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

Supporting Information

Rocking-chair Na-ion hybrid capacitor: a high energy/power system based on $Na_3V_2O_2(PO_4)_2F$@PEDOT core-shell nanorods

Langyuan Wu,[a] Shengyang Dong,[a] Gang Pang,[b] Hongsen Li,[a] Chengyang Xu,[a] Yadi Zhang,[a] Hui Dou[a] and Xiaogang Zhang,*[a]

[a]*Jiangsu Key Laboratory of Electrochemical Energy Storage Technologies, College of Materials Science and Engineering, Nanjing University of Aeronautics and Astronautics, Nanjing, 210016, P.R. China*

[b]*School of Material Science & Engineering and Anhui Key Laboratory of Metal Materials and Processing, Anhui University of Technology, Maanshan, 243002, P. R. China*

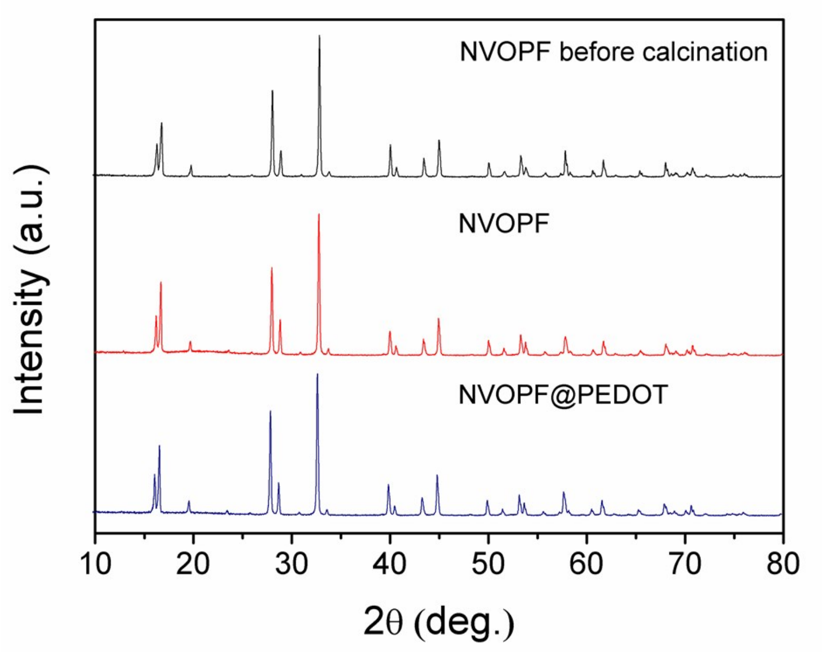

Fig. S1 Comparison of the XRD patterns of $Na_3V_2O_2(PO_4)_2F$ before calcination, $Na_3V_2O_2(PO_4)_2F$ and $Na_3V_2O_2(PO_4)_2F$@PEDOT.

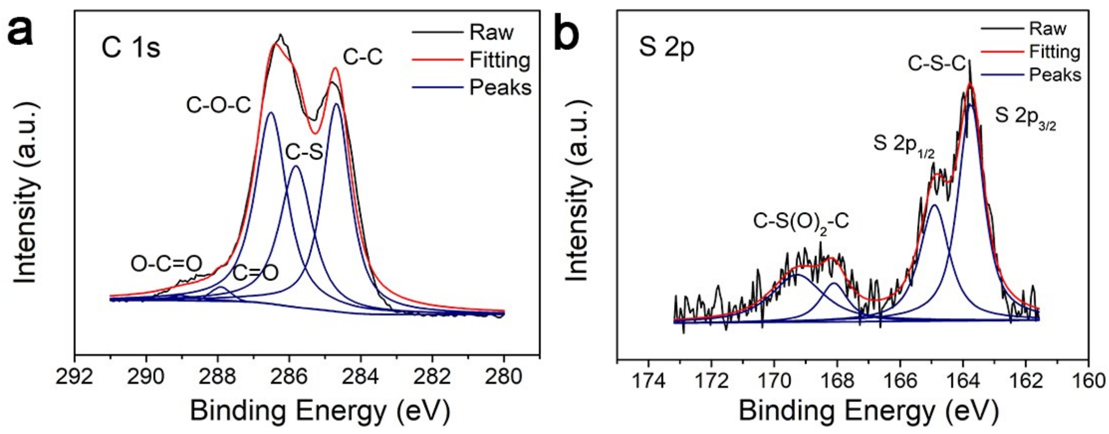

Fig. S2 XPS (a) C 1s (b) S 2p spectra of $Na_3V_2O_2(PO_4)_2F$@PEDOT.

