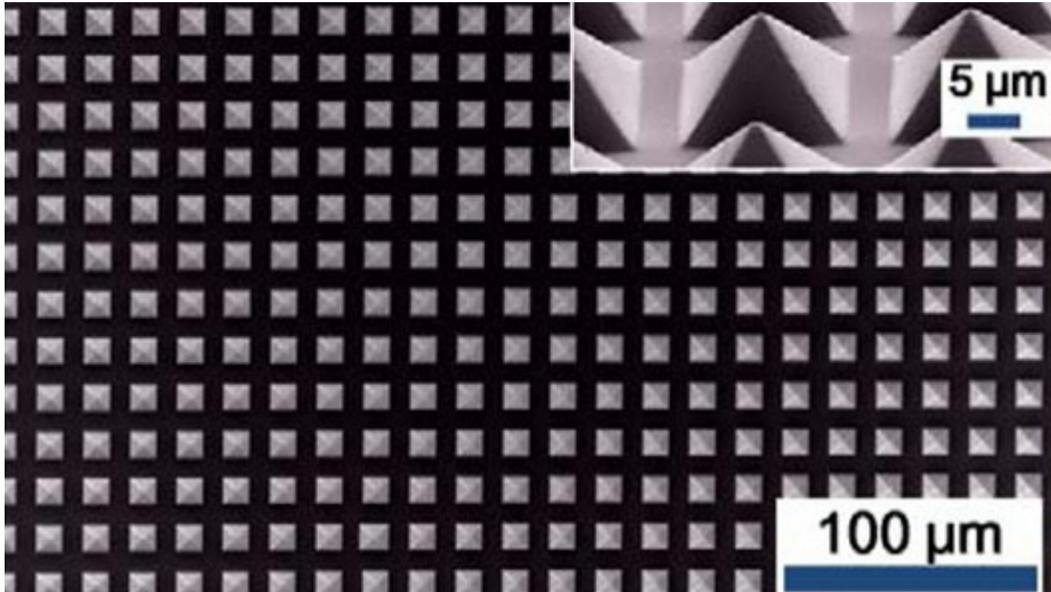
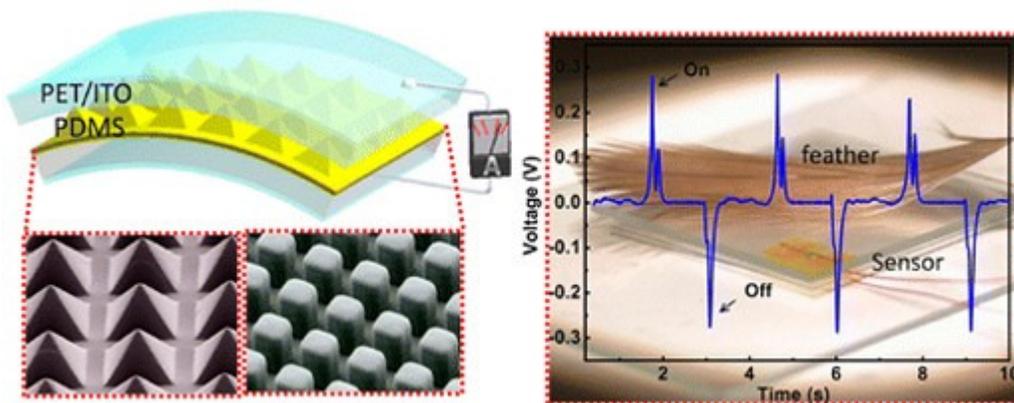


## Friction induced voltage producing touchscreens



The pyramid patterns created in a polymer sheet increase current production in the new triboelectric generator



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A research Organization has developed friction induced voltage producing touchscreens that could be used to produce touchscreens that generate their own power. By introducing a gap separation technique that produces a voltage drop, which leads to a current flow, allowing the charge to be used. This generator can convert random mechanical energy from our environment into electric energy. The team’s generator generates a charge when a sheet of polyester, which tends to donate electrons, rubs against a sheet of polydimethylsiloxane

(PDMS), which accepts electrons. Immediately after the two polymer surfaces rub together, they are mechanically separated, creating an air gap that isolates the charge on the PDMS surface and forms a separation of the positive and negative charges (known as a dipole moment).

Connecting an electrical load between the two surfaces will result in the flow of a small electric current to equalize the charge potential. Therefore, by continuously rubbing the surfaces together and then quickly separating them, the generator can produce a small alternating current. An external deformation is used to press the surfaces together and slide them to create the rubbing motion.

“For this to work, they have to use two different kinds of materials to create the different electrodes as if you rub together surfaces made from the same material, you don’t get the charge differential.”

The researchers say the technique could be used to create a very sensitive self-powered active pressure sensor for potential use with organic electronic or opto-electronic systems. Since the sensors can detect pressure as low as around 13 millipascals, they would be sensitive enough to produce a small current that can be detected to indicate contact from something as small as a feather or water droplet touching the surface of the generator.

Additionally, because the devices can be made around 75 percent transparent, there is the potential for the technology to be used in touch screens to replace existing sensors. “Transparent generators can be fabricated on virtually any surface,” “This technique could be used to create very sensitive transparent sensors that would not require power from a device’s battery.”

Although rubbing smooth surfaces together will generate a charge, the team have managed to increase the current by using micro-patterned surfaces. After testing line, cube and pyramid surface patterning, they found that surfaces patterned with pyramids generated the most electrical current: as much as 18 volts at about 0.13 microamps per square centimeter. This enhanced generating capacity of the pyramid-patterned surface was due to the air voids created between the patterns improving the capacitance change and facilitating charge separation.

The team fabricated the triboelectric generators by first creating a mold from a silicon wafer, onto which the friction-enhancing patterns were formed in recess using traditional photolithography and either a wet or dry etching process. The molds were then treated with a chemical to prevent the PDMS from sticking. The liquid PDMS elastomer and cross-linker were then mixed and spin-coated onto the mold, and peeled off as a thin film after thermal curing. The resulting PDMS film, complete with surface patterning, was then fixed onto an electrode surface made of indium tin oxide (ITO) coated with polyethylene terephthalate (PET) by a thin PDMS bonding layer. The entire structure was then covered with another ITO-coated PET film to form a sandwich structure.

“The entire preparation process is simple and low cost, making it possible to be scaled up for large scale production and practical applications.”

The generators are robust, continuing to generate a current even after days of use and after more than 100,000 cycles of operation.

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