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

Supporting Information

Flexible self-charging sodium-ion full battery for self-powered wearable electronics

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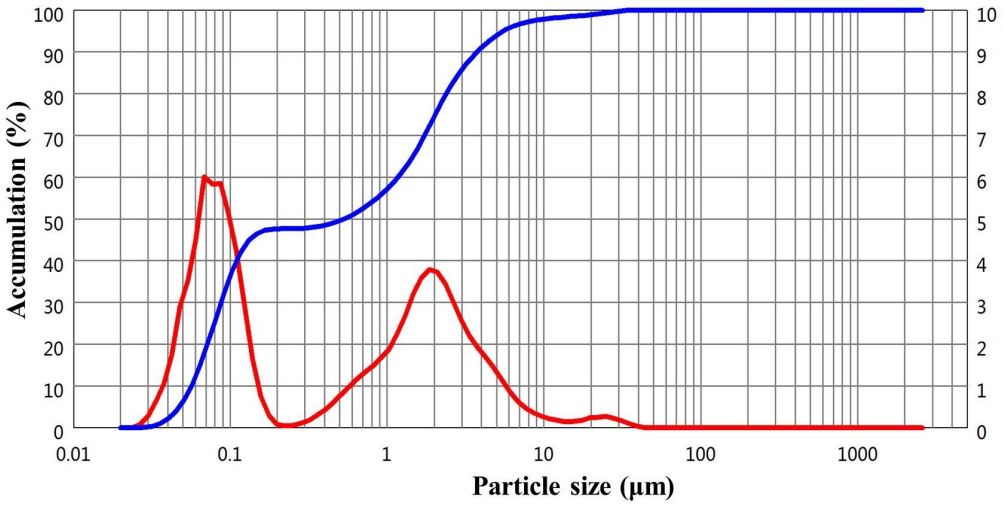
Preparation of $Na_3V_2(PO_4)_3$@C: The $Na_3V_2(PO_4)_3$@C composite was synthesized via a sol–gel method combined with a carbonization process. Initially, the stoichiometric of precursors of NaOH, NH_4VO_3 and $NH_4H_2PO_4$ were well dissolved in 300 mL of deionized water, followed by adding 12 g of citric acid that used as chelating reagent and carbon source. Subsequently, the obtained mixture was magnetically stirred at 90 °C until the internal water was fully evaporated, yielding to a black gel. After that, the black gel was dried in a vacuum oven at 80 ^oC for 24 h to form a xerogel. Finally, the xerogel was milled, followed by pre-annealed at 300 ^oC for 5 h and second-heated at 850 ^oC for 8 h in Ar flow, obtaining the desired $Na_3V_2(PO_4)_3$@C composite.

Fig. S1 Optical image of the as-prepared $BaTiO_3$-P(VDF-HFP) gel-polymer film**.**



Particle size(μm)	Content (%)
0.050	6.17
0.100	36.48
0.200	47.58
0.500	49.55
1.000	57.13
2.000	74.55
5.000	94.02
10.00	97.85
20.00	98.90
45.00	100.00

Fig. S2 Dimension distribution of $BaTiO_3$ piezoelectric particles.

Table S1 Atomic ratio and mass distribution of the $Na_3V_2(PO_4)_3$@C cathode material by XPS analysis

Element name	C	Na	V	P	O
Atomic ratio (%)	45.95	6.30	4.21	7.30	36.25
Mass ratio (%)	32.14	8.43	12.49	13.17	33.77

Table S2 Atomic ratio and mass distribution of the hard carbon anode material by XPS analysis

Element name	C	O
Atomic ratio (%)	**97.63**	**2.37**
Mass ratio (%)	**96.86**	**3.14**

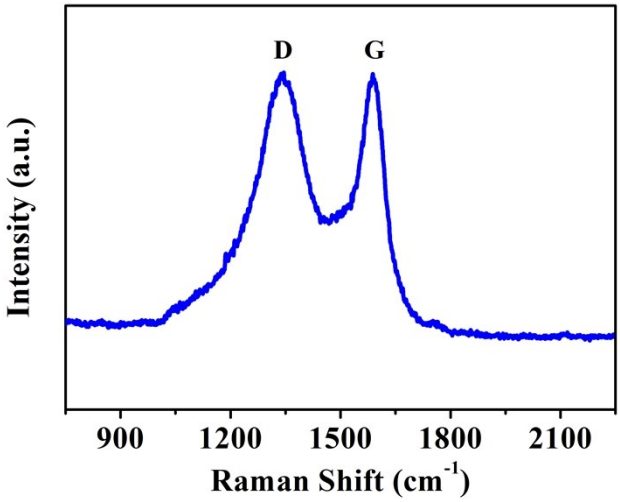


Fig. S3 Raman spectrum of the hard carbon anode material.

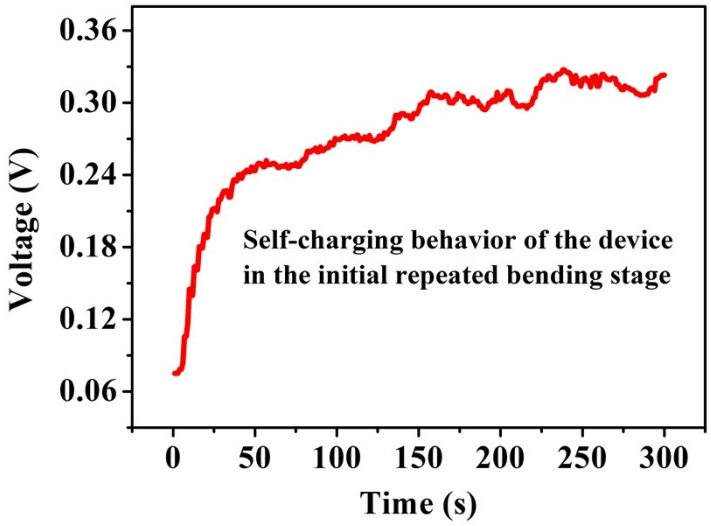


Fig. S4 Self-charging behavior of the flexible SCSFB in the initial repeated bending stage.