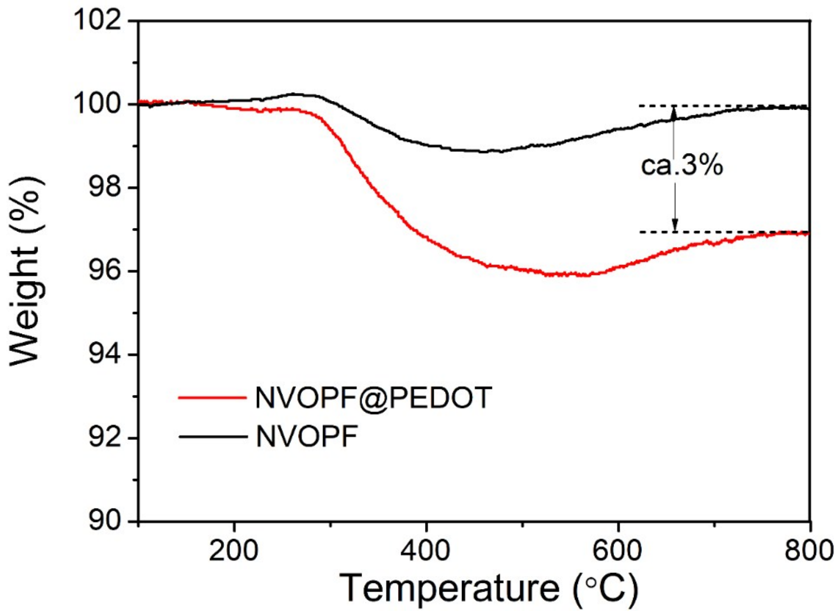

Fig. S3 TG curves of NVOPF and NVOPF@PEDOT.

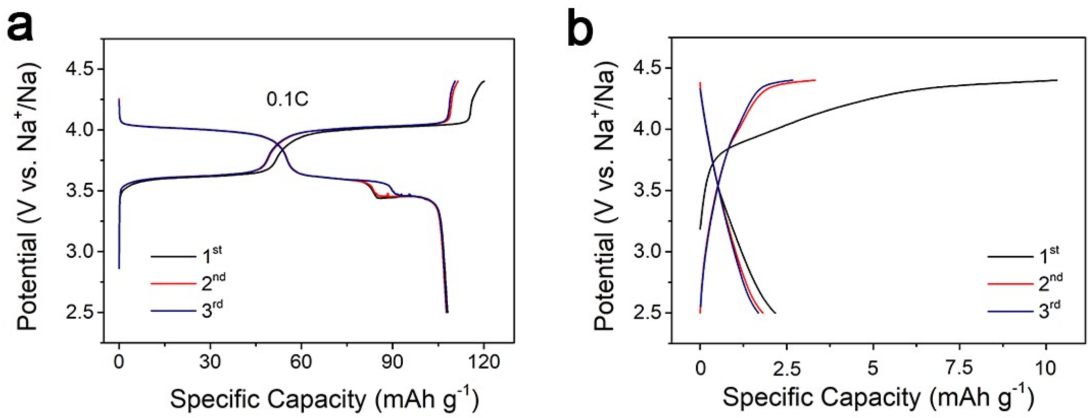

Fig. S4 (a) GCD curves of NVOPF and (b) PEDOT in 1 M $NaClO_4$ in EC/PC (1:1 in v/v) with 5 vol % FEC as the additive.

