Supporting Information

High performance pressure/strain sensors featuring conductive network constructed by c-MWCNTs and microspheres for human activity monitoring

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Fig. S1 The measurement platform for sensing performance.

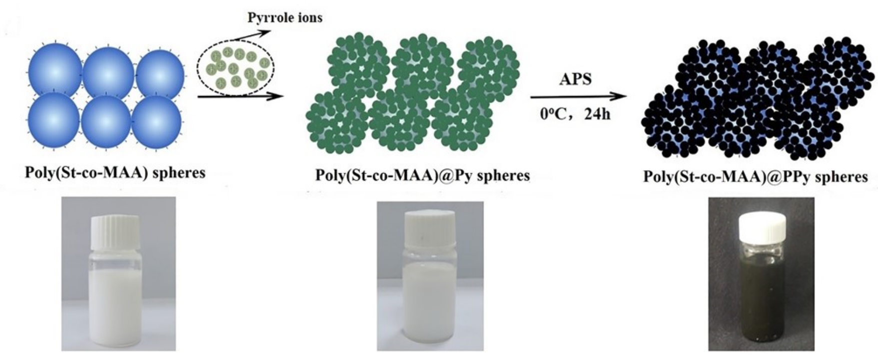

Fig.S2 Diagrams of fabrication process of PPNs.

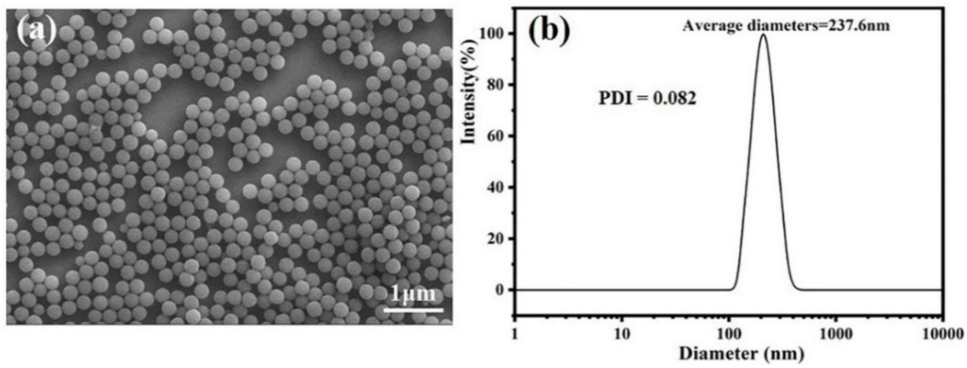

Fig. S3 (a)Scanning electron microscope characterization of P(St-MAA) nanospheres, (b)Particle size distribution of P(St-MAA) nanospheres.

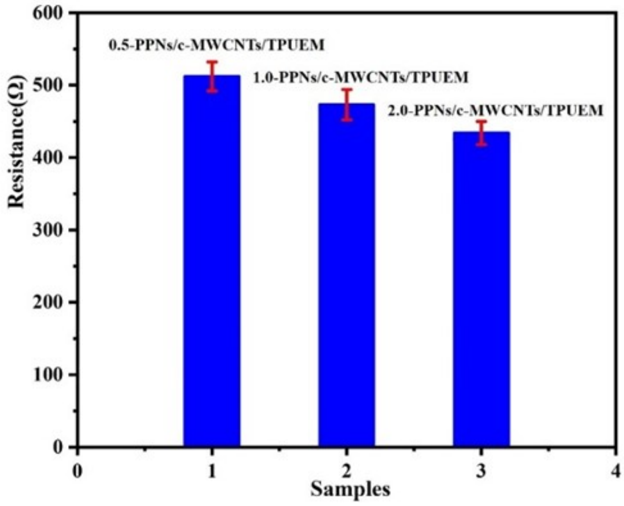

Fig. S4 The electrical conductivity of the PPNs/c-MWCNTs/TPUEM.

