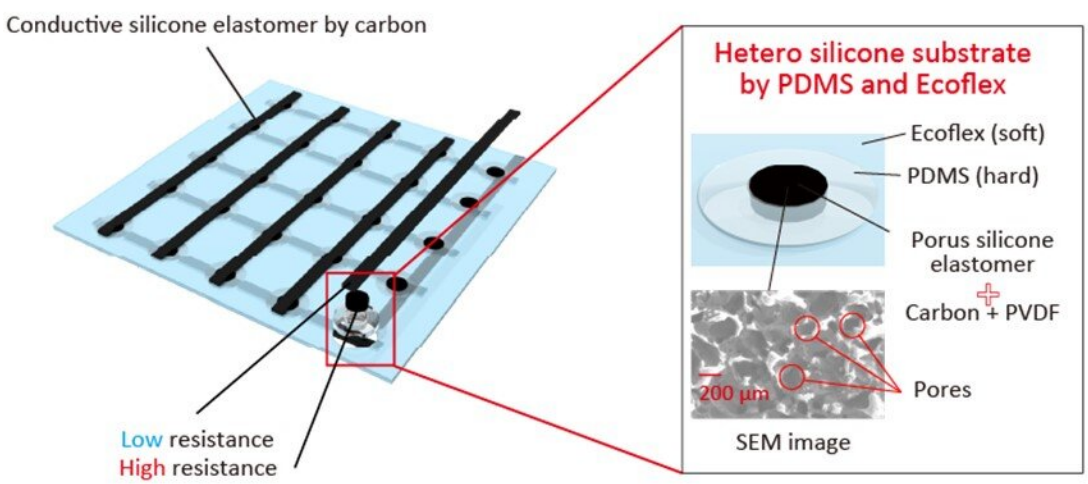
# How to bounce back from stretched out stretchable sensors

September 25 2020




Schematic of the array. This silicone substrate is made of two different silicone types with different hardness values. Harder silicone, PDMS, in the pressure part can suppress the deformation of the pressure sensing elements during tension. Credit: Hiroki Ota, Yokohama National University

Elastic can stretch too far, which could be problematic for wearable sensors. A team of researchers at Yokohama National University has proposed a fix to prevent too much stretching while improving the sensing ability of electronics. This could lead to advanced prosthetics or disaster recovery robotics.

They published their results on July 29 in the *Scientific Reports*.

"Stretchable physical sensors are crucial for the development of advanced electrical systems, particularly wearable devices and soft robotics," said Hiroki Ota, paper author and associate professor in the Faculty of Engineering at Yokohama National University. "However, current stretchable pressure sensors composed of elastic materials can be highly deformed during the strain of the devices."

The bend of an elbow or a knee can push the sensor past its structural integrity, producing a large error on the pressure movement measurement. This stops the sensor from being able to measure pressure and strain at the same time, but as independent variables.

To combat this, the researchers proposed a monolithic array of pressure and strain sensors that can simultaneously and independently detect the force and bend deformation of motion. They used two different materials—one soft and one hard—to protect the sensor's ability to stretch and still accurately measure movement. They placed a hard silicone, called PDMS, along electrodes over the array. At the center of each PDMS placement, they positioned soft porous silicone, which senses pressure.

"The PDMS around the pressure-sensing elements prevents the development of large deformations of the elements during the developed device tension," Ota said.

The soft, porous silicone pressure sensor is contained within the hard shell of the PDMS, so it can measure the force of pressure without being overextended past reliable margins of error. The containment also allows the sensors to identify and measure both pressure and strain as independent contributors to movement.

"In addition, resistances of column and row electrodes in the matrix of the mapped array are much lower than the ones of the pressure sensors," Ota said. "This substrate and control of electrode resistances can prevent stretch deformation of the device from affecting the sensing of pressure."

The electrodes in the stretchable array can measure strain at a much lower rate than is required to detect pressure.

"We could recognize pressure and strain sensing of our device independently," Ota said.

Ota said the team plans to apply the new stretchable sensor approach to a physical keyboard that can be mounted on the surface of a body, which could bend with the strain of the body and still detect fingertip pressure, as well as a physical sensor on a soft robot. They also hope to use the sensor to better understand the motion and touch of the human hand.

"In the future, by molding this sensor into a glove shape, it can be applied to the device which electronically analyzes the finger movement and tactile sense of the hand," Ota said.

**More information:** Ryosuke Matsuda et al, Highly stretchable sensing array for independent detection of pressure and strain exploiting structural and resistive control, *Scientific Reports* (2020). DOI: 10.1038/s41598-020-69689-2

Provided by Yokohama National University

Citation: How to bounce back from stretched out stretchable sensors (2020, September 25) retrieved 20 March 2024 from https://techxplore.com/news/2020-09-stretchable-sensors.html

This document is subject to copyright. Apart from any fair dealing for the purpose of private study or research, no part may be reproduced without the written permission. The content is provided for information purposes only.