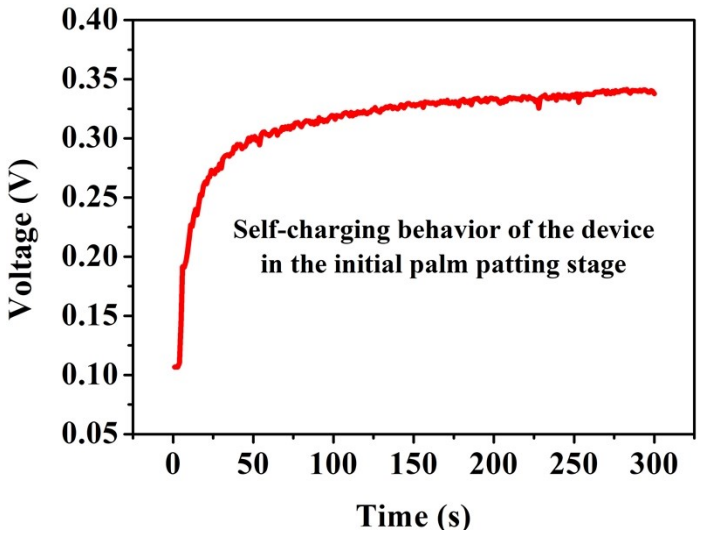


Fig. S5 Self-charging behavior of the flexible SCSFB in the initial palm patting stage.

Table S3 Self-charging voltage of similar energy device using various built-in piezoelectric materials.

Device	Piezoelectric materials	Self-charging voltage	Ref.
SCPC	PVDF	0.395 V (periodic compression)	[1]
SCPC	PVDF–PZT	~ 0.3 V (periodic compression)	[2]
SCASC	Fish swim bladder	0.281 V (finger imparting)	[3]
Flexible SCPCs	PVDF	0.22 V (periodic compression)	[4]
SCSPC	PVDF-ZnO	0.145 V (palm patting)	[5]
SCSPC	Porous PVDF	0.112 (compression)	[6]
Flexible SCSFB	$BaTiO_3$-P(VDF-HFP)	0.4 V (repeated bending); 0.46 V (palm patting);	This work

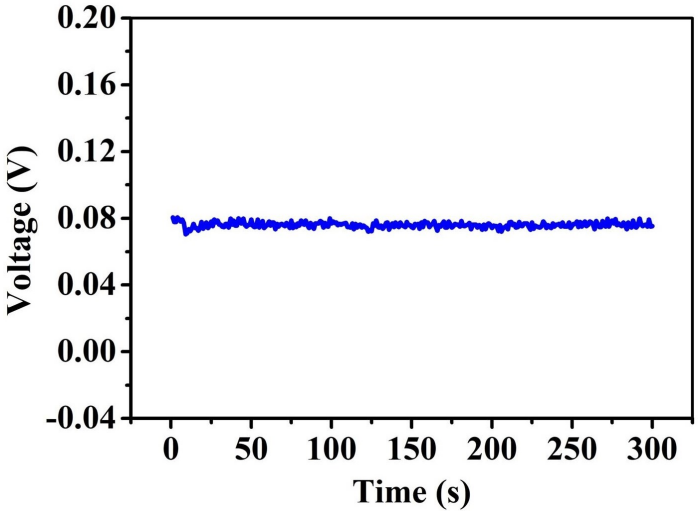


Fig. S6 Voltage curve of a device assembled with unpolarized piezoelectric gel-electrolyte film under palm patting for 300 s.

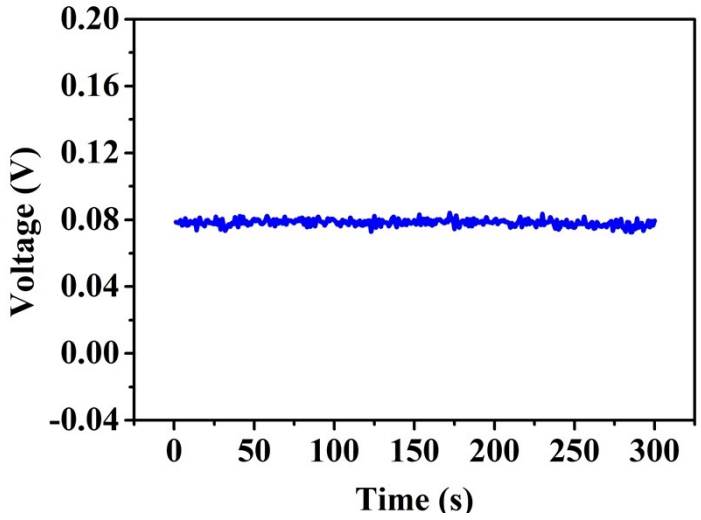


Fig. S7 Voltage curve of a device assembled with pure P(VDF-HFP) gel-electrolyte film under palm patting for 300 s.

References

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