Electronic Supplementary Information

V_2O_5 Nanowire Composite Paper as a High-performance Lithium-ion Battery Cathode

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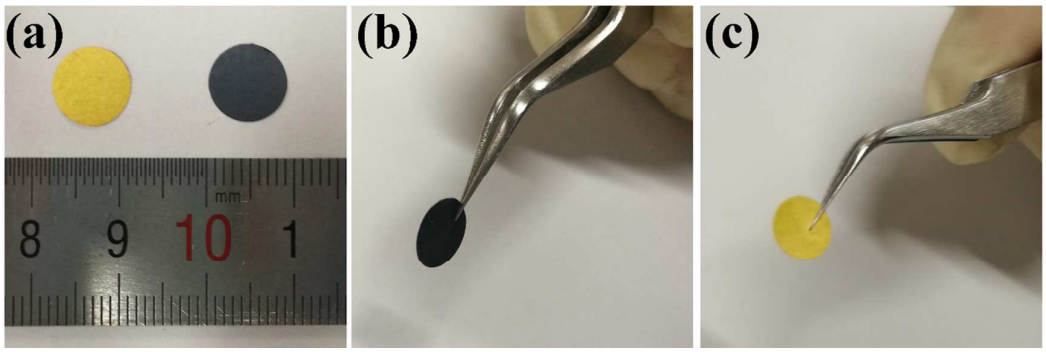

Figure S1 The digital camera pictures of (a) two kind of paper electrodes cut into small pellets ($\Phi = 9mm$) (b) V_2O_5/rGO composite paper electrodes and (c) pure free-standing V_2O_5 nanowires paper electrodes.

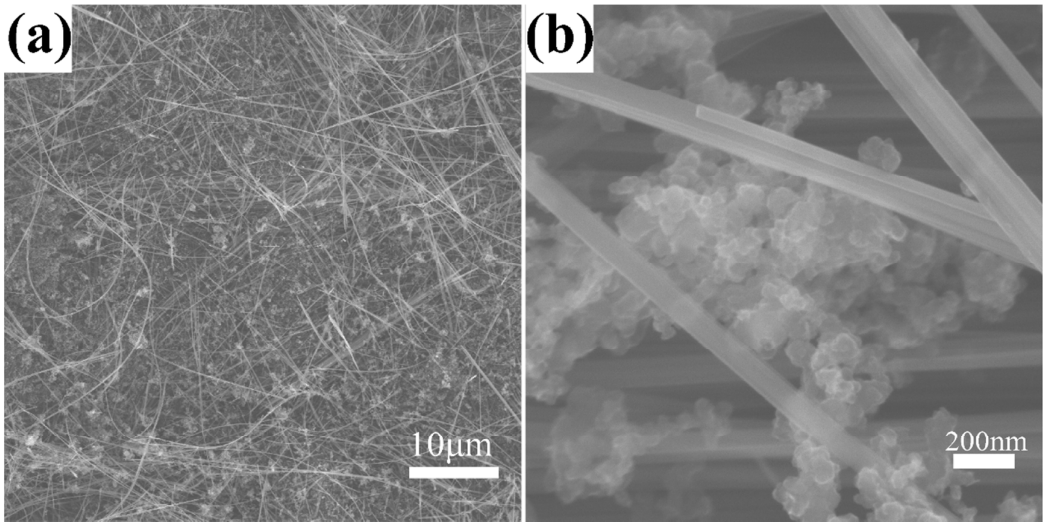

Figure S2 SEM images of V_2O_5/SP composite paper. (a) Low magnification SEM image, (b) High magnification SEM image.

