Supporting Information

Mushroom-mimetic 3D hierarchical architecture-based e-skin with high sensitivity and wide sensing range for intelligent perception

Yajie Zhang, Xinyu Zhang, Chuan Ning, Kun Dai, Guoqiang Zheng, Chuntai Liu, Changyu Shen*

College of Materials Science and Engineering, National Engineering Research Center for Advanced Polymer Processing Technology, Zhengzhou University, Zhengzhou 450001, PR China

E-mail addresses: gqzheng@zzu.edu.cn (G. Zheng).

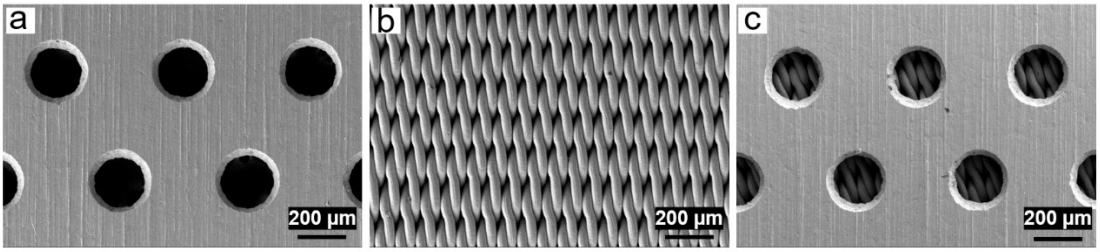

Fig. S1. SEM images of (a) punched plate, (b) mesh sieve and (c) punched plate stacked with mesh sieve.

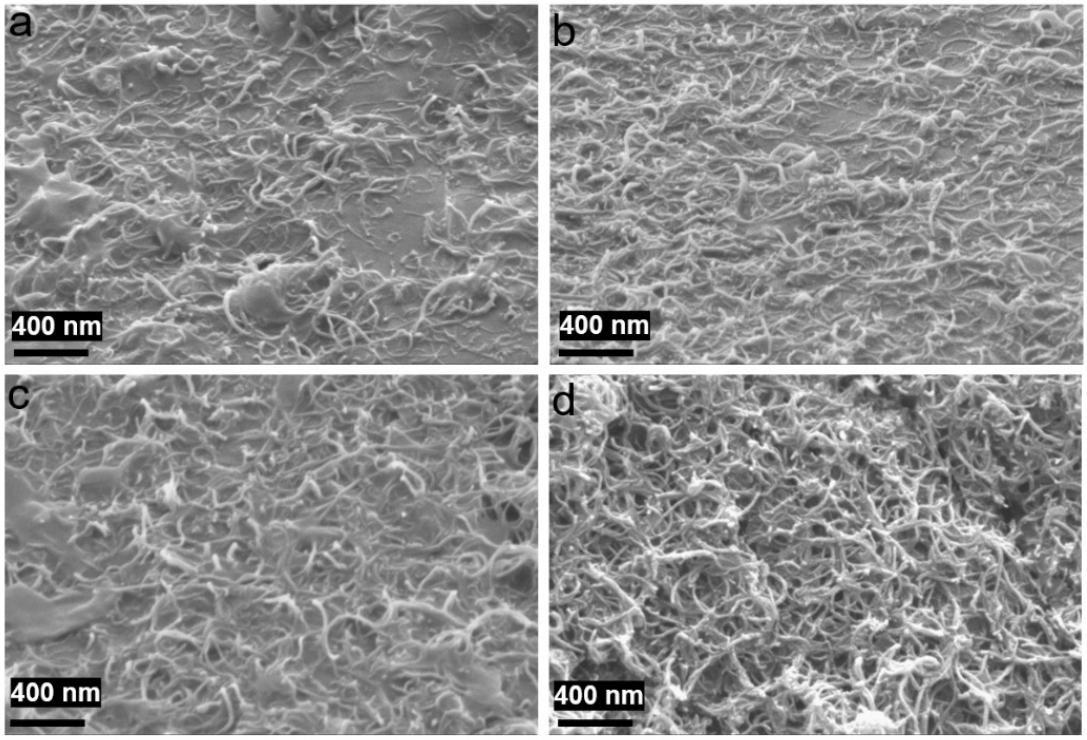

Fig. S2. SEM images of CNTs networks on the surface of MMTC sprayed for (a) 4, (b) 5, (c) 6 and (d) 7 times.

