Docket #: S18-419

A biomimetic electronic skin (e-skin) with discriminating forces

Researchers in Professor Zhenan Bao's group at Stanford University have developed a biomimetic soft electronic skin (e-skin) with multiple levels of biologically inspired patterning that can detect the direction of applied forces. Composed of an array of capacitors, this e-skin can measure and discriminate in real time, normal and shear forces. Unlike common pressure sensors which only measure one directional force limiting tactile sensing for robots, this human skin inspired design can measure multi-directional forces. Moreover, the novel dome design with microstructures enable increased sensitivity, minimal hysteresis, excellent cycling stability and response time in the millisecond range. The prototype has been tested to control a robot arm in various tasks, illustrating its potential application in robotics with tactile feedback.

Figure

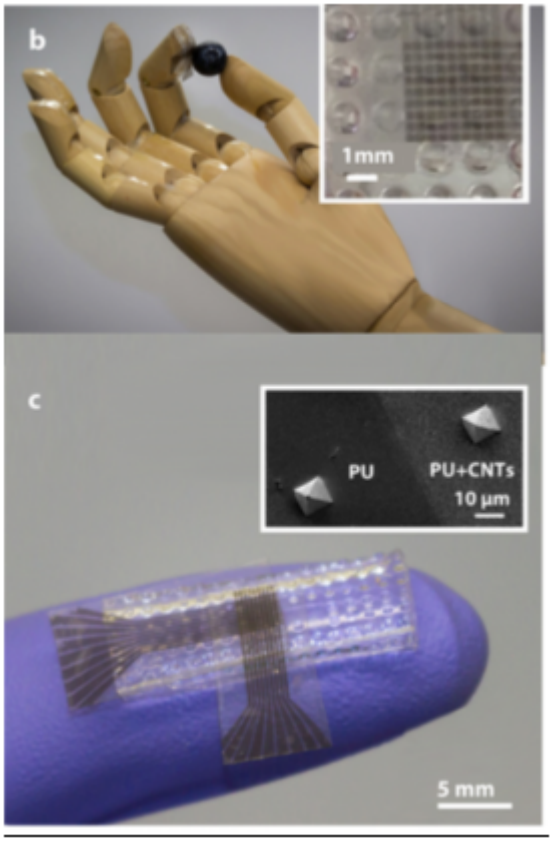


Figure description - b) Optical image of a fabricated e-skin and close-up view on the hills and electrodes (inset). c) Optical image showing the CNTs-PU (polyurethane) interconnects for signal recording with LCR (inductance-capacitance-resistance) meter and SEM picture of the top e-skin layer with molded pyramids, showing CNTs-PU and PU areas (inset).

Stage of Research

- Sensor prototypes completed
- Proof-of-concept – sensors tested on robotic arm that performed specific tasks

Applications

- Artificial Skin for prosthetic limbs or robots
- Multimodal Sensors
- Biomedical Use (healthcare, diagnosis, and surgery)
- Smart textiles
- Exploratory missions in hard to reach places

Advantages

- Flexible and skin-like
- Real time measurement of normal and shear forces
- Enables tactile sensing for dexterous movement
- Novel dome design with molded pyramid structures enhances sensitivity, efficiency, and stability

Publications

- Clementine M. Boutry, Marc Negre, Mikael Jorda, Orestis Vardoulis, Alex Chortos, Oussama Khatib and Zhenan Bao."A hierarchically patterned, bioinspired e-skin able to detect the direction of applied pressure for robotics" *ScienceRobotics*, published 21 Nov 2018, Vol 3, Issue 24
- "Stanford develops an electronic glove that gives robots a sense of touch" *Stanford News*, published online 21 Nov 2018

Innovators

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