Materials

Low-cost, Printable and Stretchable Sensor for Human Motion Monitoring

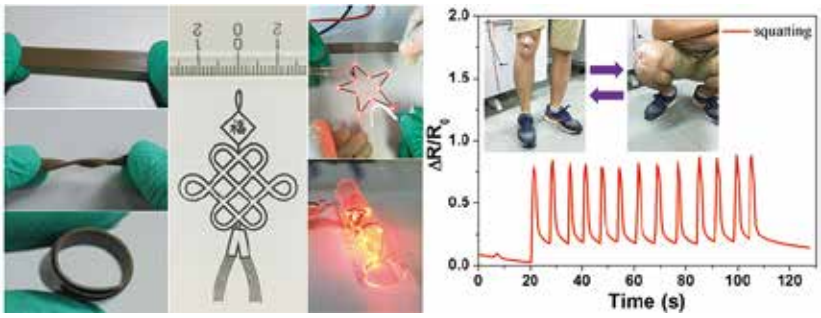
Flexible and stretchable conductive materials have received significant attention in several applications such as flexible circuits, strain sensors, electronic skins, actuators and wearable smart textile systems thanks to their high mechanical deformation capability. Because of their promising applications in electronic skins and human motion monitoring systems, strain sensors with high stretchability, broad strain range, high sensitivity, and good reliability are desirable conductive materials. Conductive elastic composite, typically composite of insulated elastomer enriched with conductive fillers, is widely used to fabricate wearable strain sensors due to its low fabrication cost. However, to make a strain sensor that simultaneously produces facile fabrication process, high stretchability and high sensitivity, even with high electrical conductivity remains challenging.

Researchers from the Shenzhen Institutes of Advanced Technology, Chinese Academy of Science have recently developed a high performance strain sensor based on printable and stretchable electrically conductive elastic composites.

The new strain sensor was fabricated by mixing silver-coated polystyrene spheres (PS@Ag) and liquid polydimethylsiloxane (PDMS) and screen printed to a desirable geometry. The strain sensor exhibits fascinating comprehensive performances, including high electrical conductivity (1.65 × 104 S/m), large workable strain range (> 80%), high sensitivity (gauge factor of 6.0~78.6), inconspicuous resistance overshoot (< 15%), good reproducibility and excellent long-term stability (1,750 h at 85 °C/85% relative humidity) for PS@Ag/PDMS-60, which only contains ~ 36.7 wt.% of silver.

Simultaneously, this strain sensor provides the advantages of low-cost, simple, and large-area scalable fabrication, as well as robust mechanical properties and versatility in applications. Based on these performance characteristics, its applications in flexible printed electrodes and monitoring vigorous human motions are demonstrated, revealing its tremendous potential for applications in flexible and wearable electronics.

The paper titled "A low-cost, printable, and stretchable strain sensor based on highly conductive elastic composites with tunable sensitivity for human motion monitoring" has been published in the *Nano Research*. This research work was supported by the Ministry of Science and Technology of China, the National Natural Science Foundation of China, the Chinese Academy of Sciences and Guangdong provincial government.



Demonstration of the mechanical flexibility and printability of the conductive elastic composites and their applications in flexible printed circuit board and human motion monitoring.