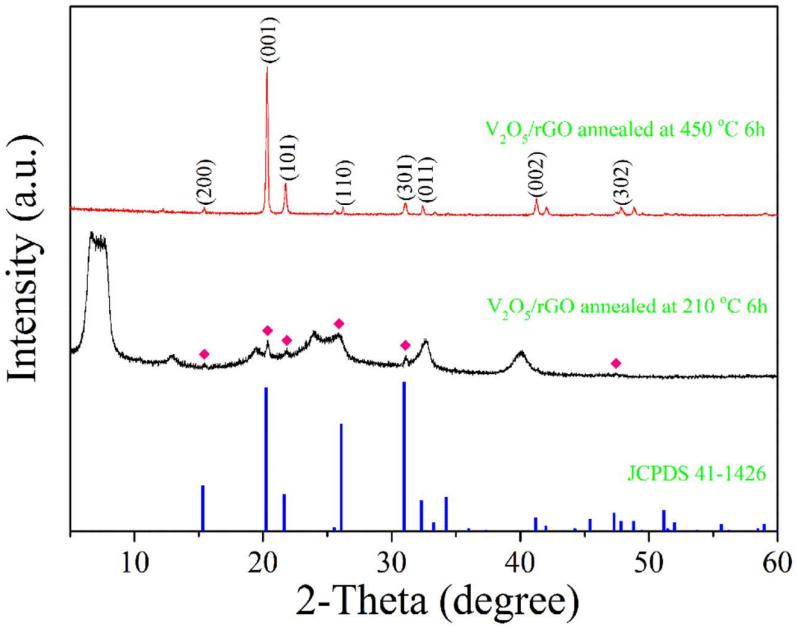

Figure S3 XRD patterns of V_2O_5/rGO composite paper annealed at 210 ^oC and 450 ^oC for 6h in the air, respectively.

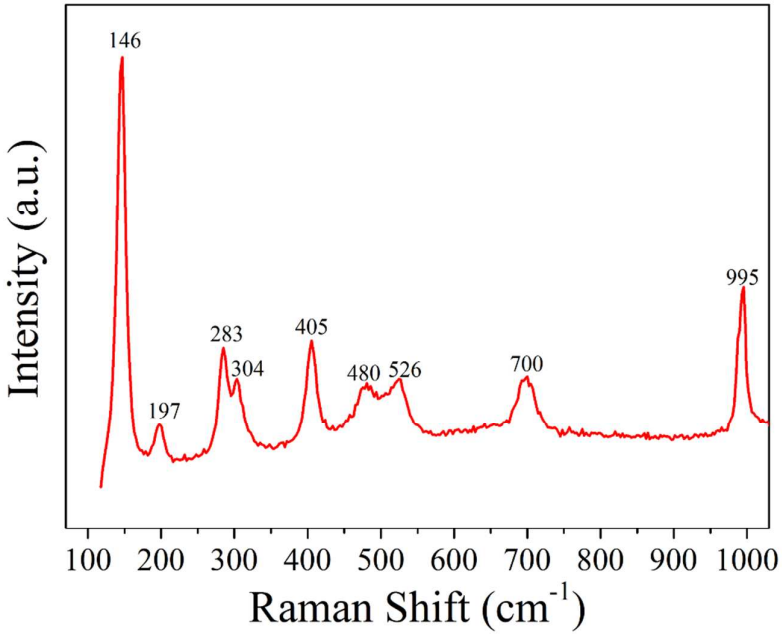

Figure S4 The Raman spectrum of pure V_2O_5 nanowires

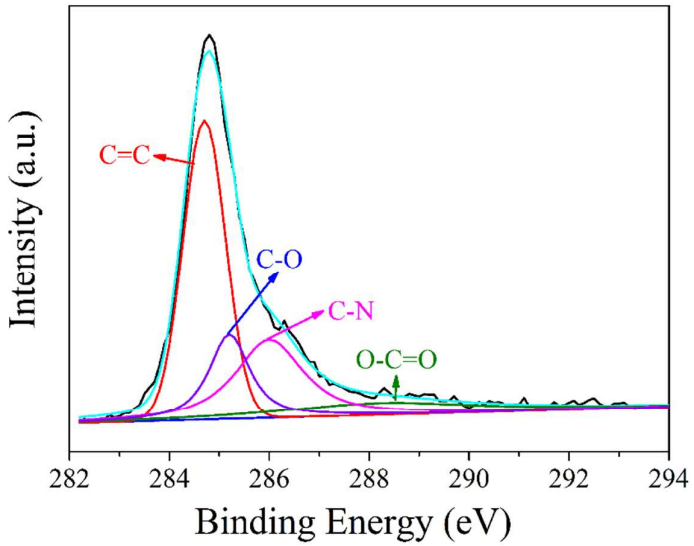

Figure S5 The C1s XPS spectrum of V_2O_5/rGO composite paper, the bond of C-O, O-C=O and C-N were produced from the preparation of GO.