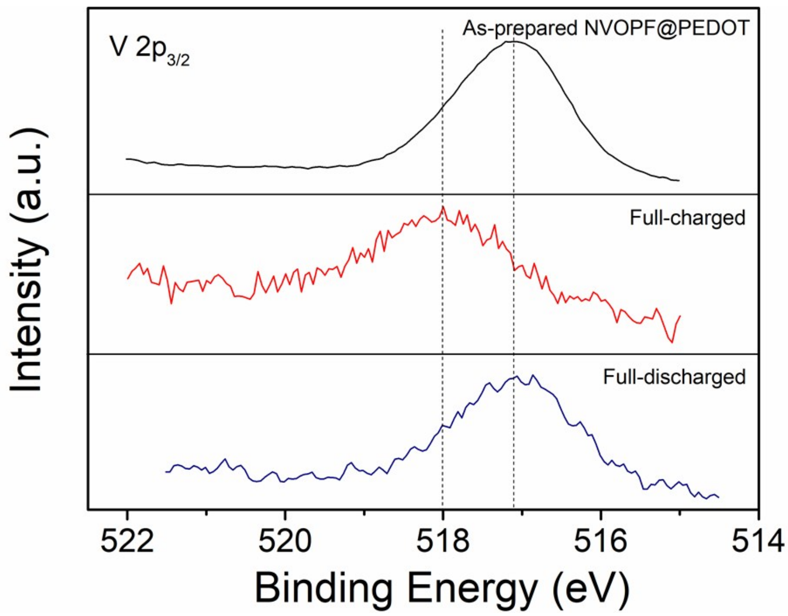

Fig. S5 XPS V $2p_{3/2}$ spectra of NVOPF@PEDOT at different SOCs.

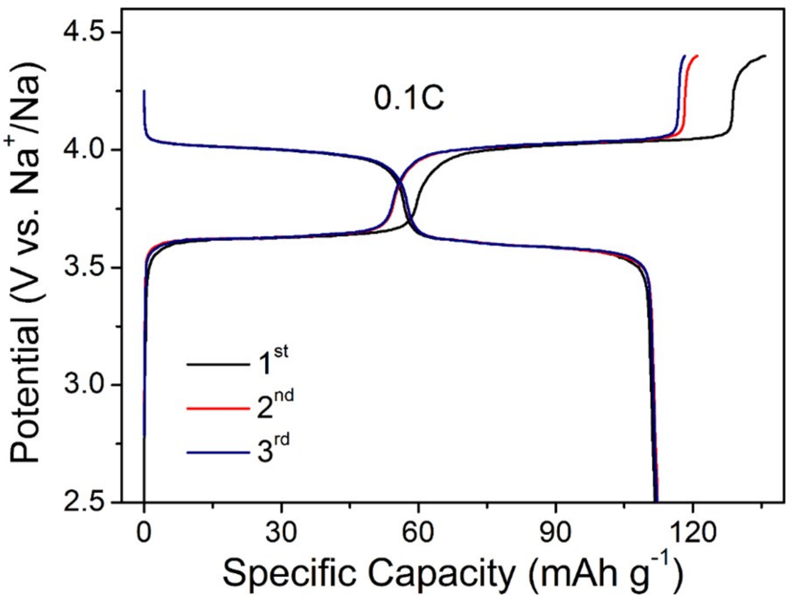

Fig. S6 GCD curves of NVOPF@PEDOT in 1 M $NaClO_4$ in EC/PC (1:1 in v/v).

J. M. Tarascon *et al*. reported that two major effects regarding the addition of FEC in Na half-cells emerge. One regards the enhanced efficiency of the cathode's first cycle by lowering the irreversible capacity and the other one deals with increase polarization penalty generated in two-electrode configuration. Some resistive layer grows at OCV on a half-cell with Na counter electrode before testing starts which limits the mass transfer from the counter electrode to the electrolyte [1].

