Supplementary Information

A wearable and high-performance capacitive pressure sensor based on a biocompatible PVP nanofiber membrane via electrospinning and UV treatment

Mengna Ren,[1] *Jiamin Li,*[1] *Luyu Lv,*[1] *Mengqi Zhang,*[1] *Xiaojun Yang,*[1] *Qihui Zhou,*[2,*] *Danyang Wang,*[3] *Rajendra Dhakal,*[4] *Zhao Yao,*[1,*] *Yuanyue Li,*[1,*] and *Nam Young Kim*[5]

[1]*College of Electronic and Information, Qingdao University, Qingdao 266071, China*

[2]*Institute for Translational Medicine, The Affiliated Hospital of Qingdao University, Qingdao University, Qingdao 266003, China.*

[3]*Department of Stomatology, The Affiliated Hospital of Qingdao University, Qingdao University, Qingdao 266003, China.*

[4]*Department of Computer Science and Engineering, Sejong University, Seoul 05006, Korea*

[5]*Department of Electronic Engineering, Kwangwoon University, Seoul 01897, Korea*

[*]corresponding author: qihuizhou@qdu.edu.cn (Qihui Zhou); yzh17@qdu.edu.cn (Zhao Yao); yyli@qdu.edu.cn (Yuanyue Li)

1. Figure S1

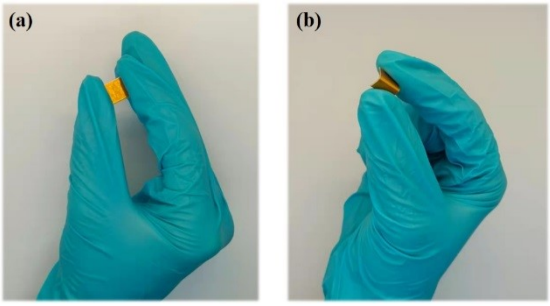

Fig. S1. Photographs of the fabricated pressure sensor: **(a)** capacitive pressure sensor with an area of 1 × 1 cm^2; **(b)** the above sensor in curved state.

2. Figure S2

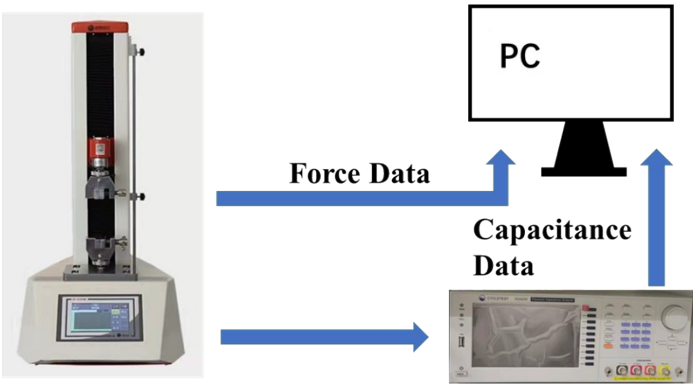

Fig. S2. Measurement setup: the data of the pressure and capacitance was recorded by using a PC.

3. Figure S3

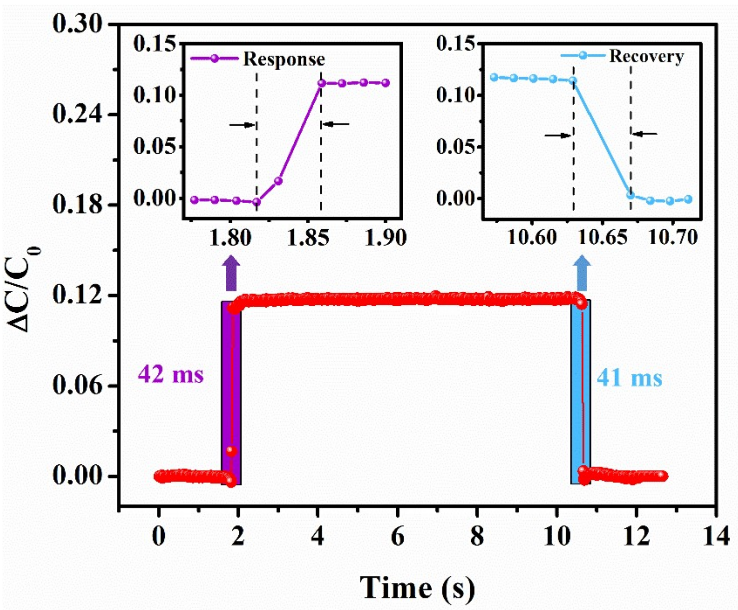

Fig. S3. Response and recovery time when a pressure of 100 kPa is applied to the S-UV-0.