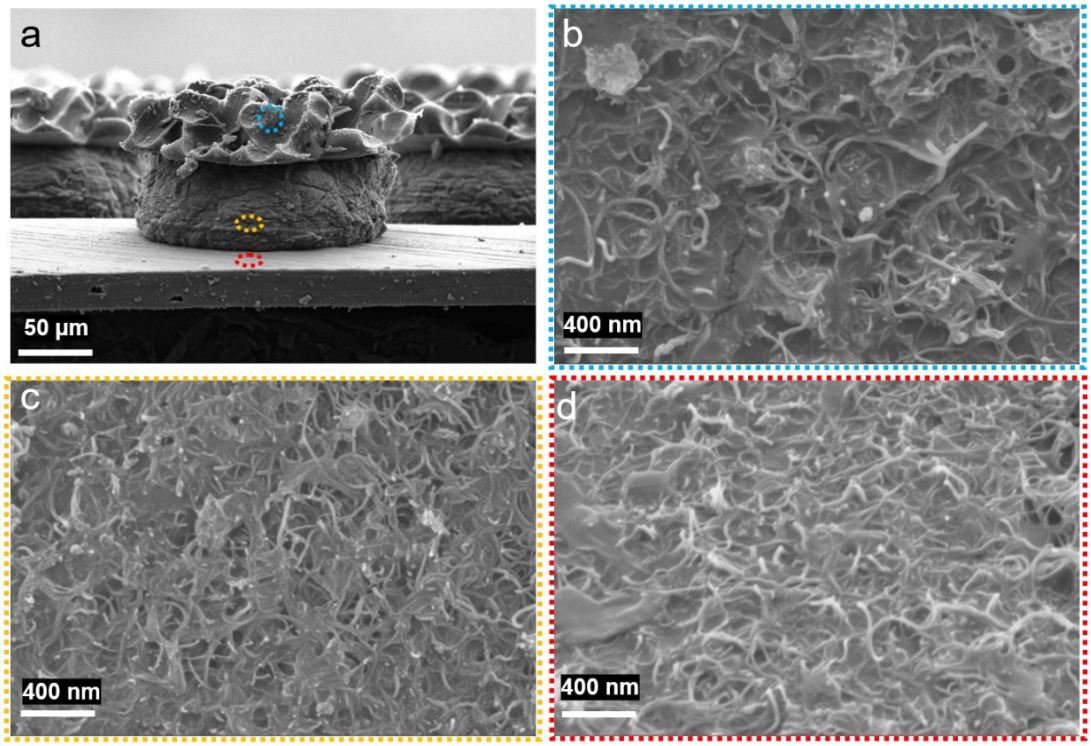

Fig. S3. (a) Side view SEM images of MMTC sprayed for 6 times. SEM images of CNTs networks on (b) top, (c) side wall and (d) bottom of micropattern.

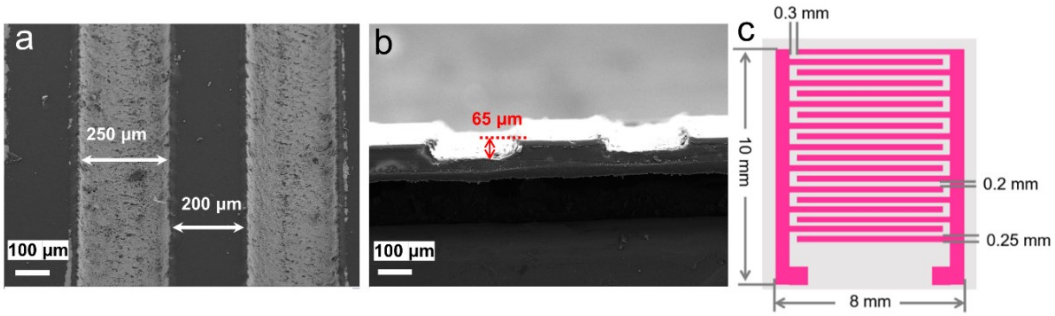

Fig. S4. The dimensions of the interdigital electrode.

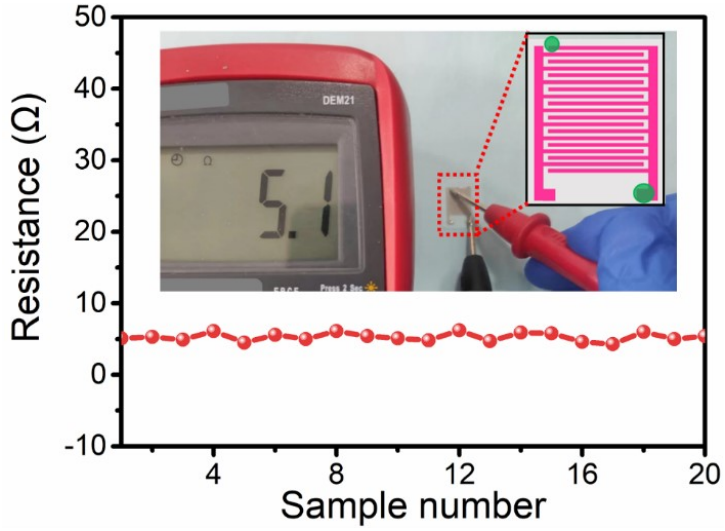

Fig. S5. The linear resistance per centimeter of as-prepared interdigital electrode.

