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Porous conductive electrode for highly sensitive flexible capacitive pressure sensor over a wide range

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Краткое описание

Flexible capacitive pressure sensors have aroused widespread concern due to their promising application in wearable electronics. However, the trade-off between sensitivity and response range is yet to be resolved. Herein, flexible capacitive pressure sensors are developed based on high concentration carbon nanotube(CNT)-doped porous electrode and an ultrathin porous polyvinylidene difluoride (PVDF) dielectric layer. Benefit from the continuous variations of contacting area between the porous electrode and dielectric layer, as well as the larger relative distance, the sensor shows high sensitivity over a wide range (1.033 kPa^{-1} within 0–1 kPa, 0.72 kPa^{-1} within 1–5 kPa, 0.34 kPa^{-1} within 5–10 kPa and 0.23 kPa^{-1} within 10–30 kPa). The sensor is differentiated from other conventional capacitive pressure sensor, which usually relies on air gap or dielectric constants to tune sensor's performance. The effect of CNT doping ratio, the thickness of dielectric layer and the thickness of porous electrode on the capacitance performance are explored. Fundamental understanding of the sensing mechanism is achieved through finite-element analysis and simplified analytical models. The capacitive sensor demonstrates its application in monitoring physiological signals such as the artery pulse, and muscle activation, showing potential in wearable healthcare monitor. © 2022 Elsevier B.V.

Ключевые слова автора

Carbon nanotubes; Flexible pressure sensor; High sensitivity; Porous electrode; Ultrathin dielectric layer

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