Electronic Supplementary Material (ESI) for Journal of Materials Chemistry A.

Supporting Information

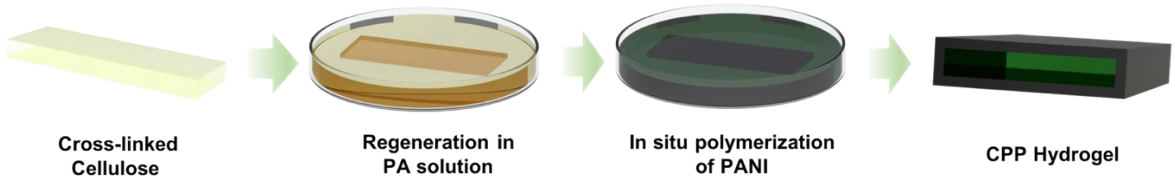

Fig. S1 Fabrication process of CPP.

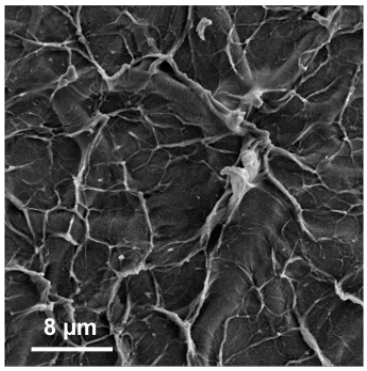

Fig. S2 Surface SEM image of CP.

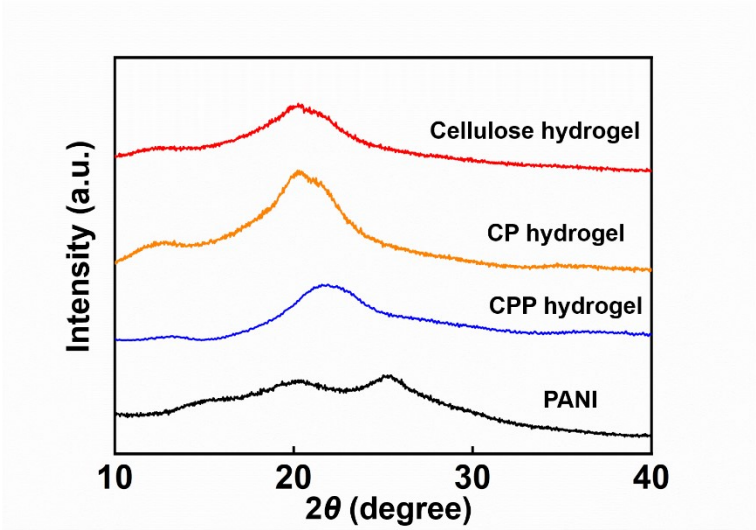

Fig. S3 XRD spectra of cellulose hydrogel, CP, CPP-1.5 and PANI.

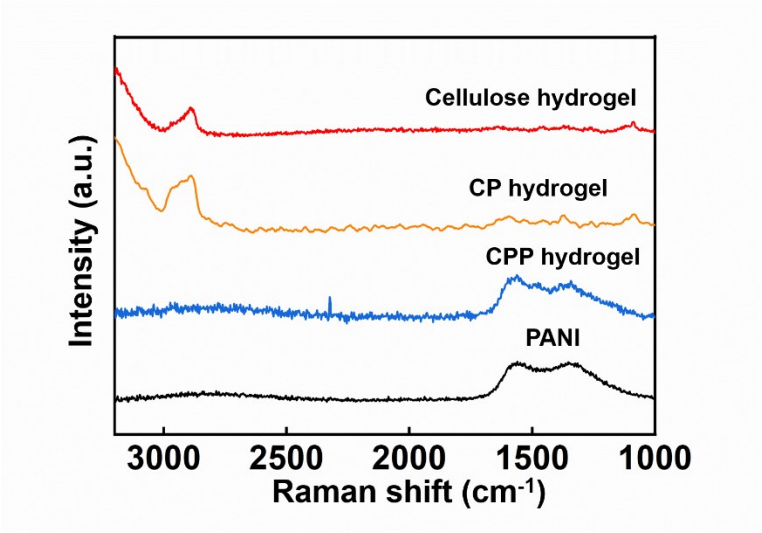

Fig. S4 Raman spectra of cellulose hydrogel, CP, CPP-1.5 and PANI.