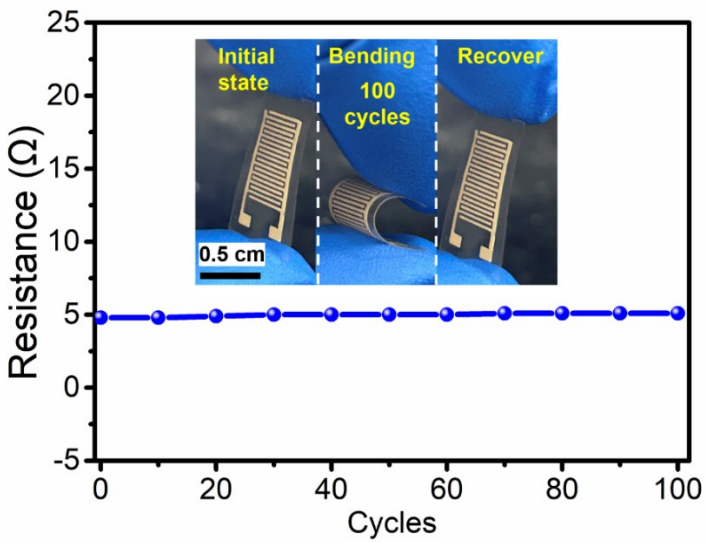

Fig. S6. The linear resistance per centimeter of interdigital electrode after 100 cycles bending/recovery test.

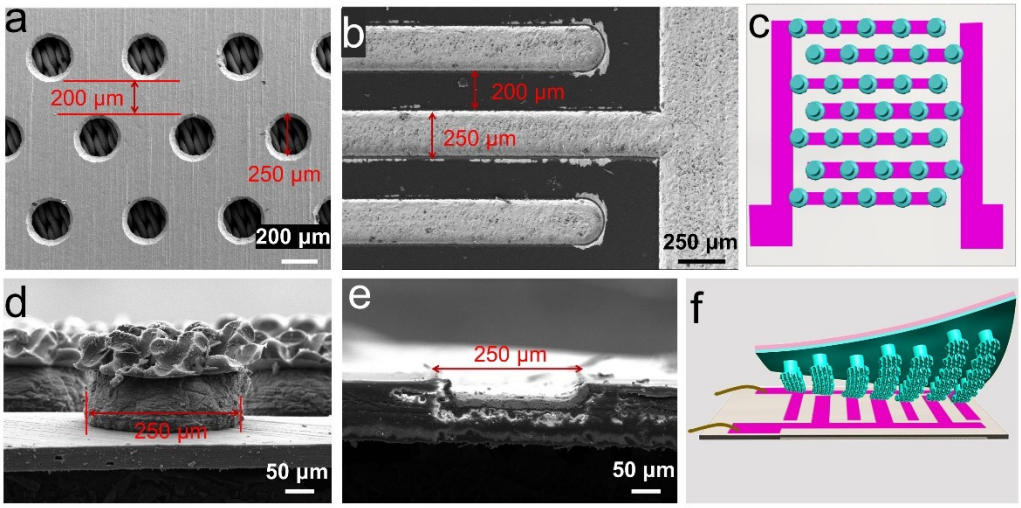

Fig. S7. (a) SEM images of punched plate stacked with mesh sieve. (b) Top view SEM images of the as-prepared interdigital electrode. (c) A diagram showing the distribution of mushroom-mimetic micropatterns on the as-prepared interdigital electrode. (d) Side view SEM images of MMTC. (e) Cross sectional view SEM image of the as-prepared interdigital electrode. (f) Schematic diagram of the structure of MMTC/interdigital electrode e-skin.

