Sweat-powered flexible battery for wearables

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(Credit: NTU Singapore)

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Researchers at NTU Singapore have developed a stretchable, soft battery that is powered by sweat and could be used in conjunction with wearable electronics.

Measuring just 2cm x 2cm, the prototype battery is made using printed silver flakes and hydrophilic poly(urethane-acrylate) (HPUA) onto a stretchable substrate. These function as the battery electrodes, which generate electricity in the presence of human perspiration.

When the device is worn on the wrist, 30 mins work on a stationary bike can generate a voltage of 4.2 V and output power of 3.9 mW, according to a trial carried by the NTU Singapore team. This is enough power to operate a commercial temperature sensor and continuously stream the data to a mobile device or computer via Bluetooth. The work is published in *Science Advances* (https://advances.sciencemag.org/content/7/29/eabg8433).

“Our technology heralds a previously unreachable milestone in the design of wearable devices,” said study lead Professor Lee Pooi See, a materials scientist at NTU Singapore.

“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.”

When the silver flakes come into contact with sweat, its chloride ions and acidity cause the flakes to clump together, increasing their conductivity. This chemical reaction also causes a current to flow between the electrodes. If the battery material is stretched, the resistance is further lowered, meaning it can be used when it is exposed to strain, such as during exercise. As the stretchable textile is highly absorbent, it retains a lot of sweat, so the battery remains powered even when the rate of sweating is inconsistent.

“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.”

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