Researchers Develop First Hybrid Perovskite-Based Energy Device

Yen Ocampo(https://opengovasia.com/author/yen-ocampo/) | June 7, 2022(https://opengovasia.com/2022/06/07/)

young asian man fixing computer with protective eyewear

A fabric-based energy-harvesting prototype has been developed (https://www.ntu.edu.sg/docs/default-source/corporate-ntu/hub-news/ntu-singapore-scientists-develop-a-fabric-that-turns-body-movement-into-electricity.pdf?sfvrsn=869781be_1) by a team of scientists at Nanyang Technological University in Singapore (NTU Singapore). It includes a stretchable electrode that is screen-printed with an 'ink' consisting of a rubber-like material found in general-purpose items such as teethers and handlebar grips.

Many attempts have been made to create fabric or garments that can harvest energy from movement, but a major challenge has been to create something that does not degrade in function after washing while also retaining 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.**
>
> **– Lee Pooi See, Lead Scientist and NTU Associate Provost (Graduate Education)**

This is the first hybrid perovskite-based energy device that is stable, flexible, breathable, waterproof, and capable of offering remarkable electrical output performance. It might be integrated into garments or wearable electronics to power devices on the go in the future.

The fabric's performance was not affected by washing, folding, or crumpling, and it could maintain a stable electrical output for up to five months, demonstrating its potential for use as a smart textile and wearable power source.

The energy harvesting technology behind the electricity-generating fabric made by the NTU team turns even the smallest body movements into power. The prototype fabric produces electricity in two ways: crushed or compressed (piezoelectricity); and when it comes into contact or is in friction with other materials, such as skin or rubber gloves (triboelectric effect).

As a result (https://www3.ntu.edu.sg/CorpComms2/Releases/NR2022/NR_220512_energy/energy%20harvesting.pdf), these lead-free halide perovskites/polymers nanofiber composites that are stretchy, waterproof, breathable, and stable have been made to use both triboelectric and piezoelectric effects to harvest energy.

To build the prototype, the researchers first created a stretchable electrode by screen-printing an 'ink' made up of silver and styrene-ethylene-butylene-styrene (SEBS), a rubber-like substance commonly used in teethers and handlebar grips, to make it more flexible and waterproof. The result is a prototype fabric that generates 2.34 watts of electricity per square metre, enough to power small electrical devices like LEDs and commercial capacitors.

The NTU scientists demonstrated how a continuous hand tapping on a 3cm by 4cm patch of the prototype cloth could light up 100 LEDs or charge various capacitors, which are devices that store electrical energy and are found in gadgets such as mobile phones.

By attaching their fabric to the arm, leg, hand, and elbow, as well as the insoles of shoes, the researchers showed that it could extract energy from a wide range of human movements while having no influence at all on the human motion.

Despite increased battery size and lower power use, wearable gadget power sources still necessitate regular battery replacements. The findings reveal that the energy collecting prototype fabric can capture human vibration energy to potentially improve the battery life or perhaps develop self-powered systems.

The NTU team's body of work looks at how the energy generated in the environment might be scavenged, and our fabric-based energy collecting prototype expands on that. For example, the team recently developed a form of film that could be put on roofs or walls to capture the energy generated by wind or rains falling on it. The researchers are currently looking at the possibility of using a single piece of fabric to collect a variety of different forms of energy.