Supplementary Information

Synthesis of high performance N-doped carbon coated on $Li_2ZnTi_3O_8$ via a NTA-assisted solid-state route

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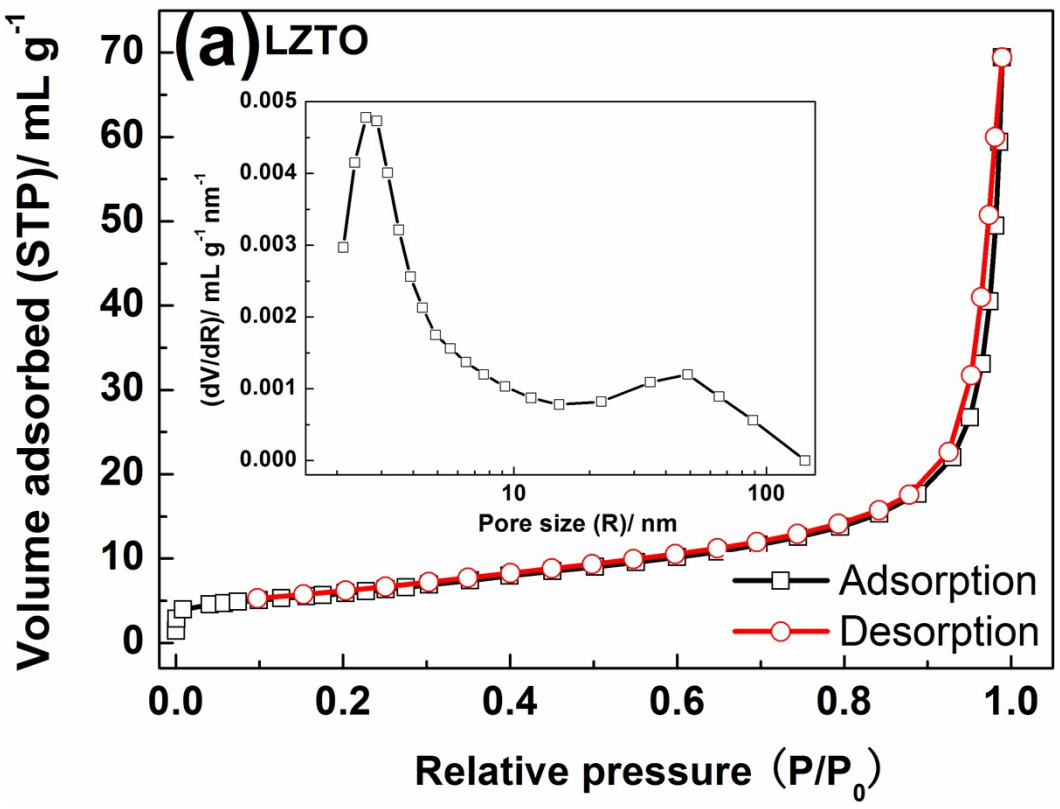
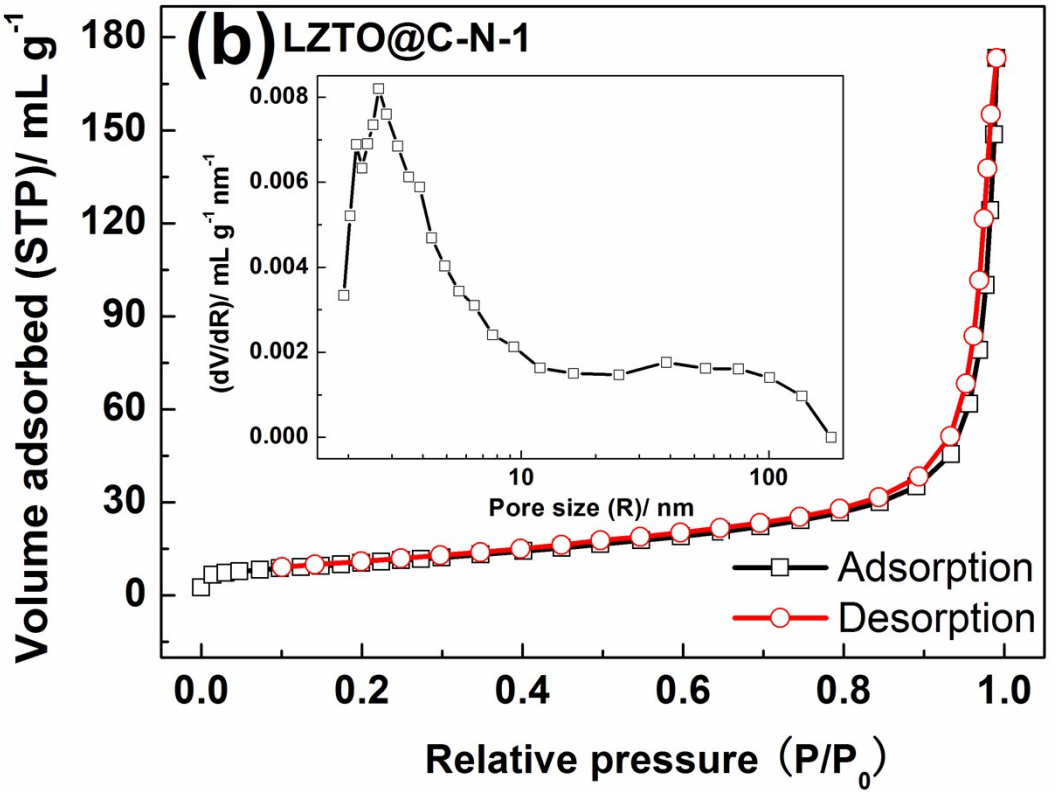

(a) LZTO
Volume adsorbed (STP)/ mL g-1
Relative pressure (P/P0)
Adsorption
