Flexible active dual-parameter sensor for sensitive temperature and physiological signal monitoring via integrating thermoelectric and piezoelectric conversion

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Abstract

Flexible sensors with high sensitivity and selectivity to different external stimuli are highly desired in wearable electronics, especially those have more than one function. Here, we developed a flexible active dual-parameter sensor based on all organic piezoelectric poly(vinylidene fluoride) and thermoelectric polyanilline (PANI)-based composite films in a sandwiched structure, for sensitive temperature and physiological signal monitoring. Highly conductive PANI-based films working as electrodes resulted in higher electromechanical conversion than traditional metal electrodes. The functions of the device as physiological signals active sensor were examined via human motion, including elbow bending, pronunciation, and artery pulse. The integration of high performance thermoelectric PANI-based films enabled the device to sense ambient temperature with high sensitivity (45.5 μV/K) and quick response (1.2 s). More importantly, a series experiments proved that the device was capable of sensing temperature and tactile stimuli simultaneously without signal interference. Our work provided a promising prototype for active dual-parameter sensor, which has great potential in applications of wearable health-monitoring systems.

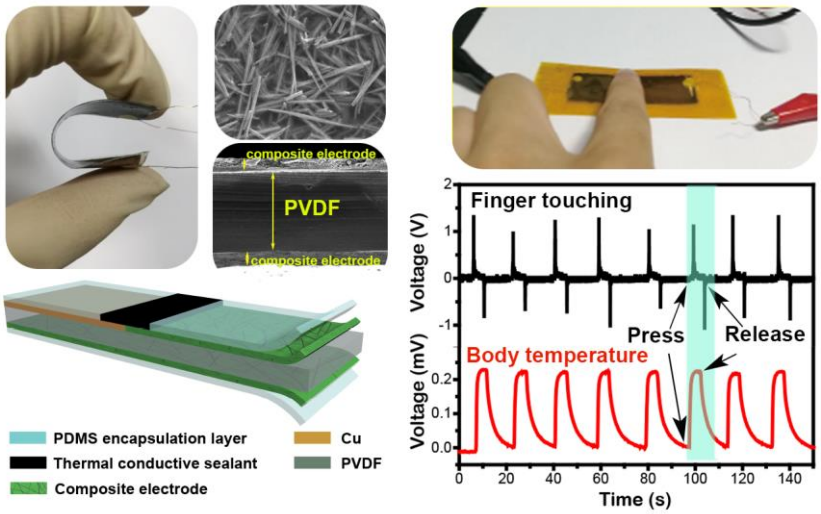

Figure 1: Flexible active dual-parameter sensor for sensitive temperature and physiological signal monitoring