ESI Support Information

Highly sensitive piezoresistive sensor with interlocked graphene microarrays for meticulous monitoring of human motions

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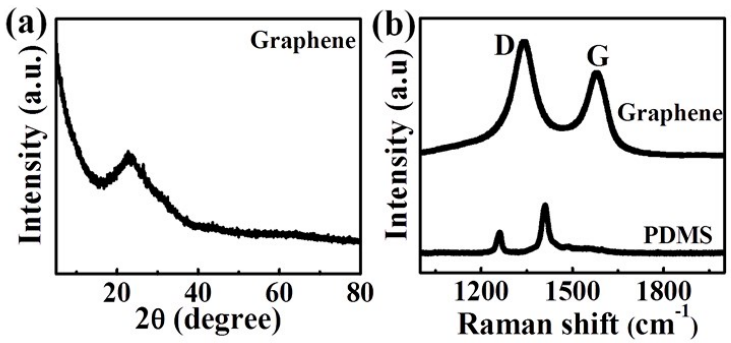

Figure S1. (a) X-ray diffraction (XRD) pattern of drop-coated graphene film. (b) Raman spectra of microstructured PDMS before and after drop-coating of graphene.

The diffraction peak at 23.9◦ can be assigned to the (002) reflection of graphene (Figure S1a). The characteristic peaks at 1344 cm^{-1} and 1580 cm^{-1} in the Raman spectra (Figure S1b) can be ascribed to D band (represents edges, disordered carbon and defects) and G band (corresponds to vibration of ordered sp^2-hybrided carbon), suggesting the successful modification of graphene on PDMS.

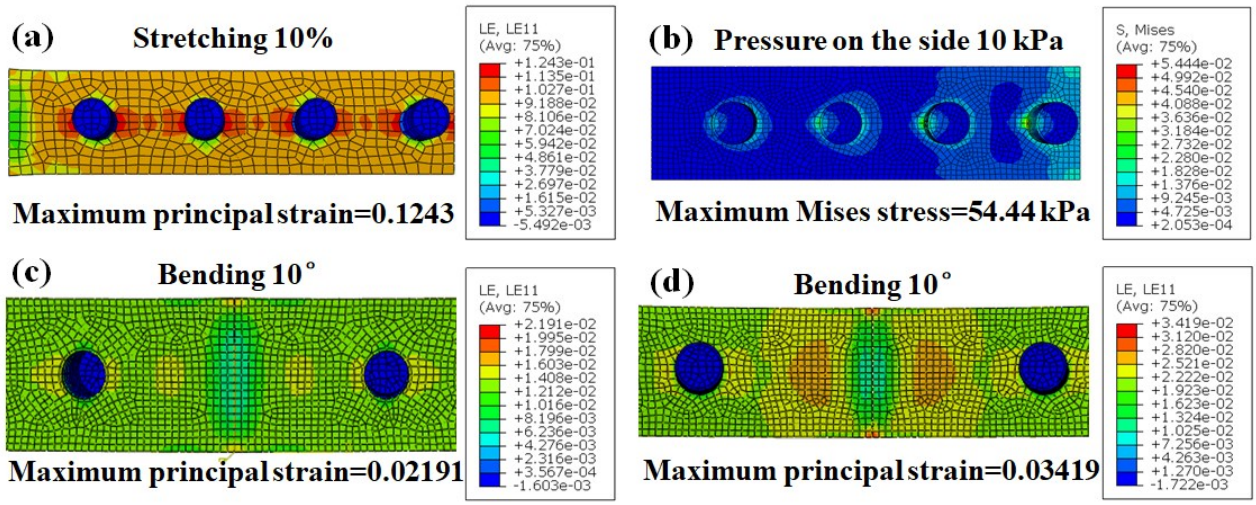

Figure S2. (a) Maximum principal strain, (b) maximum Mises stress, and (c) maximum principal strain of side-contact interlocked sensor under stretching, shear and bending forces. (d) Maximum principal strain of non-interlocked sensor under bending force.