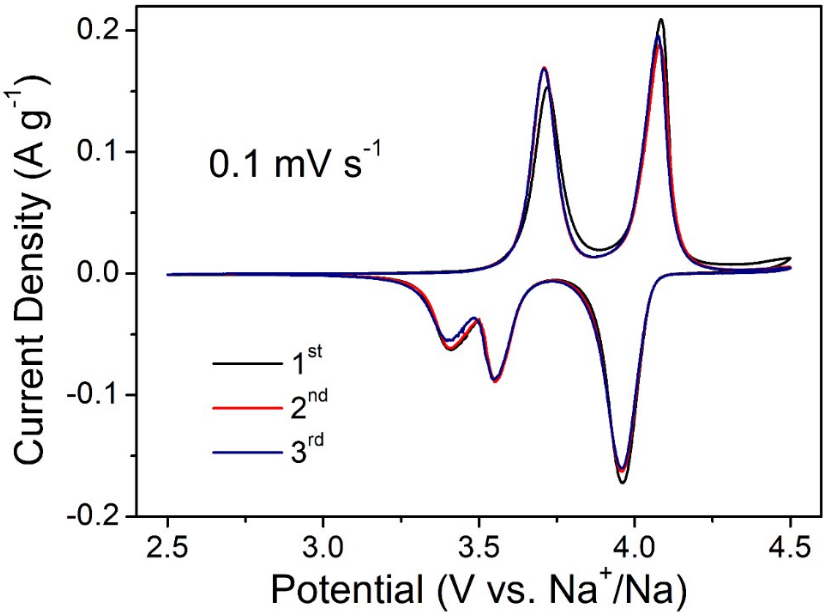

Fig. S7 CV curves of NVOPF@PEDOT.

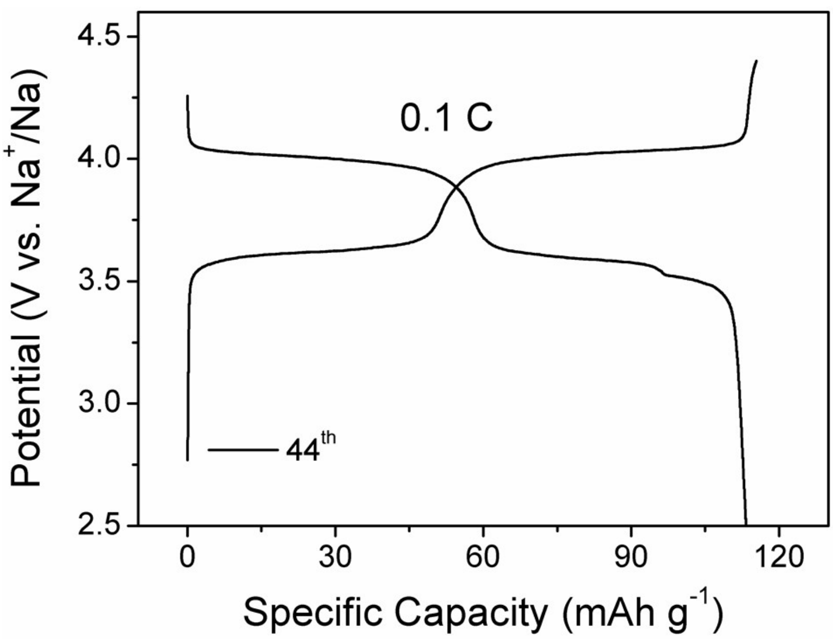

Fig. S8 The 44th cycle of GCD curves of NVOPF@PEDOT in rate test.