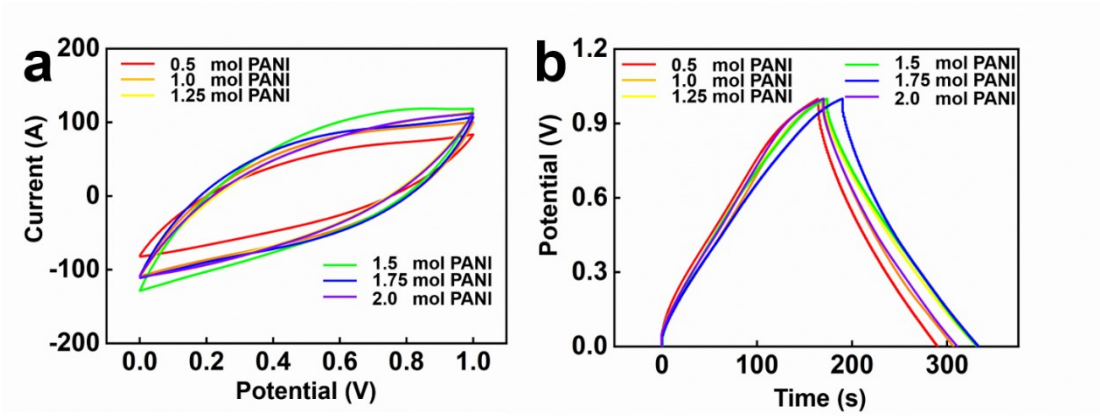

Fig. S5 (a) CV curves of CPP-0.5, CPP-1.0, CPP-1.25, CPP-1.5, CPP-1.75 and CPP-2.0 at a scan rate of 100 mV/s. (b) GCD curves of CPP-0.5, CPP-1.0, CPP-1.25, CPP-1.5, CPP-1.75 and CPP-2.0 at a current density of 5 mA/cm^2 under voltage of 1.0 V.

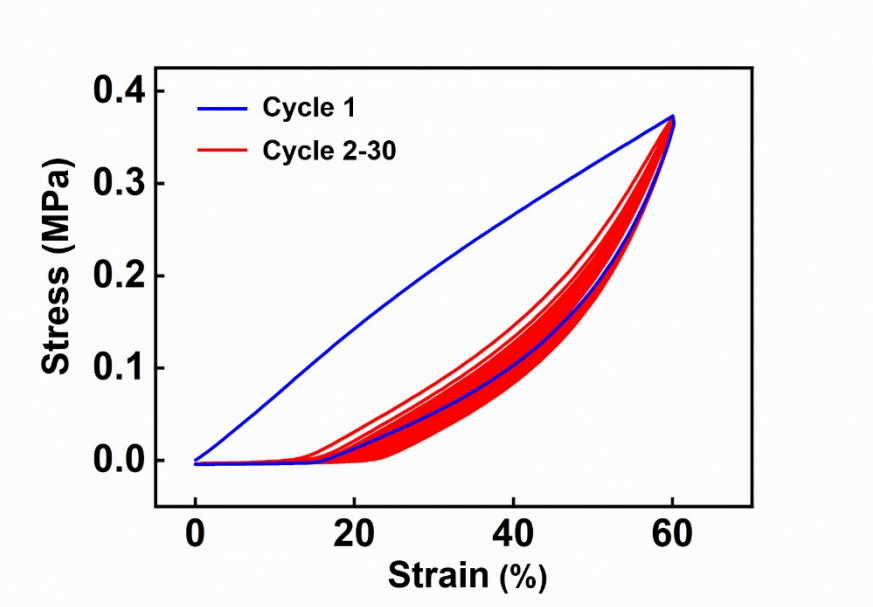

Fig. S6 Tensile stress-strain curves of CPP-1.5 within 60 % strain during loading-unloading cycles.

