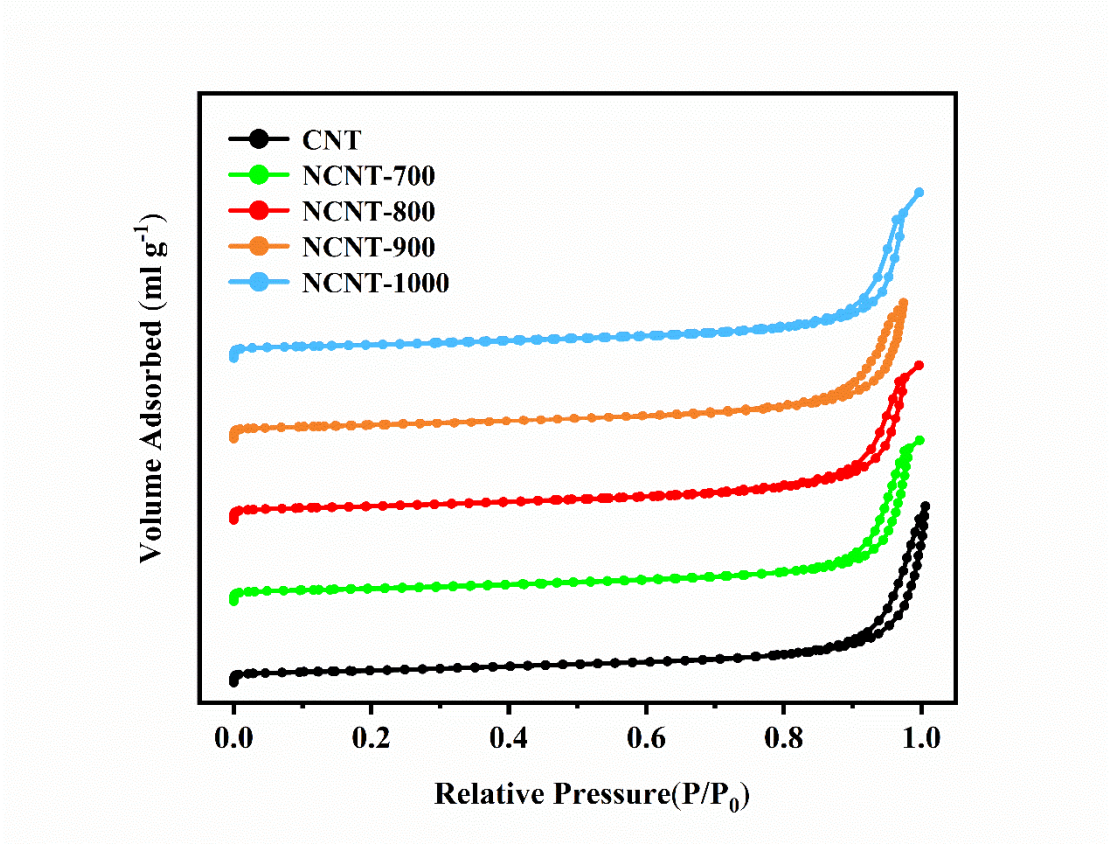

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Figure S1. N2 adsorption/desorption isotherms of CNTs and NCNTs samples.

Table S1. Specific energy and energy efficiency of each battery at different cycling rates

Sample	Cycle Rate (C)	Charge Specific Energy (mWh/g)	Discharge Specific Energy (mWh/g)	Energy Efficient
B-CNT	0.1	441.212	427.532	96.89%
	0.3	435.6	422.031	96.88%
	0.5	433.386	419.43	96.77%
	1	431.61	411.529	95.34%
	3	431.663	386.293	89.48%
	5	417.954	365.161	87.36%
	10	405.721	311.589	76.79%
B-NCNT-700	0.1	454.517	444.759	97.85%
	0.3	451.644	439.358	97.27%