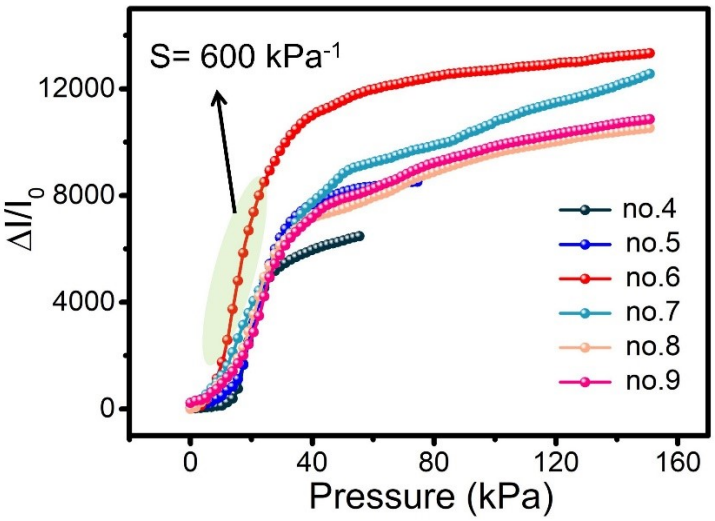

Fig. S8. Sensitivity of MMTC/interdigital electrode e-skins based on MMTC sprayed with CNTs dispersion for different times.

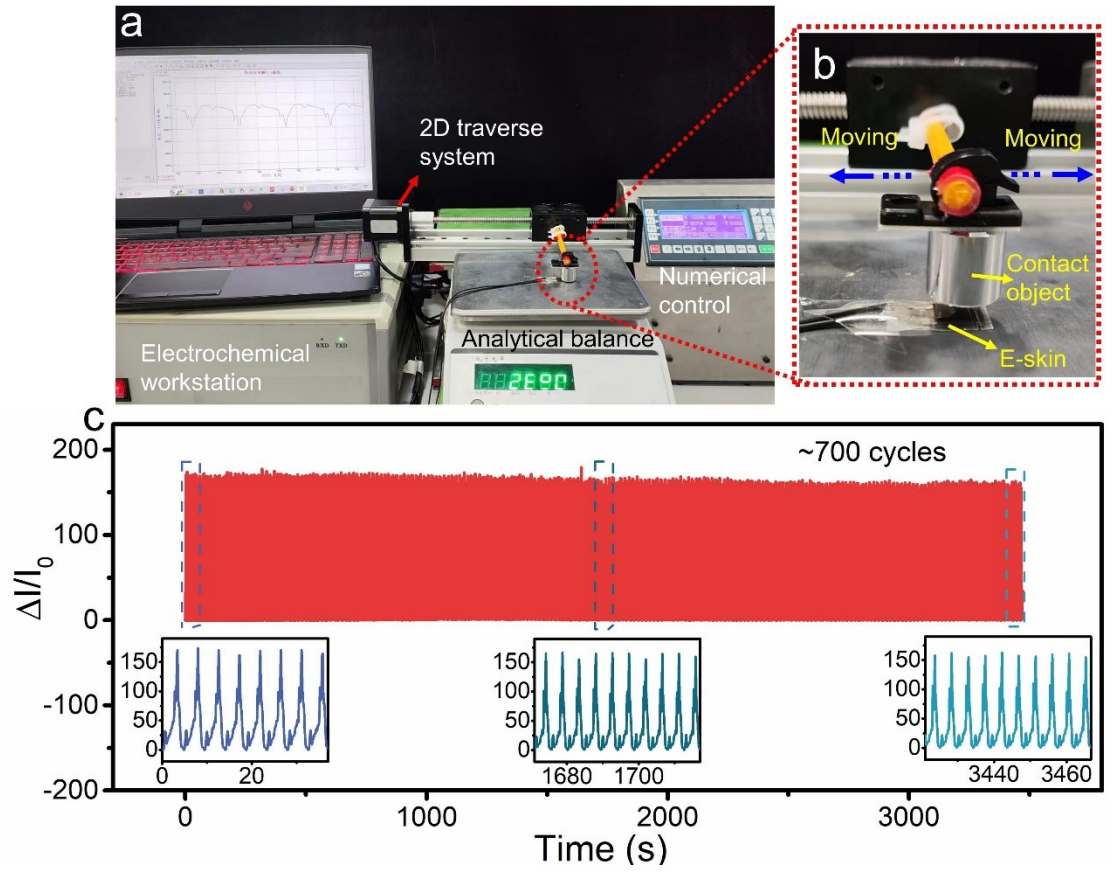

Fig. S9. (a, b) Picture of the home-made shear test equipment. (c) The e-skin was subjected to shear at a loading of 0.22 N for 700 cycles.