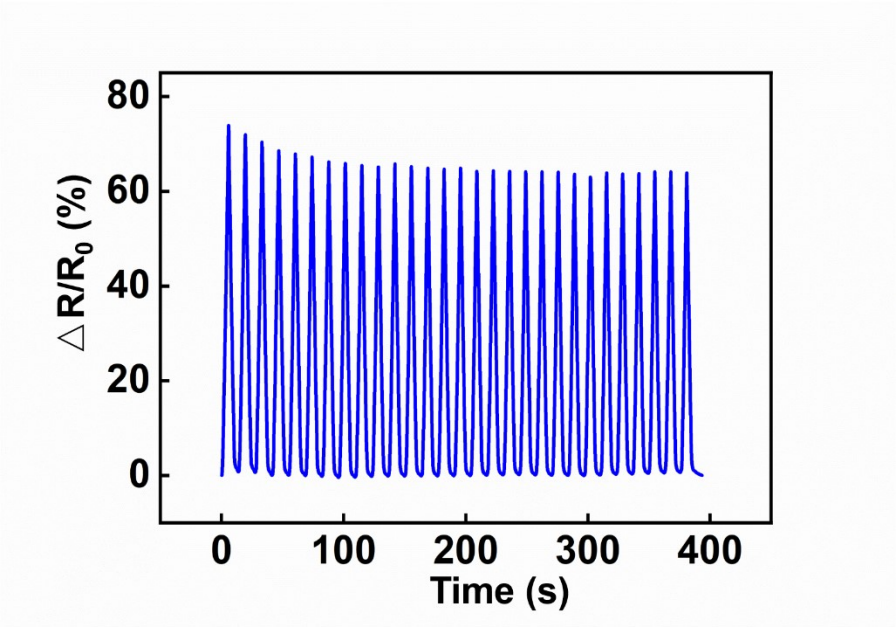

Fig. S7 Response of CPP-1.5 strain sensor during 30 cycles between 0 and 60 % strain.

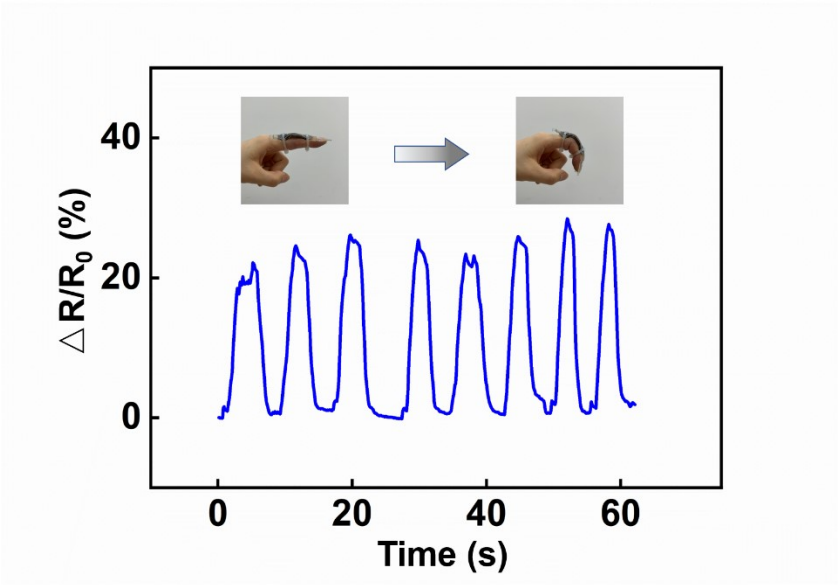

Fig. S8 Response of CPP-1.5 sensor in detecting finger bending.

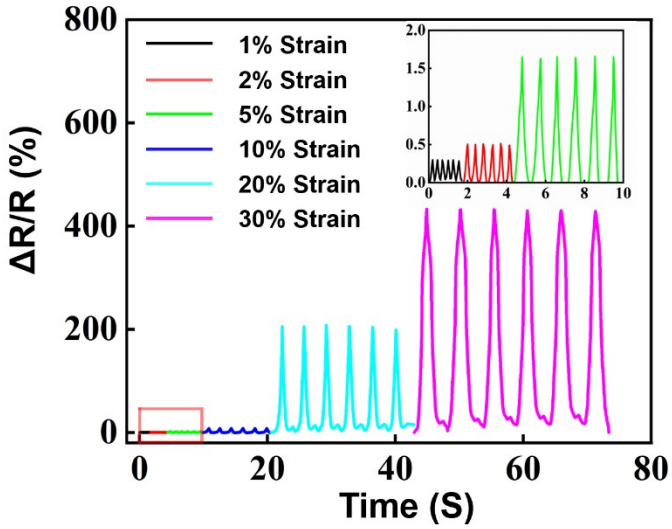

Fig. S9 Normalized resistance changes of the structural sensor under different tensile deformation with the frequencies of 10 %/s.