4. Finite Element Analysis

In the Finite Element Analysis (FEA), the specific parameters of the model were set as follows. The upper and lower electrodes were simulated as cuboids with the width of 6.5 μm, the depth of 7 μm, the height of 1 μm, and the material of copper (E = 126 GPa and nu = 0.34). In order to simplify the model, the nanofiber network was simulated as the cross cylinder array for analysis. The parameters of the cylinders were set as follows. The length of all the cylinders was set to be 6 μm, and the interval between the cylinders was 800 nm. The average diameter of the cylinders was set as 507, 700, 905, 1086, 1295 nm in turn to make performance analysis, as shown in Fig. S4. At last, using the cylinders with the average diameter of 700 nm as model, their Young's modulus was set as 60.5, 70.5, 80.5, 90.5 and 100.5 MPa in turn, as shown in Fig. S5.

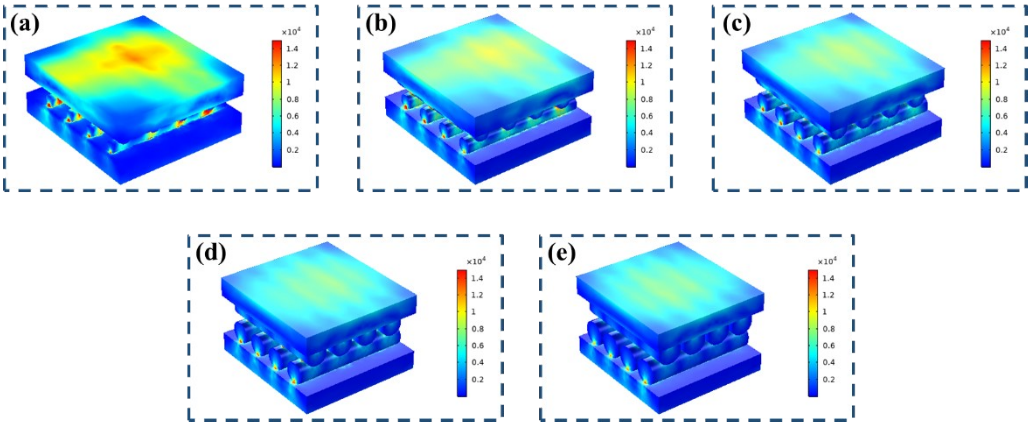

Fig. S4. Contact stress distribution images of the sensors based on the nanofibers with the average diameter of (a) 507, (b) 700, (c) 905, (d) 1086 and (e) 1295 nm, respectively.