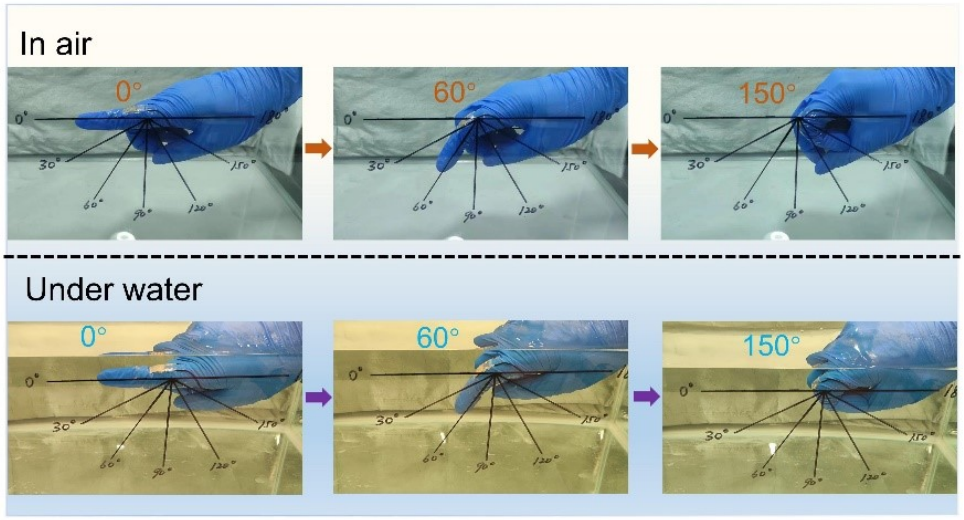

Fig. S10. Digital images displaying the index finger bending to different angles in air and under water. MMTC/interdigital electrode e-skin was simply packaged and attached on index finger bending to different angles in air or under water.

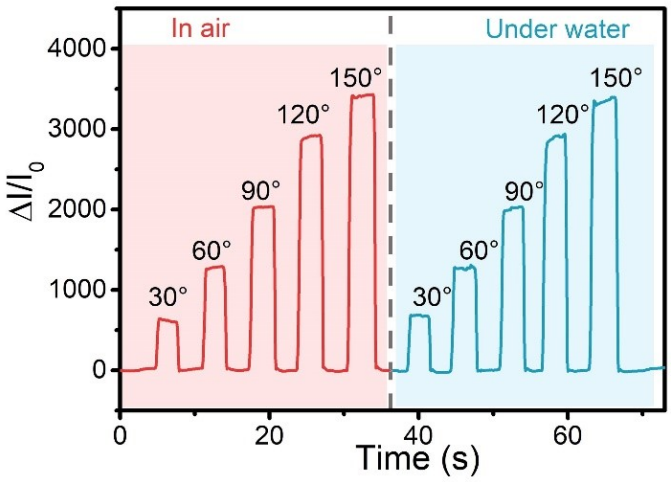

Fig. S11. Response of the index finger bending to different angles (from 30° to 150°) both in air (left side) and under water (right side).

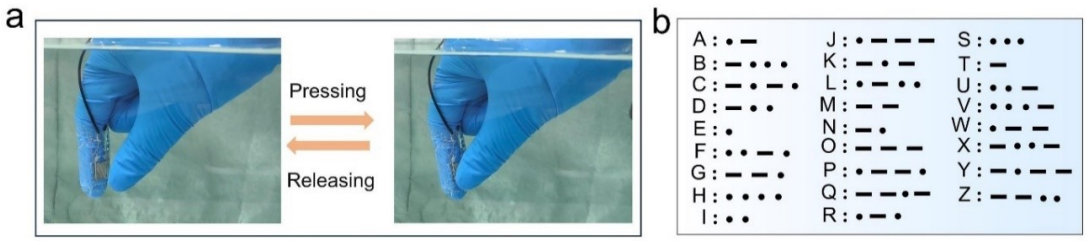

Fig. S12. (a, b) Schematic diagram of underwater communication based on the principle of Morse code.

Mechanism	Sensitivity (kPa^{-1})	Maximum sening range(kPa)	Detection limit (Pa)	Response time (ms)	Cycles	Reference
Pizoresistive	442	18.56	9	138	10000	41
Pizoresistive	151.4	15	4.4	125	10000	42
Pizoresistive	509.8	20	1	67.3	10000	43
Pizoresistive	99.5	4.5	9	4	10000	44
Pizoresistive	403.46	10	0.88	105.3	12000	45
Pizoresistive	649.3	20.55	4	123	10000	46
Pizoresistive	196	100	0.5	26	10000	47
Pizoresistive	191.3	60	8	80	18000	48
Pizoresistive	298.4	39.3	7.1	7	10000	49
Pizoresistive	**600**	**150**	**5**	**20**	**15000**	**This work**

Table S1. Performance comparison of different e-skins.