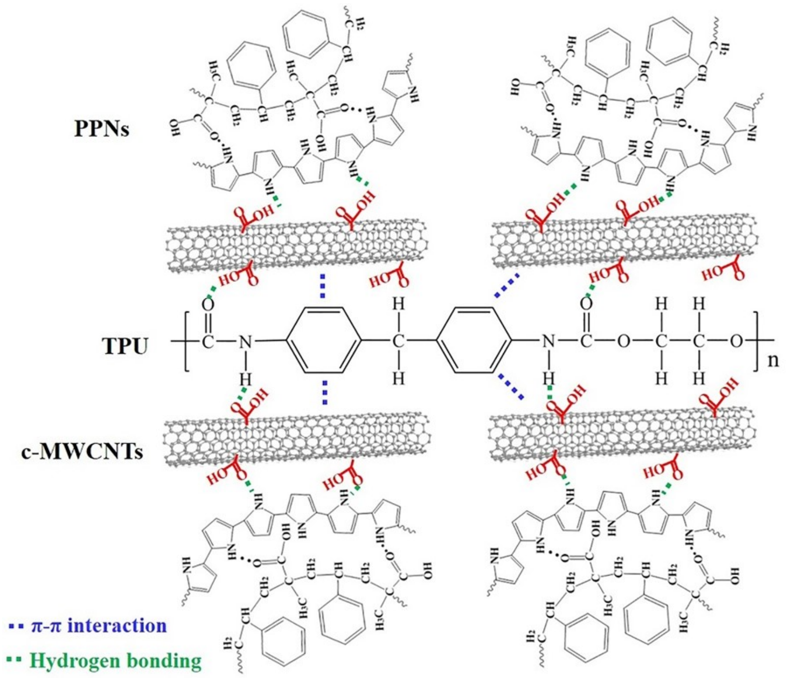

Fig. S5 Schematic diagram of the adsorption interaction among TPU, c-MWCNTs and PPNs.

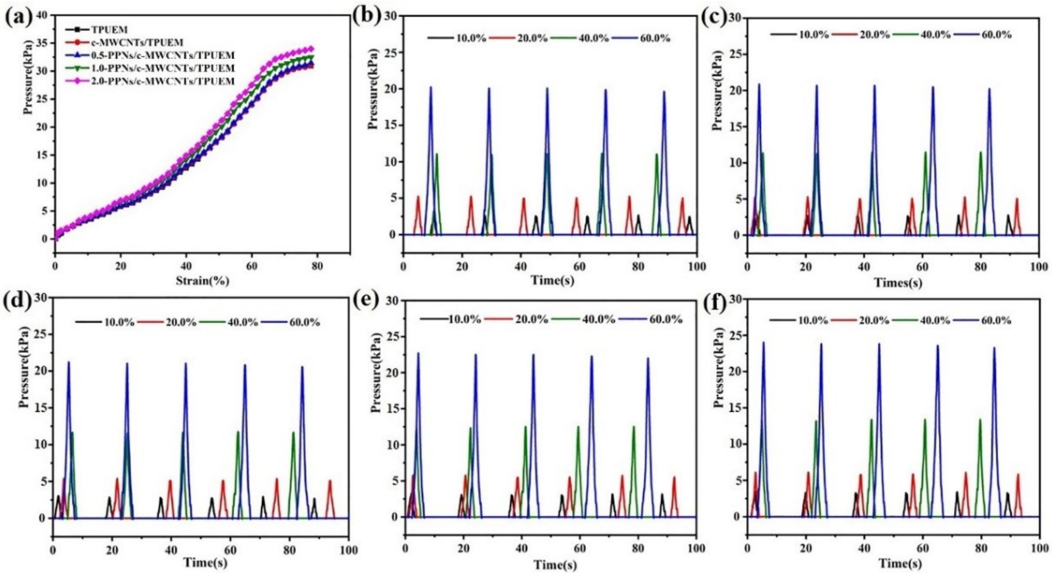

Fig.S6 (a) Stress–strain curves of samples (8.0mm×7.0mm; strain rate=1.5mm/min). Cyclic compression-release curves of samples at strain amplitudes of 10.0%, 20.0%, 40.0% and 60.0%, respectively. (b) TPUEM, (c) c-MWCNTs/TPUEM, (d) 0.5-PPNs/c-MWCNTs/ TPUEM, (e) 1.0-PPNs/ c-MWCNTs/TPUEM, and (f) 2.0-PPNs/c-MWCNTs/TPUEM.

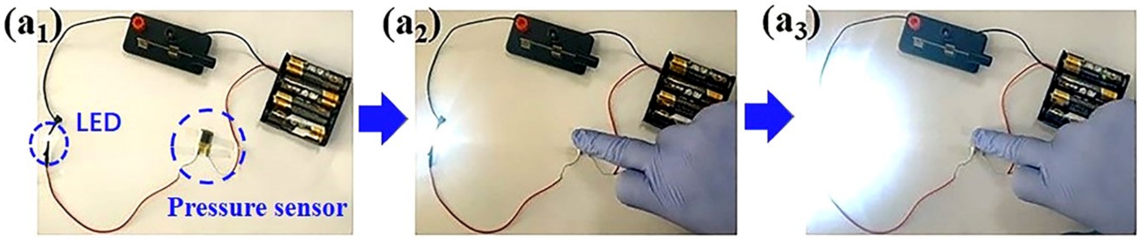

Fig. S7 piezoresistive characteristic of 2.0-PPNs/c-MWCNTs/TPUEM pressure sensor.