	0.5	448.182	434.919	97.04%
	1	446.142	424.862	95.23%
	3	445.319	396.85	89.11%
	5	426.005	369.532	86.74%
	10	410.057	316.849	77.26%
	0.1	451.619	441.038	97.65%
	0.3	447.658	436.527	97.51%
	0.5	444.762	433.538	97.47%
B-NCNT-800	1	443.794	425.65	95.91%
	3	443.279	401.458	90.56%
	5	428.955	379.647	88.50%
	10	416.953	337.312	80.89%
	0.1	436.605	407.036	94.22%
	0.3	425.448	408.152	95.93%
	0.5	421.344	405.495	96.23%
B-NCNT-900	1	418.093	395.692	94.64%
	3	416.668	369.342	88.64%
	5	401.74	347.556	86.51%
	10	388.309	303.552	78.17%
	0.1	419.002	407.478	97.24%
	0.3	414.426	402.636	97.15%
	0.5	411.248	398.745	96.95%
B-NCNT-1000	1	410.139	391.025	95.33%
	3	408.89	365.004	89.26%
	5	393.751	344.452	87.47%
	10	380.981	300.317	78.82%

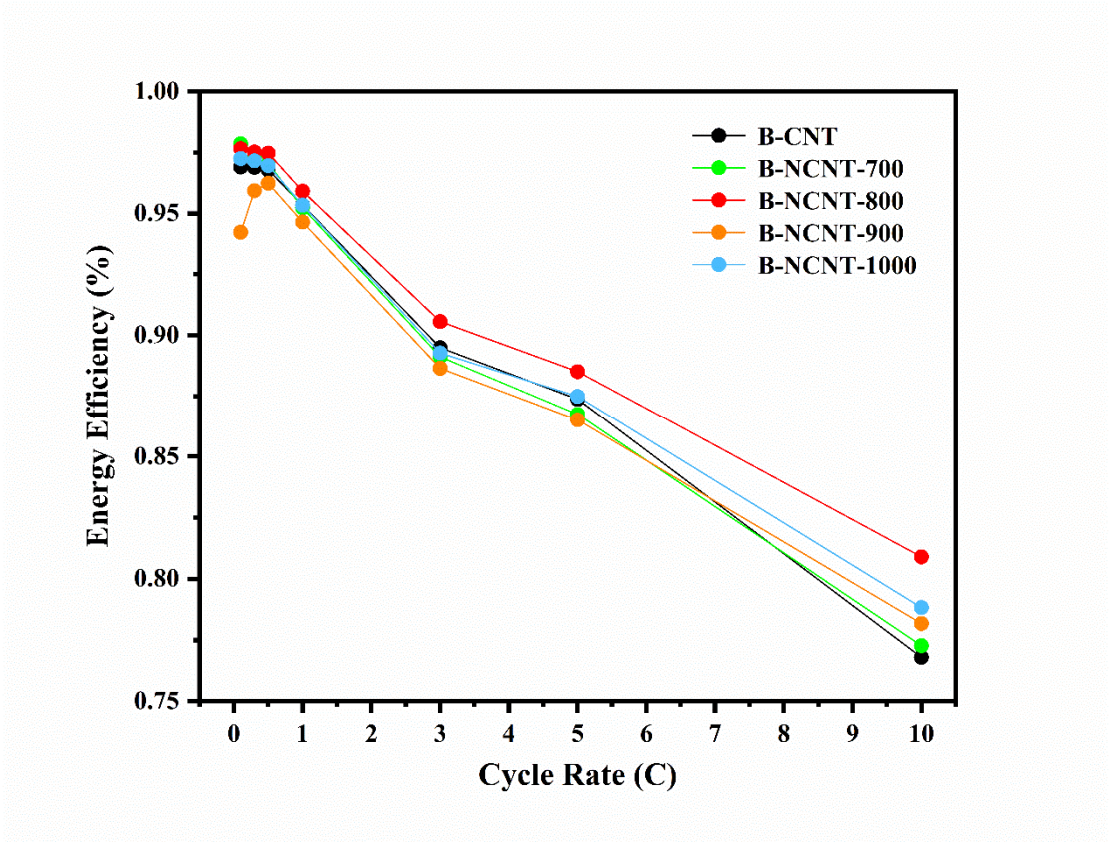


Figure S2. Energy efficiency of batteries at different cycling rates

Figs. S3 shows the CV measurement of the (c) B-NCNT-800 and (d) B-CNT at diverse scanning rates ranging from 0.1-1mV s^{-1}. The Randles-Sevcik formula was used to evaluate the lithium-ion diffusion coefficient. Accordingly, the formula can be written as follows.

