and it could maintain stable electrical output for up to five months.

Materials scientist and NTU Associate Provost (Graduate Education) Professor Lee Pooi See, who led the study, said: "There have been many attempts to develop fabric or garments that can harvest energy from movement, but a big challenge has been to develop something that does not degrade in function after being washed, and at the same time retains excellent electrical output.

"In our study, we demonstrated that our prototype continues to function well after washing and crumpling. We think it could be woven into t-shirts or integrated into soles of shoes to collect energy from the body's smallest movements, piping electricity to mobile devices."

The electricity-generating fabric is an energy harvesting device that turns vibrations produced from the smallest body movements into electricity.

The prototype fabric produces electricity when it is pressed or squashed, and when it comes into contact or is in friction with other materials.

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To fabricate the prototype, the scientists first made a stretchable electrode by screen-printing an 'ink' comprising silver and styrene-ethylene-butylene-styrene (SEBS).

This stretchable electrode is then attached to a piece of nanofibre fabric that is made up of poly(vinylidene fluoride)-co-hexafluoropropylene (PVDF-HPF), a polymer that produces an electrical charge when compressed, bent, or stretched; and lead-free perovskites.

NTU PhD student Jiang Feng, who is part of the research team, explained: "Embedding perovskites in PVDF-HPF increases the prototype's electrical output. In our study, we opted for lead-free perovskites as a more environmentally friendly option. While perovskites are brittle by nature, integrating them into PVDF-HPF gives the perovskites exceptional mechanical durability and flexibility. The PVDF-HPF also acts as an extra layer of protection to the perovskites, adding to its mechanical property and stability."

The result is a prototype fabric that generates 2.34W per square metre of electricity – enough to power small electronic devices, such as LEDs and commercial capacitors.

NTU Singapore wearable