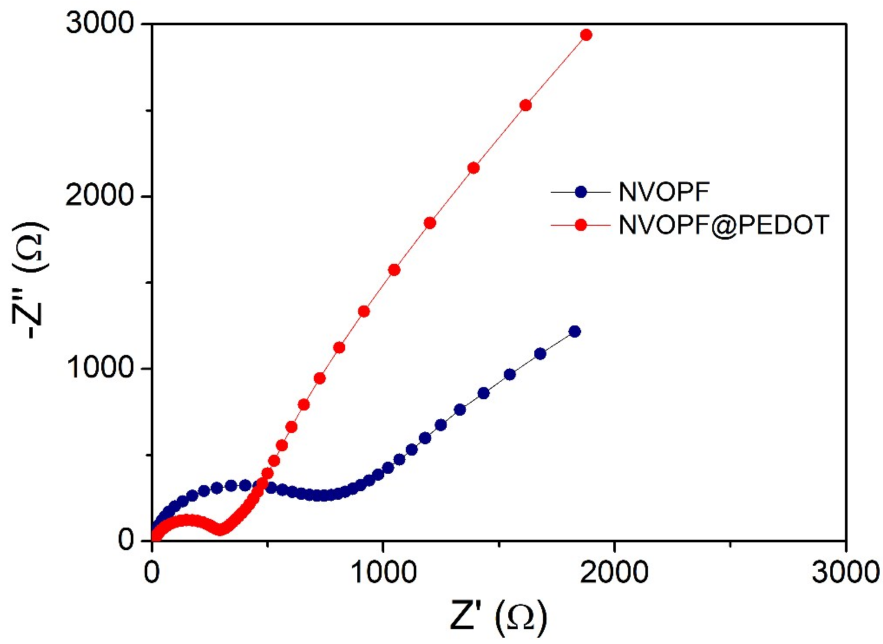

Fig. S9 EIS of NVOPF and NVOPF@PEDOT electrodes.

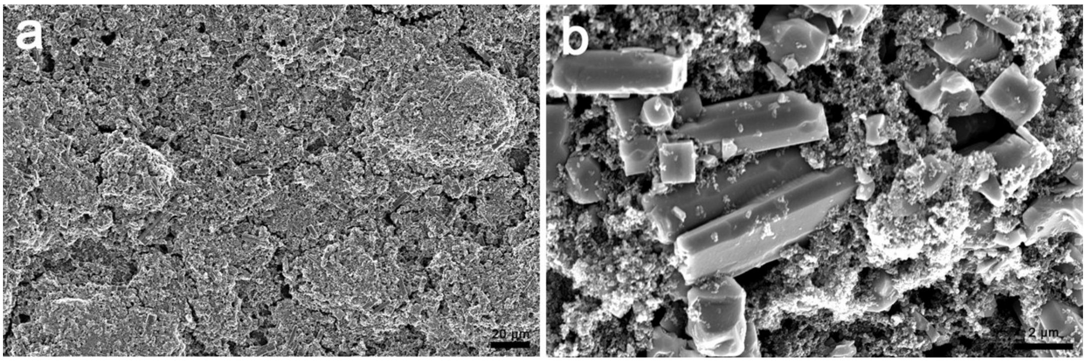

Fig. S10 Different magnification SEM images of the NVOPF@PEDOT electrode after 20 cycle at 1C.

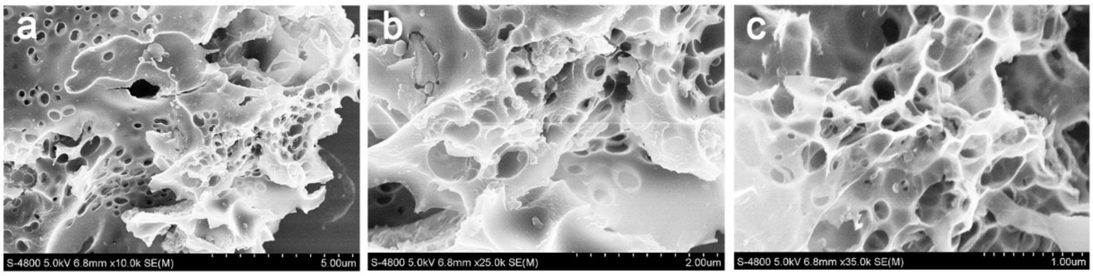

Fig. S11 SEM images of peanut shell derived carbon.