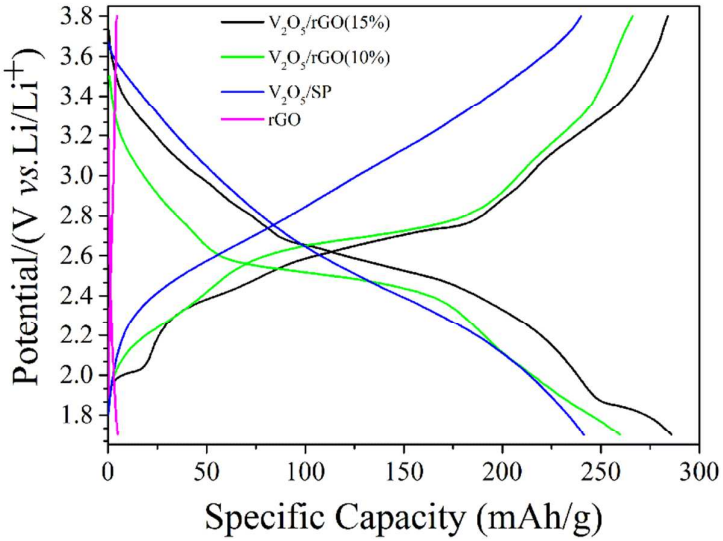

Figure S6 The voltage profiles of V_2O_5/rGO (15%), V_2O_5/rGO (10%), V_2O_5/SP and rGO paper, the specific capacity is 285.6 mAh/g, 260 mAh/g, 241 mAh/g and 5 mAh/g at current density of 30mA/g, respectively.

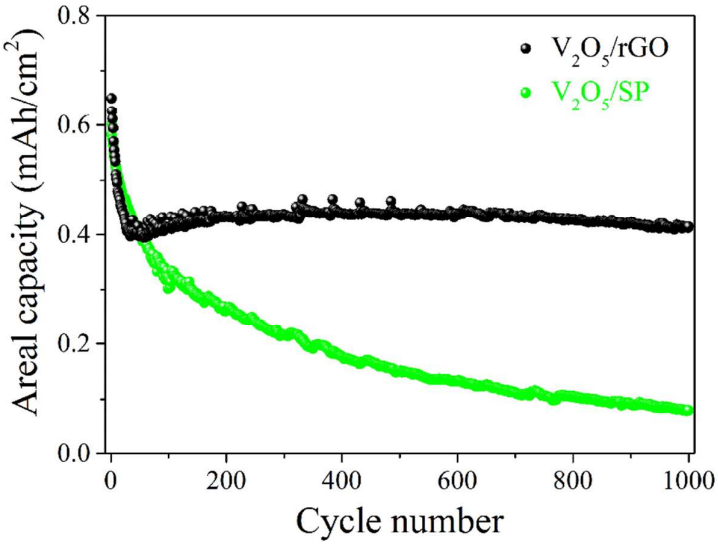

Figure S7 The cycle performance of V_2O_5/rGO and V_2O_5/SP composite paper at the current density of 0.9 mA/cm^2