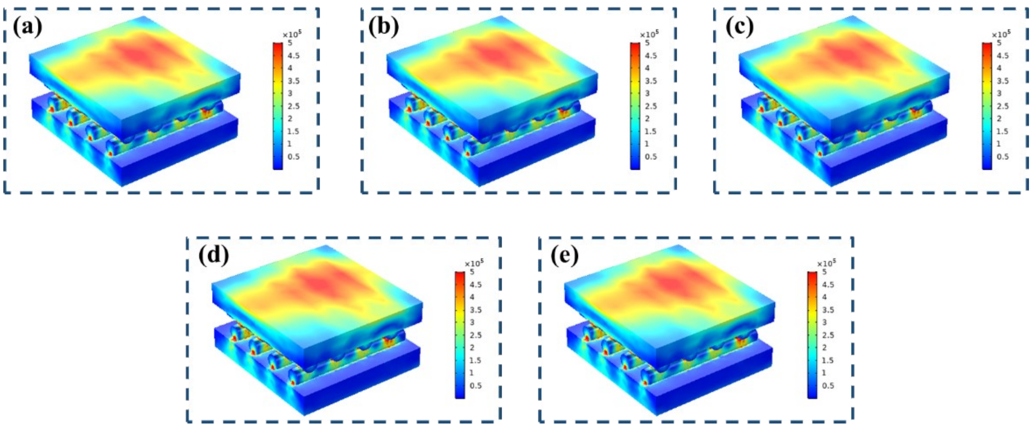

Fig. S5. Contact stress distribution images of the sensors based on the nanofibers with the Young's modulus of (a) 60.5, (b) 70.5, (c) 80.5, (d) 90.5 and (e) 100.5 MPa, respectively.

5. Detailed data of the sensor array

The capacitance changes after placing “Q”, “D” and “U” are shown in Table S1, S2 and S3. The 4 × 4 sensor array has 16 positions and their numbers are shown in Fig. S6.

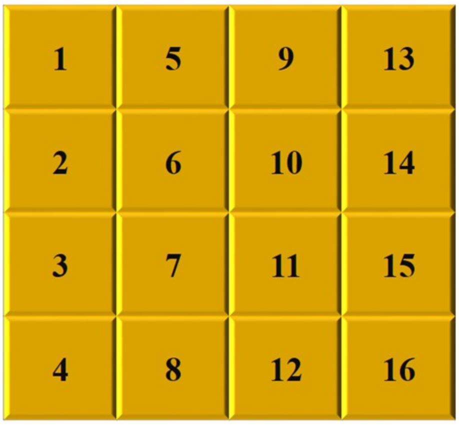

Fig. S6. Schematic diagram of the position number of the 4 × 4 sensor array

Table S1 Capacitance changes at each position of the sensor array after placing “Q”.

Position	Initial capacitive (pF)	Loading capacitance (pF)	$\Delta C/C_0$
1	6.79109	7.05111	0.038288
2	7.138988	7.593771	0.063704
3	8.23229	8.847513	0.074732
4	5.607336	5.787492	0.032128
5	6.525583	6.754044	0.035010
6	6.867211	6.867218	0
7	6.487735	6.663241	0.027052
8	5.612323	6.029286	0.074294
9	7.647986	7.932999	0.037266
10	7.720876	8.294289	0.074267
11	7.214772	7.758816	0.075406
12	6.923142	7.519799	0.086183
13	7.238542	7.238542	0
14	8.444439	8.444439	0
15	8.24601	8.24601	0
16	7.660295	7.660295	0

Table S2 Capacitance changes at each position of the sensor array after placing "D".

Position	Initial capacitive (pF)	Loading capacitance (pF)	$\Delta C/C_0$
1	6.79109	7.304510	0.075602
2	7.138988	7.675241	0.075116
3	8.23229	8.90558	0.081786
4	5.607336	6.033706	0.07603
5	6.525583	6.922801	0.06087
6	6.867211	6.867211	0
7	6.487735	6.487735	0
8	5.612323	6.05554	0.078972
9	7.647986	7.896525	0.032497
10	7.720876	8.199236	0.061956
11	7.214772	7.837699	0.086340
12	6.923142	7.126366	0.029354
13	7.238542	7.238542	0
14	8.444439	8.444439	0
15	8.24601	8.24601	0
16	7.660295	7.660295	0

Table S3 Capacitance changes at each position of the sensor array after placing "U".

Position	Initial capacitive (pF)	Loading capacitance (pF)	$\Delta C/C_0$
1	6.79109	7.146528	0.035602
2	7.138988	7.635568	0.075116
3	5.607336	5.827056	0.076037
4	8.23229	8.836831	0.081786
5	6.525583	6.525580	0
6	6.867211	6.867208	0
7	6.487735	6.487735	0
8	5.612323	6.049782	0.078972
9	7.647986	8.016589	0.032497
10	7.720876	8.302615	0.061956
11	7.214772	7.704786	0.086340
12	6.923142	7.744786	0.029354
13	7.238542	7.238541	0
14	8.444439	8.444437	0
15	8.24601	8.246015	0
16	7.660295	7.660299	0