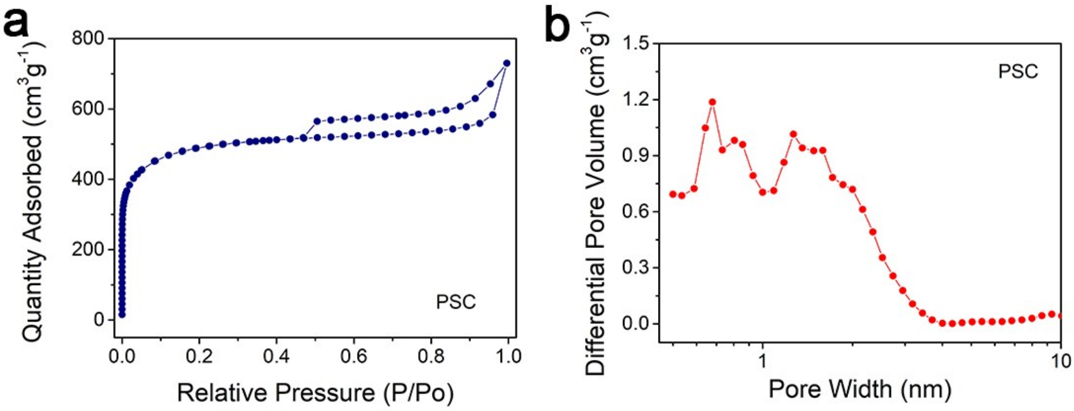

Fig. S12 (a) Nitrogen adsorption–desorption isotherm of peanut shell derived carbon. (b) Pore size distribution of peanut shell derived carbon.

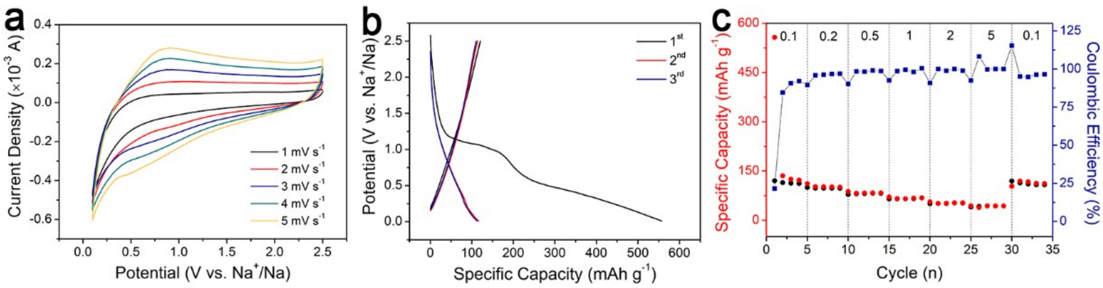

Fig. S13 (a-c) Electrochemical properties of AC (peanut shell derived carbon) in half cells: (a) CV curves at various scan rates from 1.0 to 5.0 mV s^{-1}. (b) GCD curves of the AC at 0.1 A g^{-1}. (c) Rate capabilities of AC at various current rates from 0.1 A g^{-1} to 5 A g^{-1}.

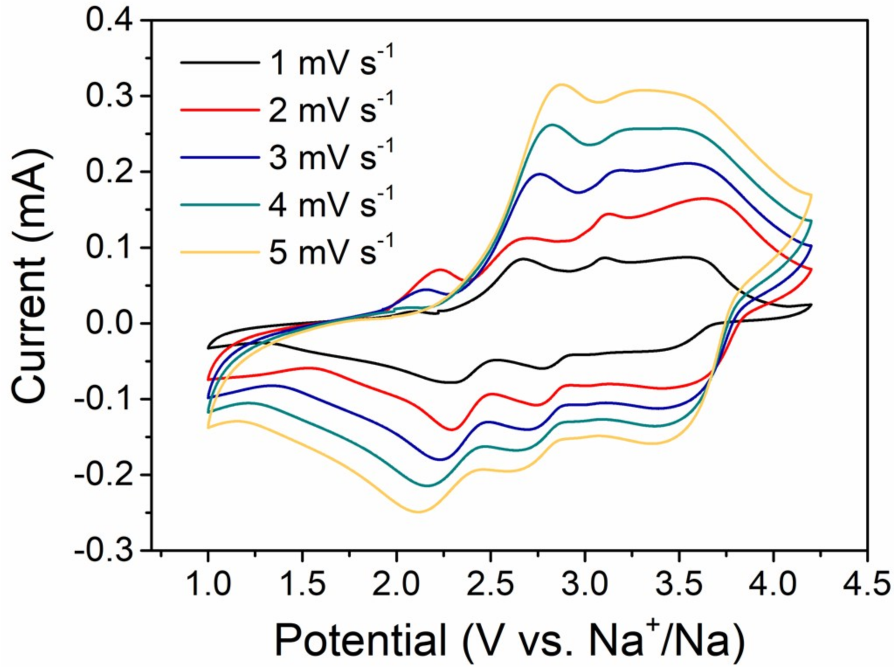

Fig. S14 CV curves at various scan rates from 1.0 to 5.0 mV s^{-1} of NVOPF@PEDOT//AC.