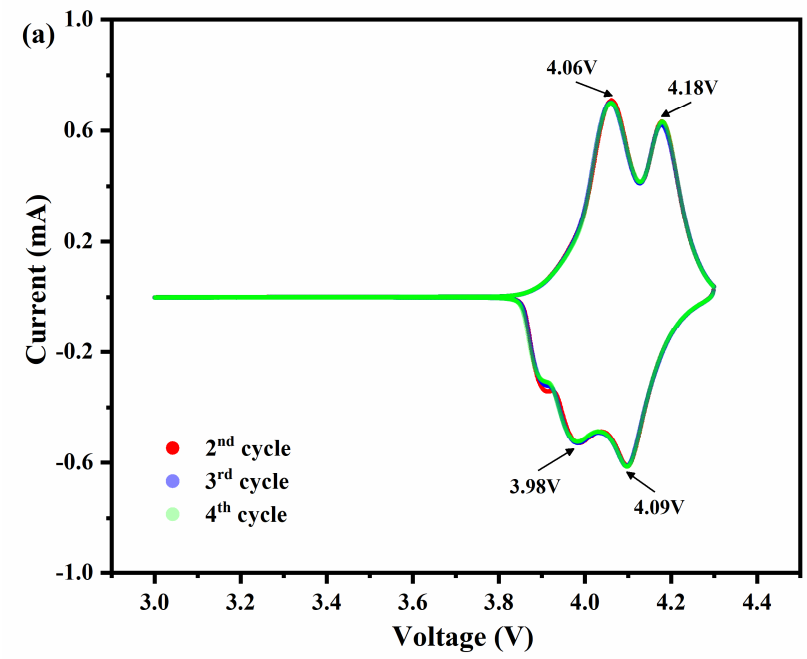
$$I_P = 2.69 \times 10^5 A n^{\frac{3}{2}} C D^{\frac{1}{2}} v^{\frac{1}{2}} \quad (1)$$

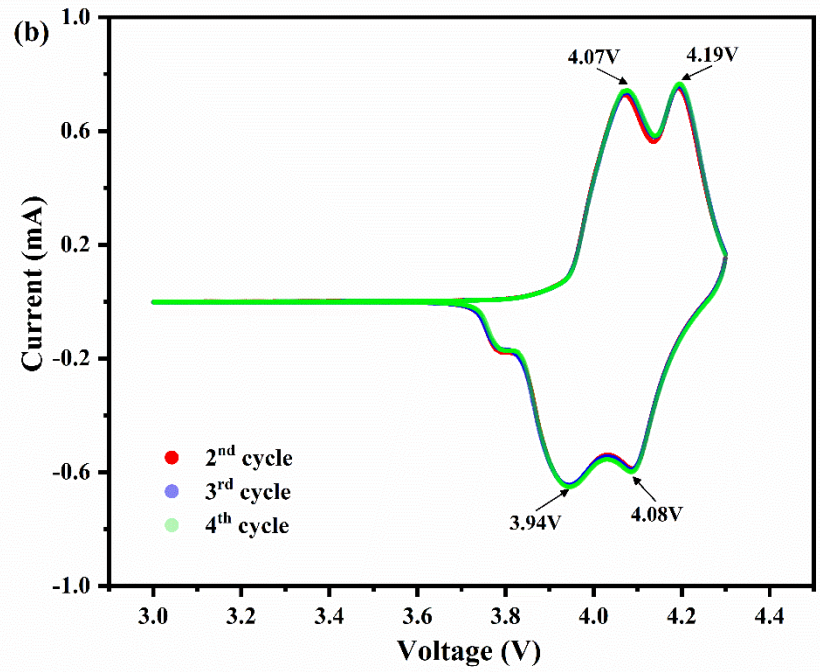
where I_p is the peak current, A is the surface area of the electrode, D is the diffusion coefficient of lithium ions, C is the concentration of lithium ions involved in the redox reaction, v is CV scanning rate, and n is the number of electron transfer in electrode reaction.
Considering that only different conductive additives are used as variables between B-NCNT-800 and B-CNT, the A, C, v parameters can be considered constant values. Fig. S3(e) shows the plotted linear regression of the peak current (I_p) versus the square root of the scan rate. It shows that the linear regression slope of B-NCNT-800 is nearly the same as that of B-CNT, which indicates that the use of nitrogen-doped carbon nanotubes could not affect the diffusion coefficient of lithium ions in the electrode.

