Ultra-sensitive piezoresistive pressure sensors based on biologically assembled conductive hybrid nanomesh of single-walled carbon nanotubes

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Piezo-resistive sensing platform, one of the conventional transduction mechanisms for tactile sensing, has been investigated exceedingly owing to its simple and facile developing process. While maintaining high sensitivity at large operating range, fabricating a simple and scalable device structure is a key in mass production of the tactile sensors. Here in, we report a novel method of developing a piezoresistive pressure sensor with readily controllable microstructures over a large area. In this experiment, we employed hydro-dynamically assembled nanomeshes of single-walled carbon nanotubes (SWNTs) as the conductive layer by placing on micro-patterned polydimethylsiloxane (PDMS) substrates. Rigorous arrays of micro-pyramid yield high pressure sensitivity at low-pressure regimes (< 1000 Pa) and the hybrid nanomeshes are mechanically robust with potential scalability. From the measurements, up to 14.5 kPa-1 of sensitivity was displayed at pressure ranges below 50 Pa, which is relatively high compared with the existing piezoresistive sensors. This work provides a promising approach to developing highly controllable, flexible tactile sensing platform.