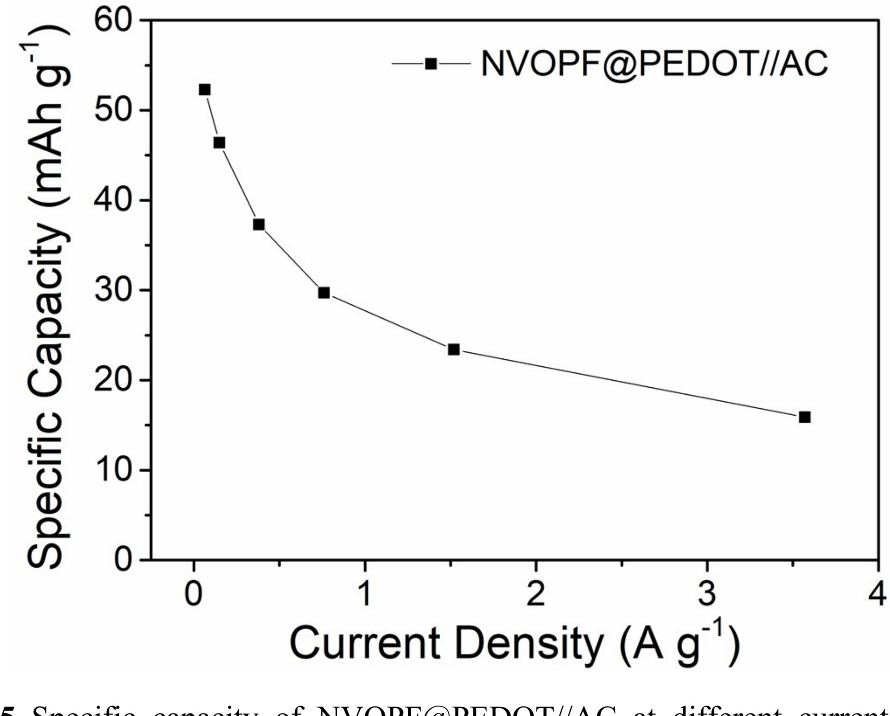

Fig. S15 Specific capacity of NVOPF@PEDOT//AC at different current density.

Table S1 The sodium storage properties for reported NVOPF half cells.

	Electrolyte	Rate capability ($mA\ h\ g^{-1}$)	Cycle life (corresponded capacity retention)
$Na_3V_2O_2(PO_4)_2F$@PEDOT (present work)	1M $NaClO_4$ in EC:PC+5%FEC	73 at 10C	8000 at 5C (83.8%)
$Na_3V_2O_2(PO_4)_2F$@carbon/graphene[2]	1M $NaClO_4$ in EC:DMC	78.5 at 10C	40 at 1C (98.9%)
$Na_3V_2O_2(PO_4)_2F/C$[3]	1 M $NaPF_6$ in EC:PC	30 at 5C	
$Na_3V_2O_2(PO_4)_2F$-nano-tetraprisms[4]	1M $NaClO_4$ in PC+5%FEC in the P(VDF-HFP)	81 at 10C	1500 at 1C (94.6%)
$Na_3V_2O_2(PO_4)_2F$/graphene[5]	1 M $NaPF_6$ in EC:DEC	40 at 10C	200 at 0.1C (91.4%)
$Na_3(VO_{1-x}PO_4)_2F_{1+2x}$ ($0 \leqslant x \leqslant 1$) nanoparticles[6]	1M $NaClO_4$ in EC:DEC+2%FEC	73 at 10C	1200 at 2C (90%)

Reference:

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