Table S1 Comparison of sensitive performance among PDMS/PPMs/c-MWCNTs/TPUEM pressure sensors.

Samples	Sensitivity (kPa^{-1})	Response time (ms)	Recovery time (ms)
0.5-PPNs/c-MWCNTs /TPUEM	1.07(0~ 8.18 kPa); 4.78 (8.18~27.68 kPa); 0.63(27.68 ~32.53 kPa)	265	189
1.0-PPNs/c-MWCNTs /TPUEM	3.81(0~ 8.18 kPa); 8.33 (8.18~27.68 kPa); 1.00(27.68 ~32.00 kPa)	230	182
2.0-PPNs/c-MWCNTs /TPUEM	9.03(0~8.18 kPa); 14.16 (8.18~27.68 kPa); 1.64(27.68 ~32.98 kPa)	223	175

Table S2 Comparison of sensitive performance among recently reported flexible pressure sensor based on electrospun membrane.

Samples	Device performance				Ref
	Pressure sensing range (kPa)	Maximum sensitivity (kPa^{-1})	Response time (ms)	Stability (cycles)	
CNTs-PVDF/PVA electrospun membrane	~ 200.0	0.023（0~25 kPa）	—	350	30
Fe_3O_4/carbon PAN electrospun membrane	~5.0	0.545(0~1.0 kPa)	430	505	31
Bi_2S_3/PPy/PVDF electrospun membrane	~ 60.0	1.51（0~60.0kPa）	40	5000	32
PEDOT:PSS/PVDF electrospun membrane	~30.0	13.50(0~5.2 kPa)	—	10000	33
c-MWCNTs/TPU electrospun membrane	~10.0	2.0 (0~1.0 kPa)	70	1000	14
PPNs/rGO/TPUEM	~62.5	13.65(0~3.75 Pa)	37	1650	10
MXene/cellulose nonwoven fabrics	~ 17.4	28.723 (3.266~12.2 kPa)	500	—	34
PDMS/2.0-PPNs/c-MWCNTs /TPUEM	~32.98	14.16 (8.18~27.68 kPa)	223	1800	This work

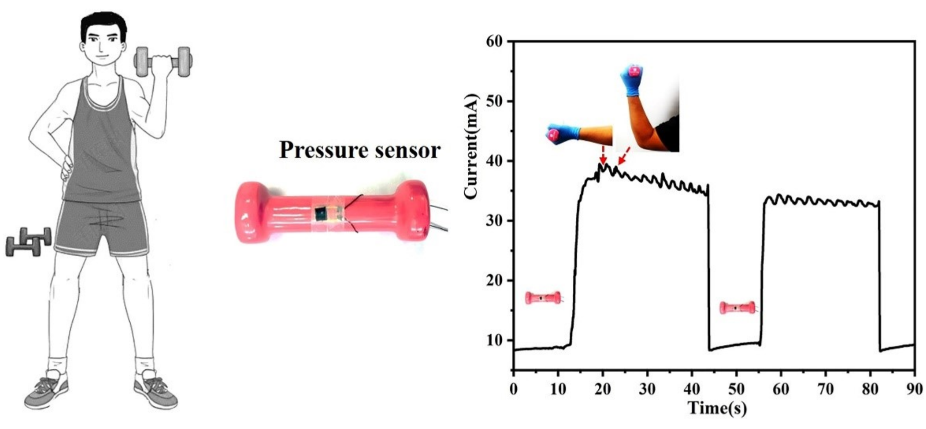

Fig. S8 Demonstration of the pressure sensor in human motion detection.

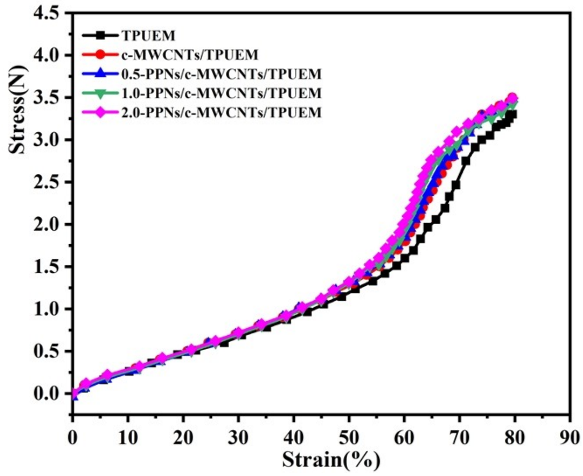

Fig.S9 The compressive stress–strain curves of TPUEM, c-MWCNTs/TPUEM, and PPNs/c-MWCNTs/TPUEM (40.0mm×13.0mm; Tensile rate=12.0 mm/ min).