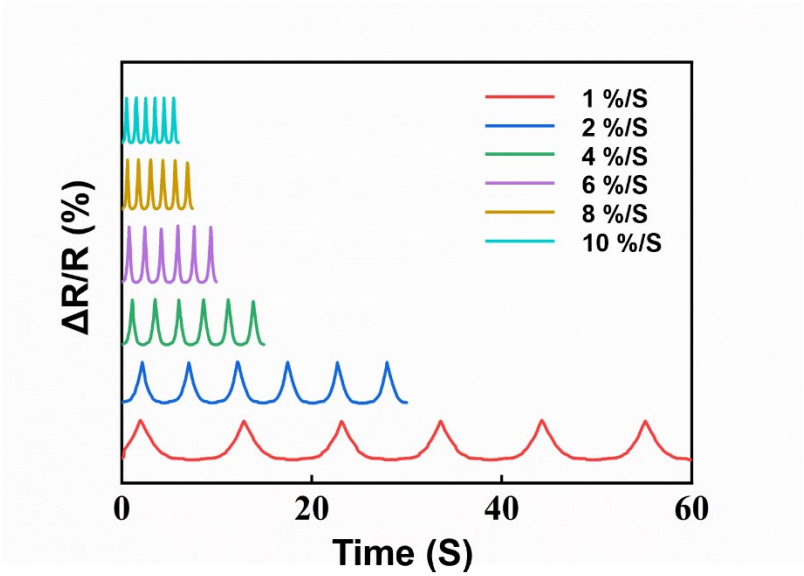

Fig. S10 Normalized resistance changes of the structural sensor under the strain of 10 % with different deformation frequencies.

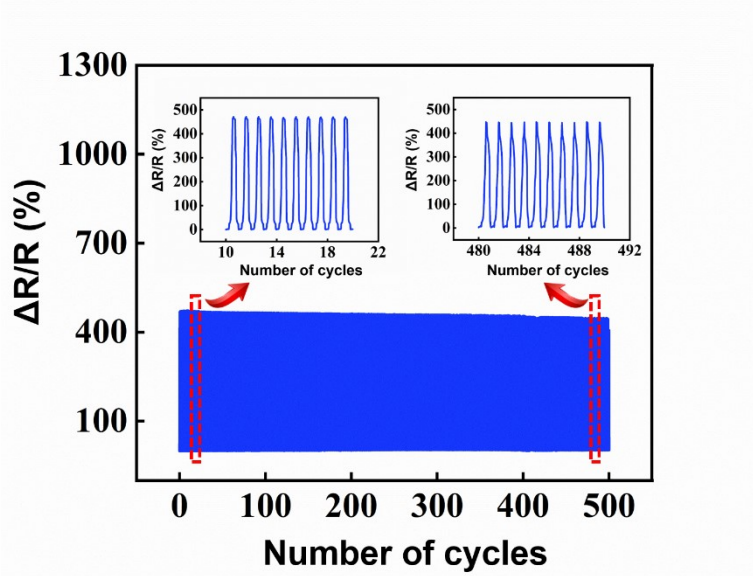

Fig. S11 Relative resistance changes of structural CPP-1.5 strain sensor under repeated loading–unloading processes with a strain of 30 % for 500 cycles.

Table. S1 Comparison of reported all-in-one supercapacitors.

Materials	C_t(mF/cm^2)	Cyclic Stability	References
Cellulose/PA/PANI	1210.7 (1.0mA/cm^2)	84.00 % (5000)	*This work*
PANI/cellulose/PAAM	835.0 (1.0mA/cm$^{2)}$	96.00 % (5000)	[1]
PANI/(β)CD_3-g-Cell	1003.50 (1.0mA/cm^2)	90.00 % (2000)	[2]
PPy/KCl/PVA	224 (0.8 mA/cm^2)	92.00 % (1000)	[3]
MOF-PPy/PDA/BC	1710 (0.4mA/cm^2)	71.04 % (5000)	[4]
PANI/PCH	488 (0.2mA/cm^2)	90.00 % (7000)	[5]
PPy/CPH	261.2 (0.1mA/cm^2)	86.30 % (10,000)	[6]
PANI-CNTP/PM	158.4	-	[7]
PPy-PANI/H_2SO_4/PVA	773 (0.2 mA/cm^2)	85 %（1900）	[8]
$Ti_3C_2T_x$/NaOH/PVA	559.3	-	[9]
CMC/$ZnSO_4$	1297（0.16 mA cm^{-2})	100 % (10000)	[10]

Table. S2 Gauge factor (GF) of reported gel-based strain sensors.

Materials	GF	Strain range (%)	Reference
Cellulose/PA/PANI	2.62	*0-120*	*This work*
Cellulose/PA/PANI (zigzag pattern)	20.74	*0-40*	*This work*
Cellulose/GnPs plates	5.87	*0-6*	[11]
COH	1.02	*0-30*	[12]
WCT	1.00	*0-80*	[13]
ACC/PAA/alginate	1.19	*0-325*	[14]
PVA/PVP/CNC hydrogel	0.48	*0-150*	[15]

Cellulose /PVA hydrogel	1.04	*0-500*	[16]
PAA/PDArGO/Fe^{3+} hydrogel	1.32	*0-500*	[17]
OP/PVA/borax hydrogel	6.34		[18]
HEC/Ag/polyacrylamide functional hydrogel	4.07	*0-200*	[19]
PU-DA-1/1-PANI hydrogel	2.90	*0-120*	[20]

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