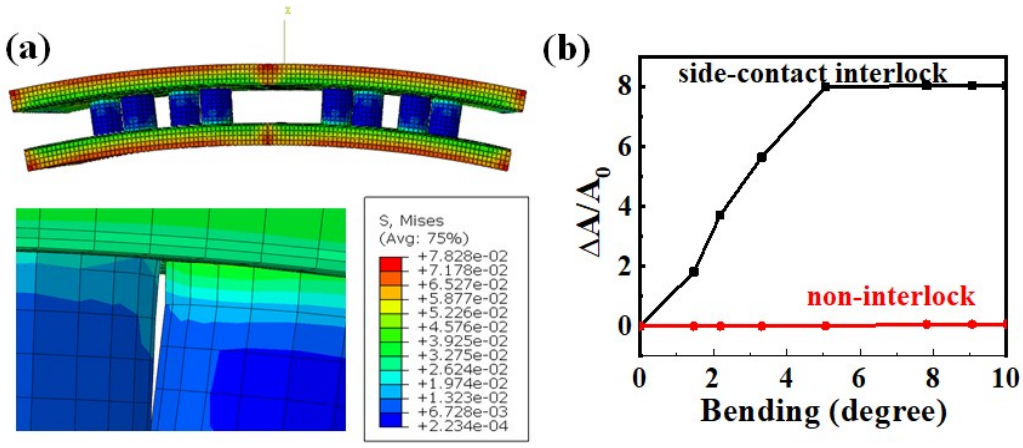

Figure S3. (a) Mises stress distribution of the side-contact interlocked sensor under bending force. (b) The change of area increment with bending angle for the side-contact interlocked and non-interlocked sensors.

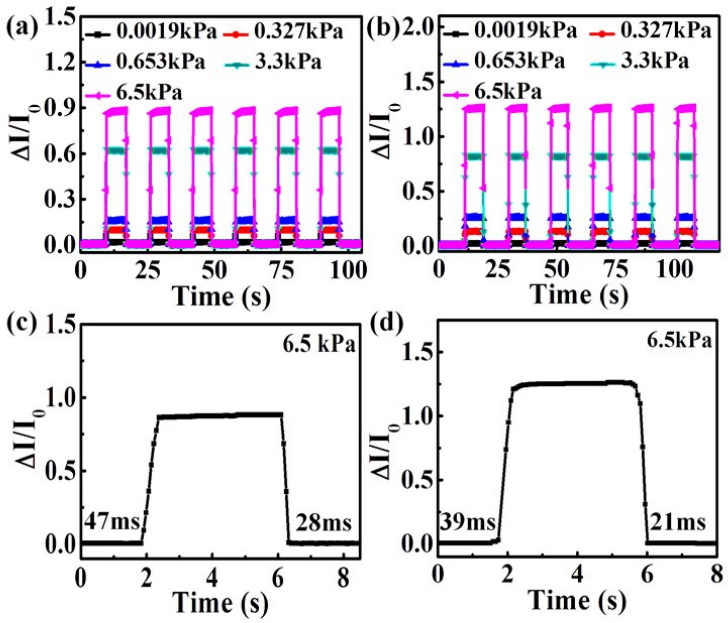

Figure S4. (a)-(b) Relative current changes of (a) planar sensor without microstructures and (b) single microarray sensor under different pressure loadings. (c)-(d) The response time and relaxation time of (c) planar sensor without microstructures and (d) single microarray sensor under a loading of 6.5 kPa.

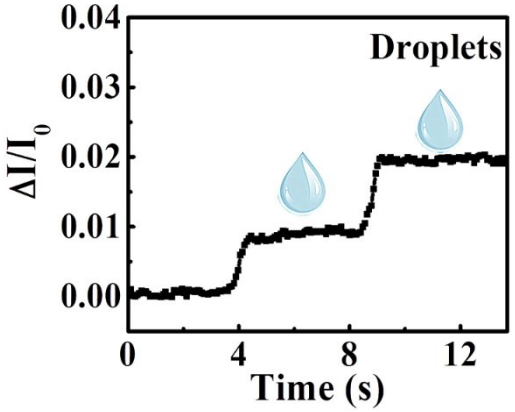

Figure S5. The electrical signal change of side-contact interlocked pressure sensor when a droplet (about 1.0 Pa) was continuously deposited on it.

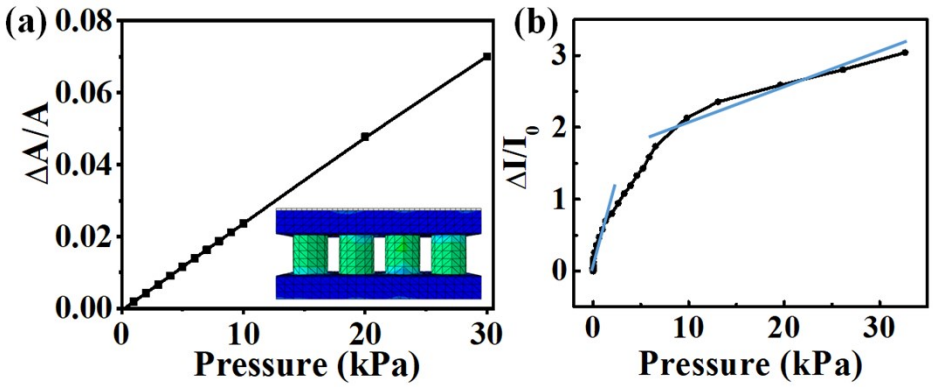

Figure S6. (a) The change of area increment with external pressure and stress distribution and (b) pressure sensitivity for the sensor with non-interlock interposition way.