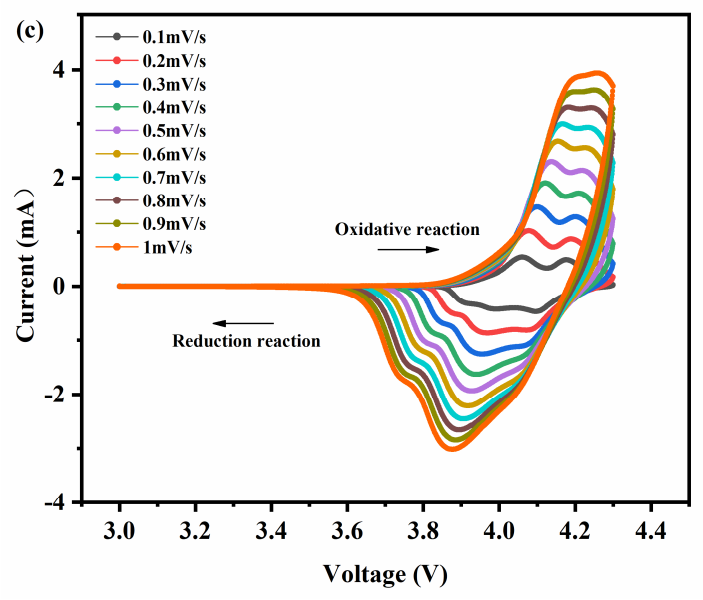
The effect of pseudocapacitance can be determined by using the following formula to investigate the charge-transfer process at the surface.

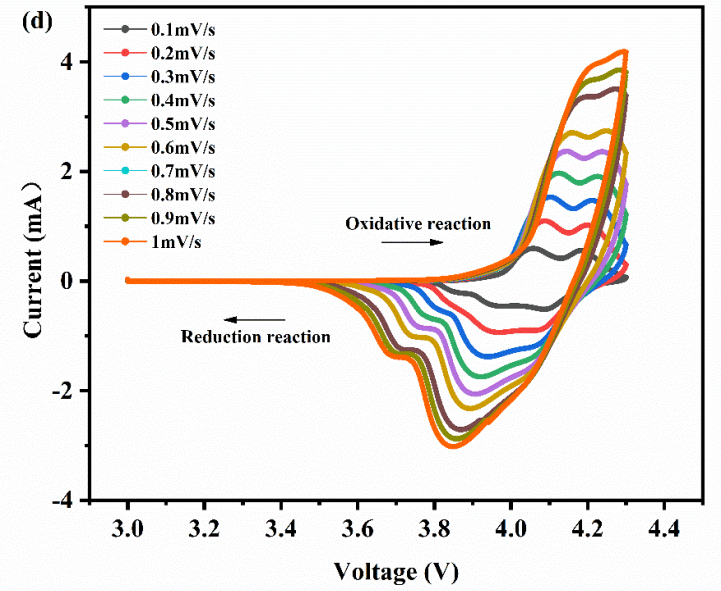
$$I_P = a v^b \quad (2)$$

Where both a and b are adjustable parameters. The value of b can be determined by the slope of $\log I_p$ Vs. $\log v$. Fig. S3(f) shows the linear regression of $\log I_p$ and $\log v$. While the b-values of both cells are in the range of 0.8 to 1.0, indicating that the current is predominantly capacitive.


(a)
1.0
0.6
0.2
-0.2
-0.6
-1.0
Current (mA)
4.06V
4.18V
3.98V
4.09V
2nd cycle
3rd cycle
4th cycle
3.0
3.2
3.4
3.6
3.8
4.0
4.2
4.4
Voltage (V)


(b)
1.0
0.6
0.2
-0.2
-0.6
-1.0
Current (mA)
4.07V
4.19V
3.94V
4.08V
2nd cycle
3rd cycle
4th cycle
3.0
3.2
3.4
3.6
3.8
4.0
4.2
4.4
Voltage (V)


(c)
0.1mV/s
0.2mV/s
0.3mV/s
0.4mV/s
0.5mV/s
0.6mV/s
0.7mV/s
0.8mV/s
0.9mV/s
1mV/s
Oxidative reaction
Reduction reaction
Current (mA)
Voltage (V)
4
2
0
-2
-4
3.0
3.2
3.4
3.6
3.8
4.0
4.2
4.4


