This fabric converts body movement into electricity
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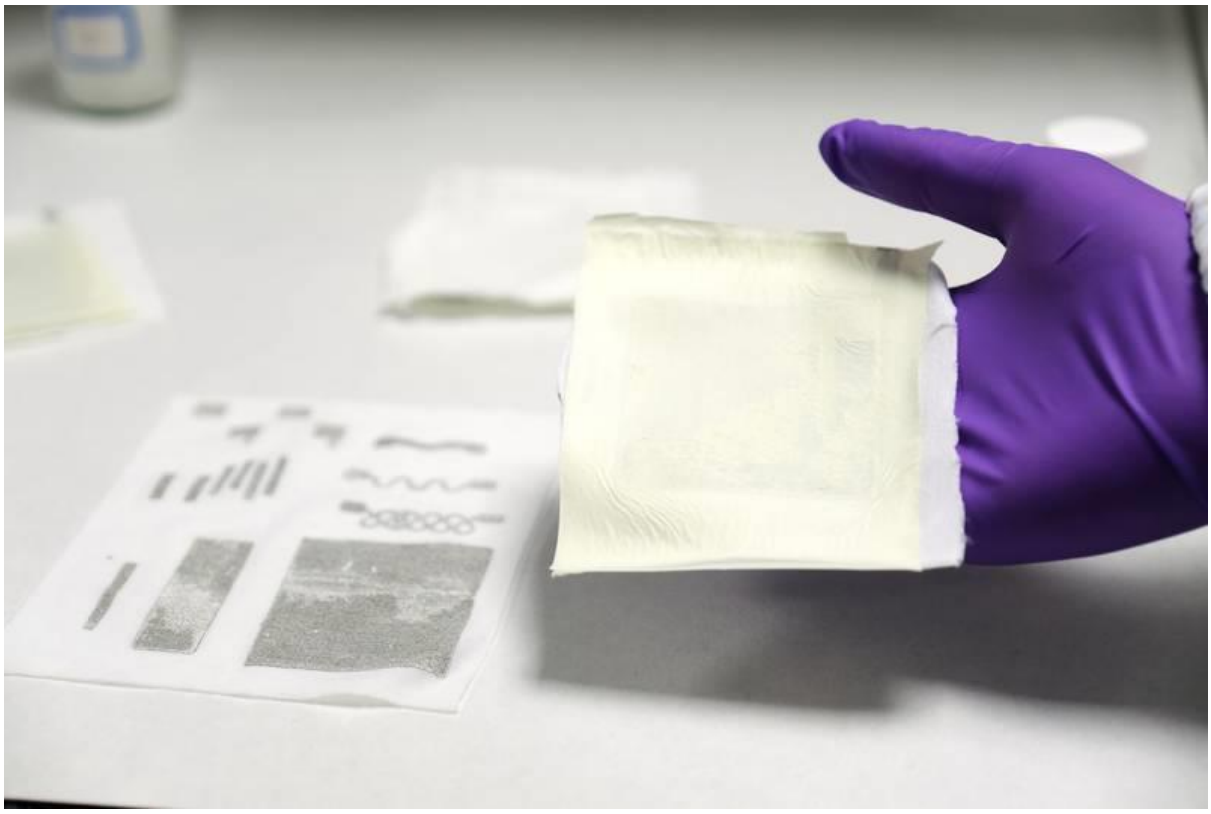
Fabric could one day be integrated into clothing or wearable electronics to power moving devices



The fabric generates electricity with human body movement

By Daniel Casillas
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As part of the transition towards renewable energies in the context of global warming, interesting projects have emerged to generate energy. One of them is a fabric that generates energy with movement.

Scientists at Singapore's Nanyang Technological University (NTU) developed an elastic, waterproof "fabric" that converts the energy generated by body movements into electrical energy.

A crucial component of the fabric is a polymer that, when pressed or squeezed, converts mechanical stress into electrical energy. It is also made with stretchy spandex as a base layer and integrated with a rubber-like material to keep it strong, flexible and waterproof.

