# Sweat-powered battery gets charge from silver flakes

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**The burgeoning world of sweat-powered wearables now includes a prototype battery from Singapore consisting of printed silver flake electrodes that generate electricity in the presence of sweat.**


The soft and stretchable battery has been designed by scientists from Nanyang Technological University, Singapore (NTU Singapore).

Measuring 2cm by 2 cm, the flat battery is fixed to a flexible and sweat absorbent textile that is stretchable and attachable to wearable devices, like watches, wrist bands or arm straps.

To demonstrate its potential use when it becomes incorporated in wearable biosensors and other electronic devices, the team of scientists tested their device with artificial human sweat.

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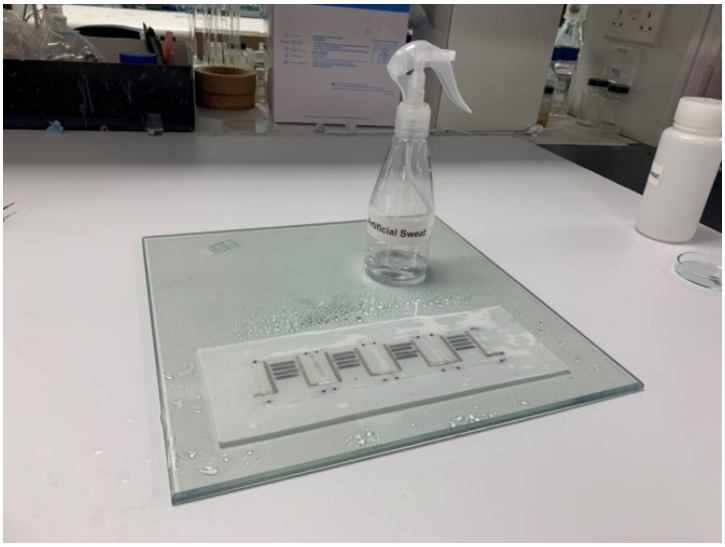
In a separate trial, the team reported that an individual wearing the battery around their wrist and cycling on a stationary bicycle for 30 minutes was able to generate a voltage of 4.2V and output power of 3.9mW that was sufficient to power a commercial temperature sensor and send the data continuously to a smartphone via Bluetooth.

Materials scientist Professor Lee Pooi See, and Dean of NTU Graduate College, who led the study, said: "By capitalising on a ubiquitous product, perspiration, we could be looking at a more environmentally friendly way of powering wearable devices that does not rely on conventional batteries. It is a near-guaranteed source of energy produced by our bodies. We expect the battery to be capable of powering all sorts of wearable devices."

The study has been published in *Science Advances* and a patent application for the sweat-powered battery has also been filed through NTUitive, NTU's enterprise and innovation company.

NTU Singapore said its battery is created by printing ink containing silver flakes and hydrophilic poly(urethane-acrylate) (HPUA), which function as the battery electrodes, onto a stretchable textile.



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When the silver flakes come into contact with sweat, its chloride ions and acidity cause the flakes to clump together, increasing their ability to conduct electricity. This chemical reaction also causes an electric current to flow between the electrodes.

When the battery material is stretched, its resistance is further lowered so it can be used when exposed to strain.

As the stretchable textile is very absorbent, it retains a lot of sweat, so that the battery remains powered even when the rate of sweating is inconsistent. NTU Singapore add that this is important for consistent functioning as the amount of human sweat secreted is variable and depends on the area of the body it is in, the environmental conditions and the time of day.

“Our device could be more durable than current technology, as we showed it could withstand strain from a wearer’s daily activities, and repeated exposure to stress or sweat,” said Prof Lee. “The slim size of our battery also solves two problems in wearable tech: traditional button batteries are a problem for achieving the sort of sleek aesthetics that are attractive to consumers, while thinner batteries reduce the item’s ability to carry enough charge to last throughout the day.”

The researchers plan to further explore the effects of other components of human sweat and how factors such as body heat may affect the performance of the battery.

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