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# Energy-generating cloth could replace batteries in wearable devices

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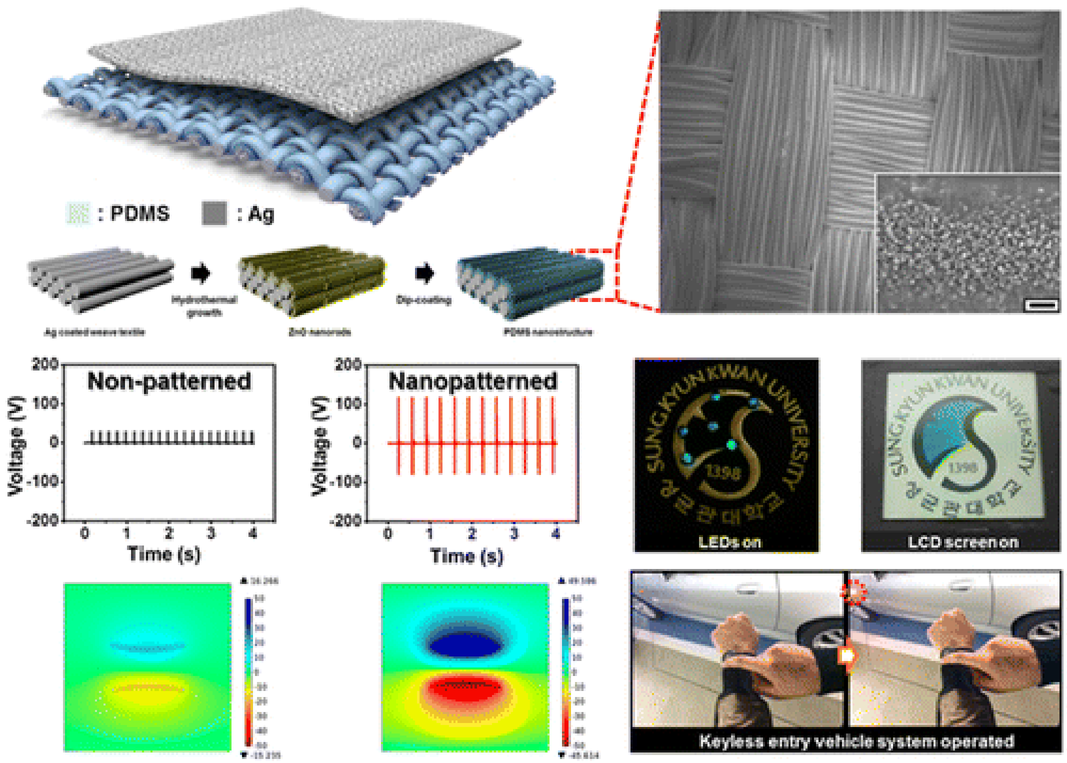


From light-up shoes to smart watches, wearable electronics are gaining traction among consumers, but these gadgets' versatility is still held back by the stiff, short-lived batteries that are required. These limitations, however, could soon be overcome. In the journal *ACS Nano*, scientists report the first durable, flexible cloth that harnesses human motion to generate energy. It can also self-charge batteries or supercapacitors without an external power source and make new commercial and medical applications possible.

Sang-Woo Kim and colleagues point out that the potential of wearable electronics extends far beyond the flashy and convenient. Small, lightweight devices could play life-changing roles as robotic skin or in other biomedical applications. But to maximize their utility, such electronics need an ultra-flexible, long-lasting energy source that is seamlessly incorporated into the device's design. For a possible solution, Kim's team turned to the emerging technology of "triboelectric nanogenerators," or TNGs, which harvest energy from everyday motion.

The researchers created a novel TNG fabric out of a silvery textile coated with nanorods and a silicon-based organic material. When they stacked four pieces of the cloth together and pushed down on the material, it captured the energy generated from the pressure. The material immediately pumped out that energy, which was used to power light-emitting diodes, a liquid crystal display and a vehicle's keyless entry remote. The cloth worked for more than 12,000 cycles.

**More information:** Nanopatterned Textile-Based Wearable Triboelectric Nanogenerator, *ACS Nano*, Article ASAP. DOI: 10.1021/nn507221f

**Abstract**

Here we report a fully flexible, foldable nanopatterned wearable triboelectric nanogenerator (WTNG) with high power-generating performance and mechanical robustness. Both a silver (Ag)-coated textile and polydimethylsiloxane (PDMS) nanopatterns based on ZnO nanorod arrays on a Ag-coated textile template were used as active triboelectric materials. A high output voltage and current of about 120 V and 65 μA, respectively, were observed from a nanopatterned PDMS-

based WTNG, while an output voltage and current of 30 V and 20 μA were obtained by the non-nanopatterned flat PDMS-based WTNG under the same compressive force of 10 kgf. Furthermore, very high voltage and current outputs with an average value of 170 V and 120 μA, respectively, were obtained from a four-layer-stacked WTNG under the same compressive force. Notably it was found there are no significant differences in the output voltages measured from the multilayer-stacked WTNG over 12 000 cycles, confirming the excellent mechanical durability of WTNGs. Finally, we successfully demonstrated the self-powered operation of light-emitting diodes, a liquid crystal display, and a keyless vehicle entry system only with the output power of our WTNG without any help of external power sources.

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