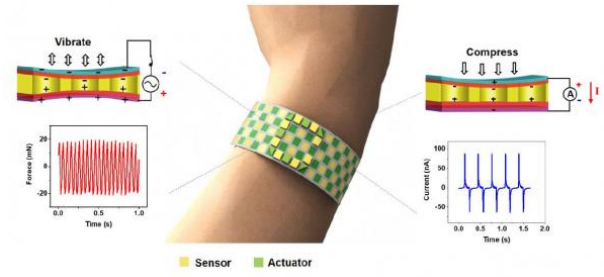
Micrometers-thin haptics film senses pressure too

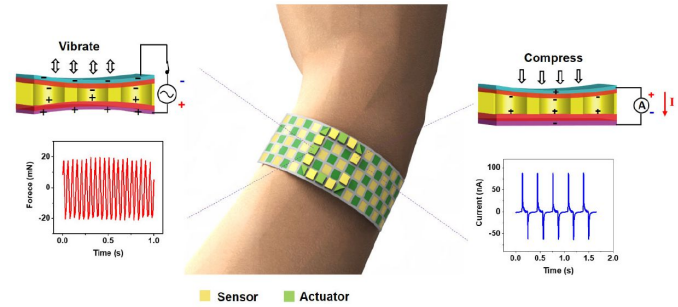
June 12, 2019 //By Julien Happich



Using readily available flexible foil materials, researchers from the University of California, Berkeley, have designed an ultra-thin haptics film capable of strong actuations but also suitable as a pressure sensor.

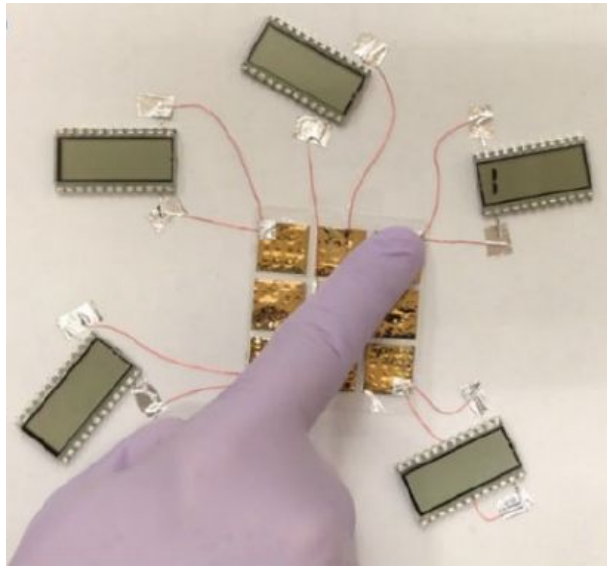
In a paper titled “A Flexible Piezoelectret Actuator/Sensor Patch for Mechanical Human-Machine Interfaces” published in ACS Nano, the authors describe 150um thin sandwich-structured piezoelectret-based device able to assume both the sensor and actuator functions. The flexible device consists of top and bottom fluorinated ethylene propylene (FEP) electret films interspaced by an Ecoflex spacer (with 2mm diameter holes patterned throughout), finalized with gold (Au) and aluminium (Al) electrodes at the top and bottom surfaces, respectively.

To turn the device into an electret, a corona charging process is used to generate megascopic electrical dipoles inside the air cavities formed between the FEP films sandwiching the holed-out Ecoflex spacer. Then, the mere application of an alternating voltage generates alternating electrostatic forces across the device, inducing small vibrations that can be felt by touch for haptics applications.



The actuator/sensor structures as a bracelet-shaped flexible device for mechanical human-machine interfaces providing real-time haptics and sensing through electrostatic actuation and charge generation under mechanical deformation, respectively.

Reversibly, under a mechanical deformation such as body motions (if the sensor patch is worn on the skin across a joint) or a tactile input, the flexible piezoelectret outputs small charges which can be correlated to the applied pressure or motion. By connecting different areas or piezoelectret pixels with driving electrodes (for the haptic effects) or with sensing electrodes (to sense local pressure), one simple piezoelectret film can be designed into an integrated actuator/sensor device with multiple pixels individually driven for real-time sensing and actuation feedback across a wearable skin patch. To prove their concept (for which a patent has been filed), the authors fabricated a 3x3 array intermixing 5 sensor pixels with 4 actuator pixels on the same piezoelectret film, each about one square centimetre.



A 3x3 matrix of piezoelectret pixels intermixing 5 sensor (S) pixels and 4 actuator (A) pixels on the same piezoelectret film.

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