To demonstrate how their prototype fabric could work, the NTU scientists showed how a hand continuously tapping a 3-by-4-centimeter piece of fabric could light 100 LEDs or charge several capacitors, which are devices that store electrical energy and are found in gadgets such as cell phones.

The study also showed that washing, folding and crumpling the fabric did not cause any performance degradation, and that it could maintain a stable electrical output for up to five months, which its creators say demonstrates its potential for use as a smart textile and portable power source.

"In our study, we showed that our prototype continues to perform well after washing and crumpling," Lee Pooi See, President's Chair Professor of Materials Science and Engineering at NTU Singapore, who led the team that developed the prototype, told Metro.

The electricity-generating fabric developed by the NTU team is an energy-harvesting device that converts vibrations produced by the slightest body movements in everyday life into electricity.

To create the prototype, the scientists first fabricated a stretchable electrode by screen-printing an "ink" composed of silver and styrene-ethylene-butylene-styrene (SEBS), a material similar to the rubber in teethers and handlebars, to make it more stretchable and waterproof.

This stretchable electrode is bonded to a piece of nanofiber fabric consisting of two main components: poly(vinylidene fluoride)-co-hexafluoropropylene (PVDF-HPF), a polymer that produces an electrical charge when compressed, bent or stretched; and lead-free perovskites, a promising material in the field of solar cells and LEDs.

"Embedding perovskites in PVDF-HPF increases the electrical performance of the prototype. In our study, we opted for lead-free perovskites because it is a more environmentally friendly option," explains Jiang Feng, a doctoral student at NTU who is part of the research team.

The developers of this material believe it could be used in T-shirts or shoe soles to harvest energy from the smallest movements of the body.

"We believe it could be woven into T-shirts or integrated into the soles of shoes to harvest energy from the smallest movements of the body, conducting electricity to mobile devices."

- Lee Pooi See, President's Chair Professor of Materials Science and Engineering at NTU Singapore, who led the team that developed the prototype

2.34 watts per square meter of electricity generated by the fabric.

How does this fabric produce power?
The prototype fabric produces electricity in two ways:

- When it is pressed or crushed (piezoelectricity).

- When it comes into contact or is in friction with other materials, such as skin or rubber gloves (triboelectric effect).

Interview
Lee Pooi See,
President's Chair Professor of Materials Science and Engineering at NTU Singapore, who led the team that developed the prototype.

Q. How did the idea of developing a fabric that converts motion into energy come about?

A. There have been many attempts to develop fabrics or garments that can harvest energy from motion, but a big challenge has been to develop something that does not degrade its function after being washed, while retaining excellent electrical output. In our study, we demonstrated that our prototype continues to function well after washing and wrinkling. We believe it could be woven into T-shirts or integrated into the soles of shoes to harvest energy from the smallest movements of the body, and thus transmit electricity to mobile devices.

Q. Does this fabric withstand washing and creasing?

A. The fabric showed good durability and stability: its electrical properties did not deteriorate after washing, folding and creasing. In addition, it continued to produce stable and continuous electrical power for up to five months. This is due to the materials from which the fabric is made.

The prototype fabric consists of a stretchable and breathable spandex electrode that is printed with silver and styrene-ethylene-butylene-butylene-styrene (SEBS). SEBS is a material similar to the rubber found in teething rings and handlebar grips, and helps make the fabric more elastic and also waterproof.

In the prototype, the stretchable electrode is bonded to a nanofiber fabric containing a polymer called poly(vinylidene fluoride)-co-hexafluoropropylene, or PVDF-HFP for short. PVDF-HFP helps make the fabric more durable and flexible.

Q. What are the applications of this technology and how much energy can it produce?

A. The prototype fabric generates 2.34 watts per square meter of electricity, enough to power small electronic devices, such as LEDs and commercial capacitors. Capacitors are devices that store electrical energy and are found in devices such as cell phones.

NTU researchers found that tapping a 3-by-4-centimeter fabric sample produced enough energy to power 100 LEDs or charge several capacitors.

The scientists believe the fabric can be woven into T-shirts or integrated into the soles of shoes to harvest energy from the body's smallest movements, help power mobile devices, extend the life of a battery or even build self-powered systems.

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