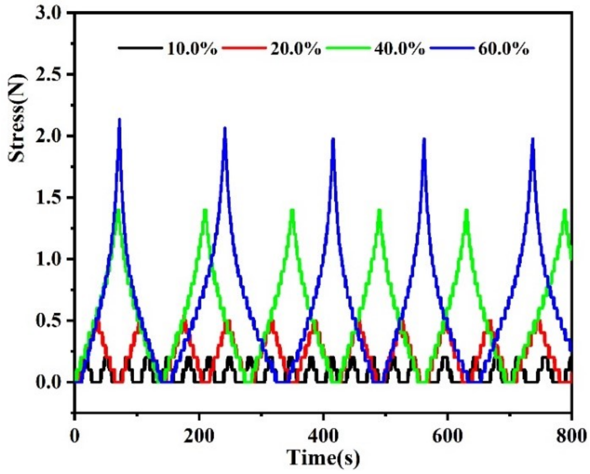

Fig.S10 Stress curves at different compression ratios of PDMS/2.0-PPNs/c-MWCNTs/ TPUEM (40.0mm×13.0mm; Tensile rate=12.0 mm/min).

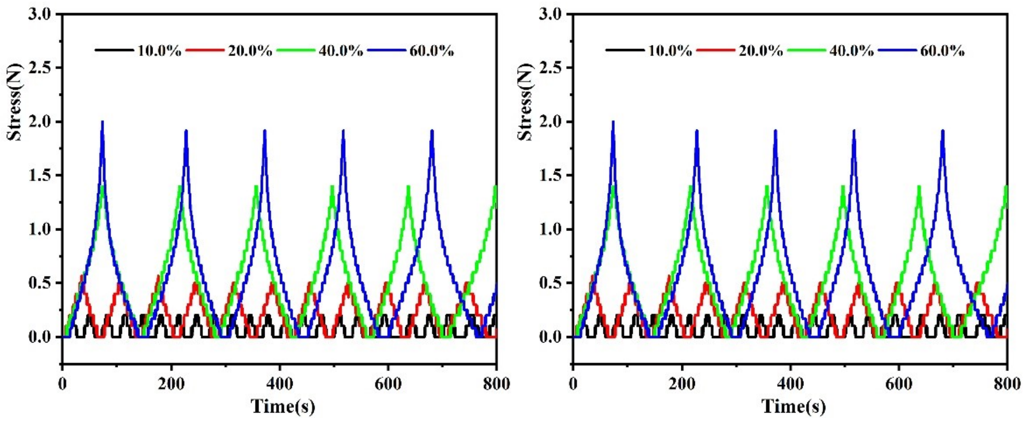

Fig. S11 Stress curves at different compression ratios of PDMS/0.5-PPNs/ c-MWCNTs/ TPUEM and PDMS/1.0-PPNs/c-MWCNTs/TPUEM (40.0mm×13.0 mm; Tensile rate=12.0 mm/min).

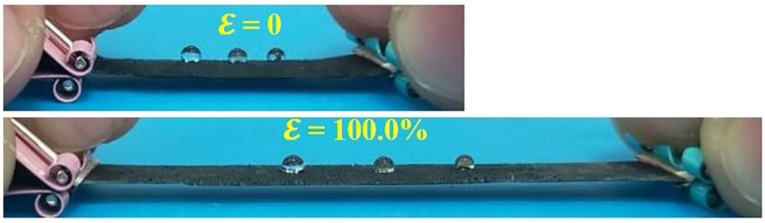

Fig. S12 Photos of droplets (water, orangeade and green tea) standing on the hydrophobic surface of PDMS/2.0-PPMs/c-MWCNTs/TPUEM under 100.0% strain.

Table S3. Comparison of sensitive performance among recently reported flexible strain sensor based on TPUEM.

Samples	Device performance			Ref
	Strain sensing range (%)	Maximum *GF*	Stability (cycles)	
CNTs/TPUEM	~900.0	19.96(600.0~900.0 %)	10000	35
PDA/rGO/TPUEM	~100.0	23.3(~60.0 %)	100	36
PDMS/AgNWs/TPUEM	~150.0	12.9(0~20.0 %)	800	37
PFDT/PDA/graphene/TPUEM	~100.0	5.9(0~20.0 %)	1000	38
PDMS/CNTs-50/TPUEM	~100.0	0.34(50.0~100.0 %)	700	18
PDMS/2.0-PPMs/c-MWCNTs /TPUEM	~100	2.03(94.3~100.0 %)	650	This work

MovieS1 Monitoring of finger bending using PDMS/2.0-PPNs/c-MWCNTs/TPUEM strain sensor.