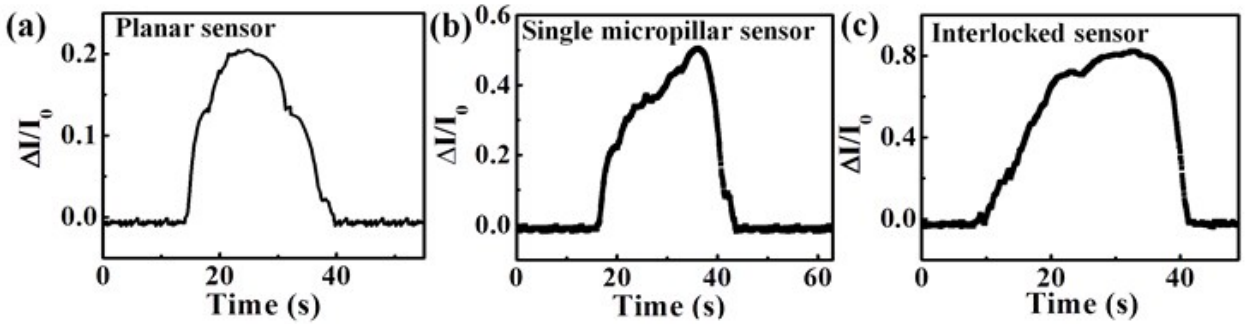

Figure S7. (a,d) Detection of backward bending gesture (low speed) by using different sensors: (a) planar sensor without microstructures, (b) single microarray sensor, and (c) side-contact interlocked sensors.

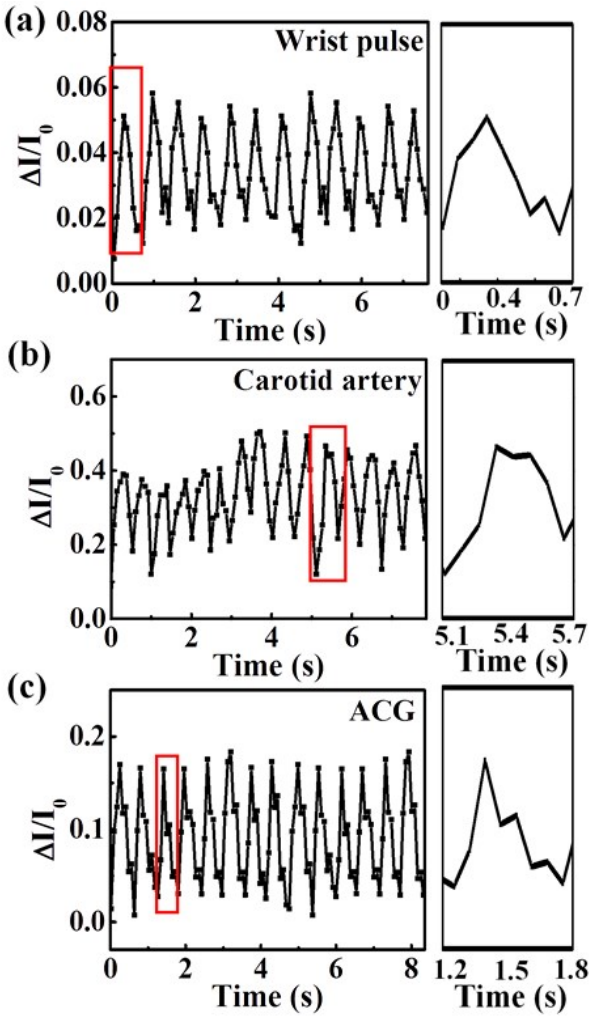

Figure S8. (a) Physiological signal patterns obtained by using side-contact interlocked sensors after exercise condition: (a) wrist pulse, (b) carotid artery, (c) ACG.

Table S1. A brief summary of performances of flexible pressure sensors.

Sensors	Workable range	Sensitivity (kPa^{-1})	Response time (ms)	Reference
rGO/PU sponge	9 Pa-10 kPa	0.26 (<2 kPa)	-	(45)
rGO foam	165 Pa-2 kPa	15.2 (<0.3 kPa)	-	(48)
Carbonaceous nanofibrous aerogels	10 Pa-4.5 kPa	0.43 (<3 kPa)	-	(49)
Laser-scribed graphene pressure sensors	-110 kPa	0.96 (<50 kPa)	72	(50)
Double-layered graphene sensors	0.3 Pa-10 kPa	0.24 (<600 Pa)	390	(51)
Conductive fibers coated with dielectric rubber	-10 kPa	0.21 (<2 kPa)	40	(52)
Graphene/PI foam	-6.5 kPa	0.18 (<2 kPa)	-	(53)
Au-Ppy pressure sensors	2 Pa-3 kPa	1.8 (<350 Pa)	-	(54)
Graphene-CNTs hierarchical foam	36 Pa-13 kPa	0.19 (<2.5 kPa)	-	(55)
Interlocked graphene microarray sensors	1.0 Pa-32 kPa	10.41 (<2.5 kPa)	19	Our work

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