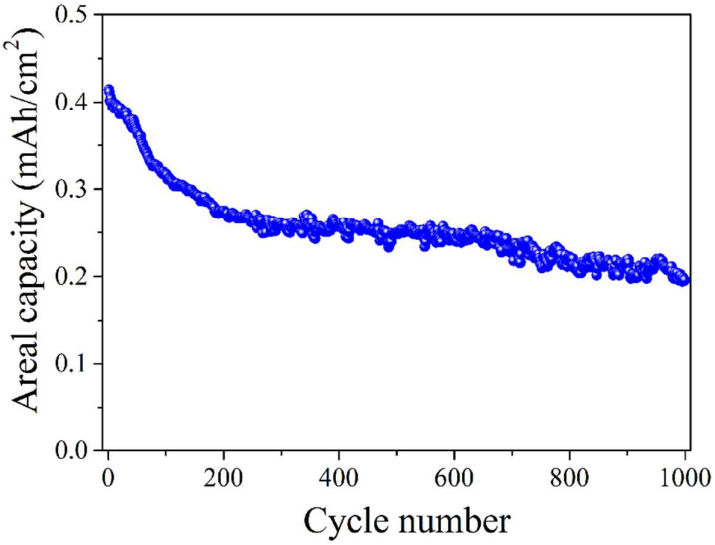

Figure S8 The cycle performance of V_2O_5/rGO composite paper at the current density of 1.8 mA/cm^2

Table S1. Performance of V_2O_5-based composite electrodes for Lithium batteries published in the literatures

Material	V_2O_5 (wt.%)	Free-standing or binder-free	Specific capacity	Cycling stability	Ref
V_2O_5 nanobelts	100	Yes	127.4mAh/g at 60 mA/g	89.8% after 200 cycles at 60 mA/g	S1
Graphene-V_2O_5	98	No	438mAh/g at 22mA/g	74% after 200 cycles at 443 mA/g	S2
3-D V_2O_5 nanosheets/RGO	95	No	271 mAh/g at 60mA/g	52% after 160 cycles at 600mA/g	S3
V_2O_5@PPy	88	No	208 mAh/g at 7.5 mA/g	83% after 200 cycles at 7.5 mA/g	S4
3D V_2O_5/RGO/CNT	87	No	265 mAh/g at 300mA/g	80% after 80 cycles at 300mA/g	S5
V_2O_5/rGO	**85**	**Yes**	**285mAh/g at 30mA/g**	**69.1% after 1000 cycles at 300mA/g**	***This work***
V_2O_5 nanosheets/CNT	81	No	245.8 mAh/g at 100mA/g	76.6% after 100 cycles at 5A/g	S6
V_2O_5-Graphene	75.8	Yes	283 mAh/g at 200mA/g	77% after 100 cycles at 50mA/g	S7
V_2O_5/PANi	65	Yes	270 mAh/g at 295 mA/g	96.6% after 50 cycles at 295 mA/g	S8
Graphene–V_2O_5•nH_2O	60.4	No	299 mAh/g at 30 mA/g	86% after 50 cycles at 30mA/g	S9
Graphene Nanoribbon/V_2O_5	60	No	278 mAh/g at 30mA/g	78% after 200 cycles at 30mA/g	S10
Porous V_2O_5 spheres/rGO	54	No	211 mA h/g at 190mA/g	85% after 50 cycles at 90 mA/g	S11
TiO_2/V_2O_5/CNT	52	Yes	390 mAh/g at 100mA/g	85% after 100 cycles at 100mA/g	S12
MWCNT/V_2O_5	50	Yes	818 μAh/cm^2 at 300mA/g	90% after 100 cycles at 300mA/g	S13

Table S2. Freestanding composite paper or film electrodes for Lithium batteries published in the literature

Material	Active material (wt.%)	Cycling stability	Ref
$Na_{2+2x}Fe_{2-x}(SO_4)_3$/PCN hybrid films	90	95% after 500 cycles at 5C	S14
Homogeneous CoO on Graphene	87	99% after 5000 cycles at 1 A/g	S15
V_2O_5/rGO	**85**	**69.1% after 1000 cycles at 300mA/g**	***This work***
$LiMn_2O_4$-CNT films	71	82.1% after 300 cycles at 1C	S16
Mn_3O_4/Graphene	68	87.5% after 100 cycles at 100mA/g	S17
Graphene/CNT/Si hybrid grid	56	45% after 60 cycles at 420mA/g	S18
MoS_2-FSG	45	66% after 30 cycles at 150mA/g	S19
Si/rGO hybrid film	33	64% after 150 cycles at 200mA/g	S20
SnO_x−ZnO/CNF Composites	28	72% after 55 cycles at 100mA/g	S21
V_2O_5/Graphene	15	40% after 100000 cycles at 10A/g	S22

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