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SOFT ELECTRONICS

Stretchable artificial synapse for soft robots

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Neuromorphic computing refers to electronic devices and computer architectures that mimic the behavior of human brain and they offer significant advantages compared to conventional Von Neumann computer architecture for parallel computation and machine learning applications. For example, the neuronal activities and synaptic behavior can be emulated using either CMOS integrated circuits or individual devices such as memristors or artificial synaptic transistors. While there has already been abundant literature on artificial synaptic transistors based on floating gate, ferroelectric dielectric layer, or ionic liquid, most of those devices are built on either rigid or plastic substrates.

Cunjiang Yu *et al.* has recently demonstrated intrinsically-stretchable transistors that can be used for artificial synapse applications. Such devices can be stretched by up to 50% while maintaining their functionality. Due to the stretchability and the use of elastomeric materials, these devices are especially suitable for bio-inspired soft robot applications. Using such stretchable synaptic transistors, the team has demonstrated a deformable bioinspired electronic skin comprising an array of monolithically integrated pressure sensor used to generate the presynaptic pulses and synaptic transistors that converts the signal to postsynaptic currents (PSC), allowing spatiomapping of the applied pressure to be achieved. Furthermore, they showthat touch can be used to triggers voltage pulses generated by a triboelectric nanogenerator, which induces PSC inthe synaptic transistor and the signal can be used to control the bending of pneumatic actuators. Based on the mechanism above, a very interesting soft robot whose locomotion can be controlled through simply touching the stretchable skin on the robot is demonstrated.

Chuan Wang (Department of Electrical & Systems Engineering, Washington University in St. Louis, USA)
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WEARABLE SENSOR

MXene-based wearable biosensor

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Wearable multifunctional sweat-based sensingis a promising strategy for noninvasive biomarker monitoring. However, in spite of the progressive improvements through various strategies, sweat-based biosensors still face several challenges, for example, operating instability of enzymes or biomaterials, limited detection range and sensitivity, and poor shelf life of working electrodes.

Recently, Alshareef *et al.* from King Abdullah University of Science and Technology (KAUST) reported a stretchable, wearable, and multifunctional biosensor based on MXene/Prussian blue ($Ti_3C_2T_x$/PB) composite. Due to the metallic conductivity and excellent electrochemical activity of $Ti_3C_2T_x$, the $Ti_3C_2T_x$/PB composites exhibited distinctly improved electrochemical performance when compared to graphene/PB or carbon nanotubes/PB composites. Furthermore, the implemented solid-liquid-air three-phase interface design ensures a sufficient supply of O_2 and increases the stability of biosensors. As a result, typical electrochemical sensitivities of 35.3 μA mm^{-1} cm^{-2} for glucose and 11.4 μA mm^{-1} cm^{-2} for lactate are achieved, together with the high sensitivity and good repeatability during *in situ* perspiration monitoring of human subjects. This work represents an essential step toward the realization of ultrasensitive enzymatic wearable biosensors for personalized health monitoring.

You Meng and Johnny C Ho (Materials Science and Engineering, City University of Hong Kong, Hong Kong SAR, China)
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