(d)
0.1mV/s
0.2mV/s
0.3mV/s
0.4mV/s
0.5mV/s
0.6mV/s
0.7mV/s
0.8mV/s
0.9mV/s
1mV/s
Oxidative reaction
Reduction reaction
Current (mA)
Voltage (V)
4
2
0
-2
-4
3.0
3.2
3.4
3.6
3.8
4.0
4.2
4.4

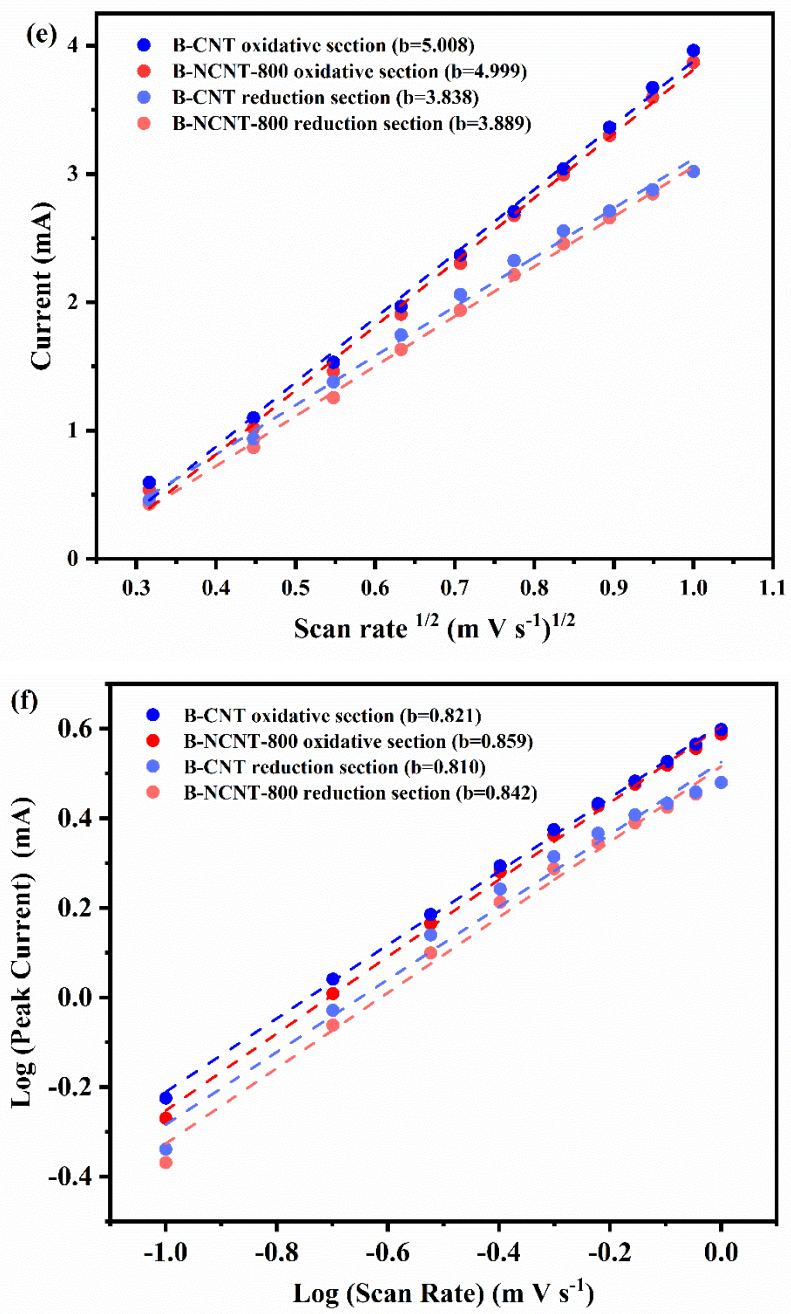


Figure S3. a-f): CV curves of the B-NCNT-800 (a) and B-CNT (b) cells for second to third cycles at a scan rate of 0.1 mV s^{-1} over the potential range of 3.0–4.3 V, the CV curves at diverse scanning rates of the B-NCNT-800 (c) and B-CNT(d), use of eq 1 to analyze the CV data for the B-NCNT-800 and B-CNT(e), and the use of eq 2 to analyze the CV data for the B-NCNT-800 and B-CNT(f).