Desorption
(dV/dR)/ mL g-1 nm-1
Pore size (R)/ nm


(b) LZTO@C-N-1
Volume adsorbed (STP)/ mL g-1
Relative pressure (P/P0)
Adsorption
Desorption
(dV/dR)/ mL g-1 nm-1
Pore size (R)/ nm

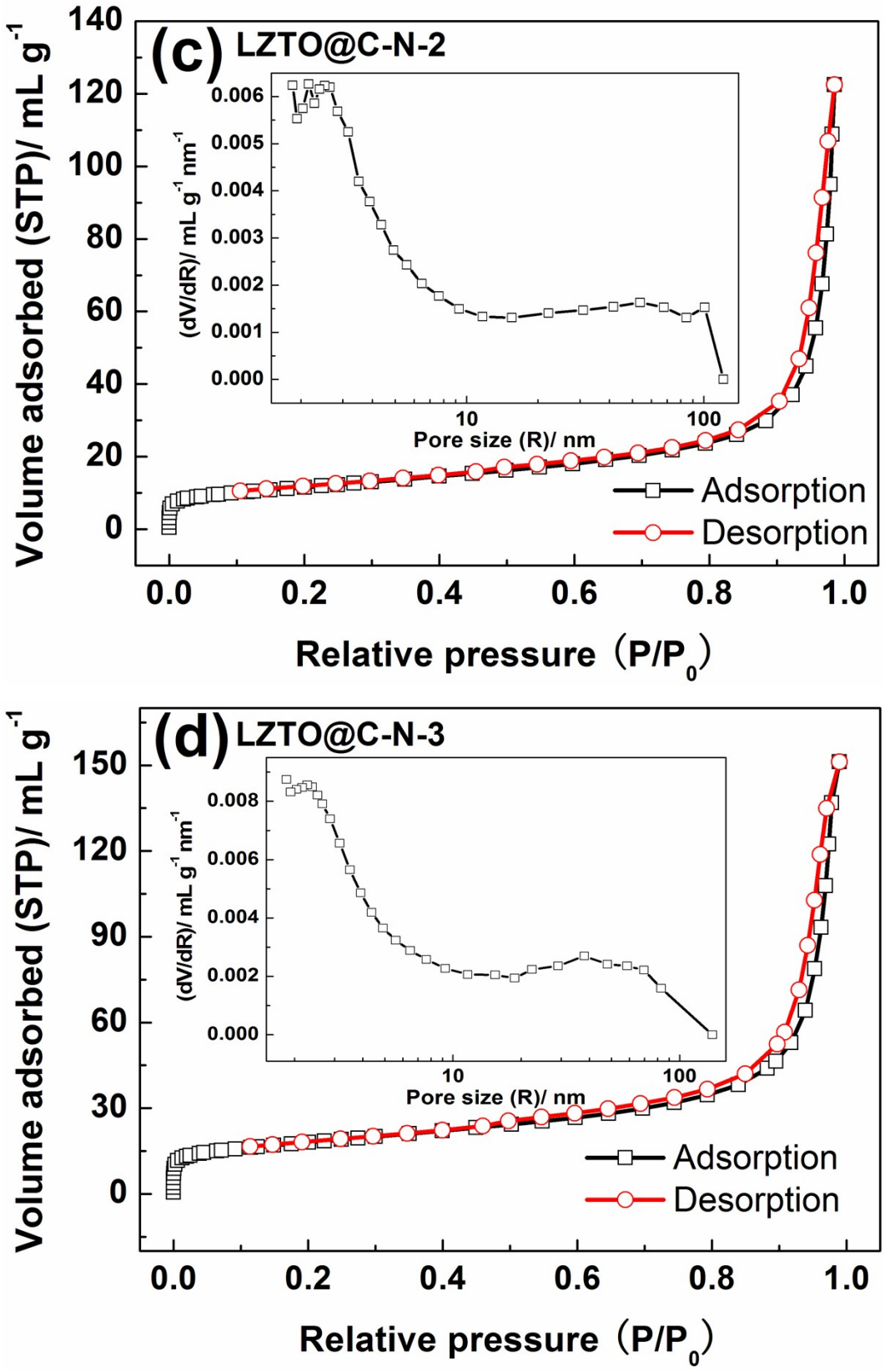
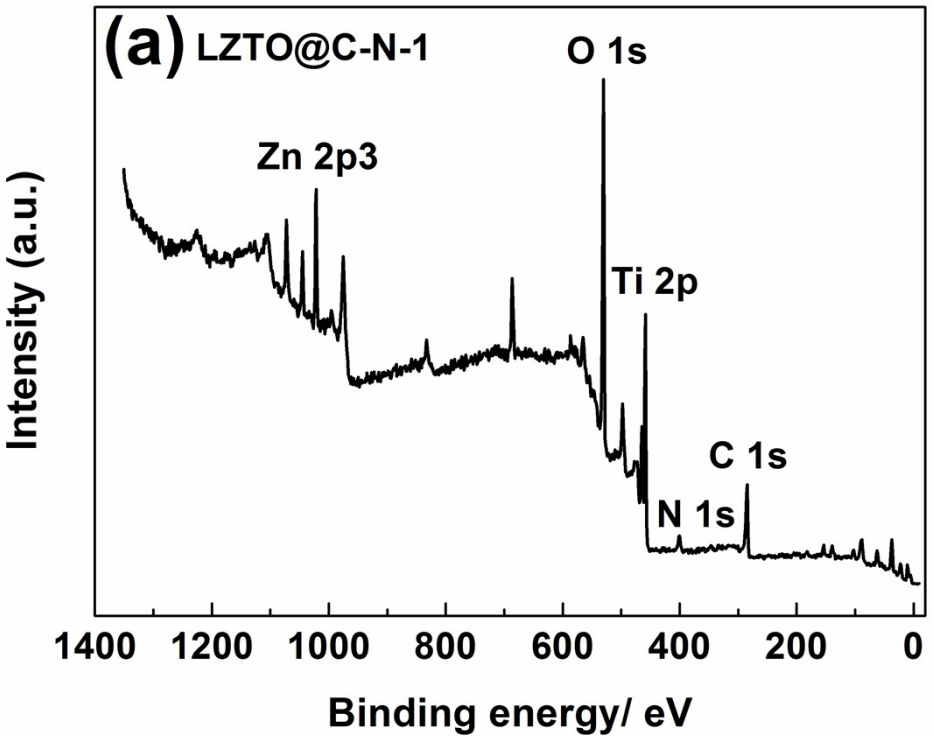
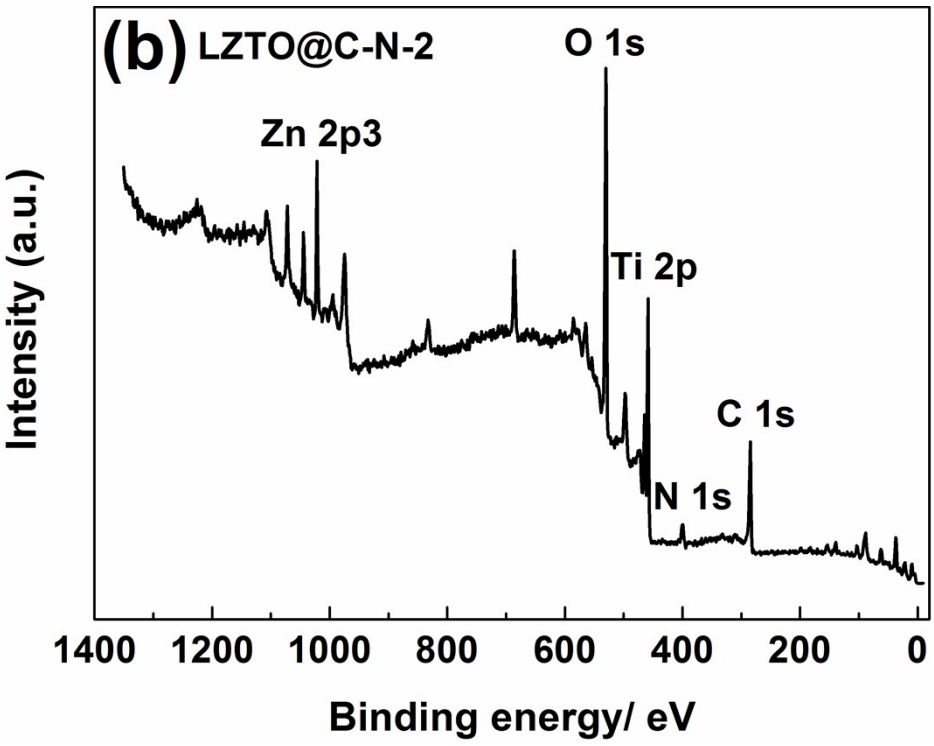
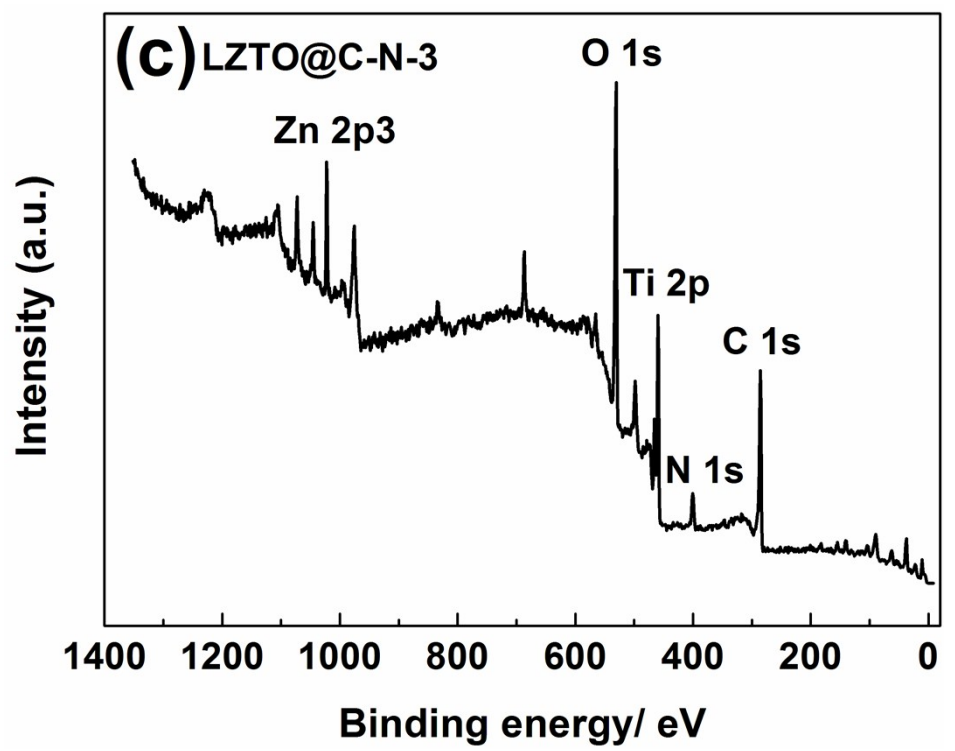
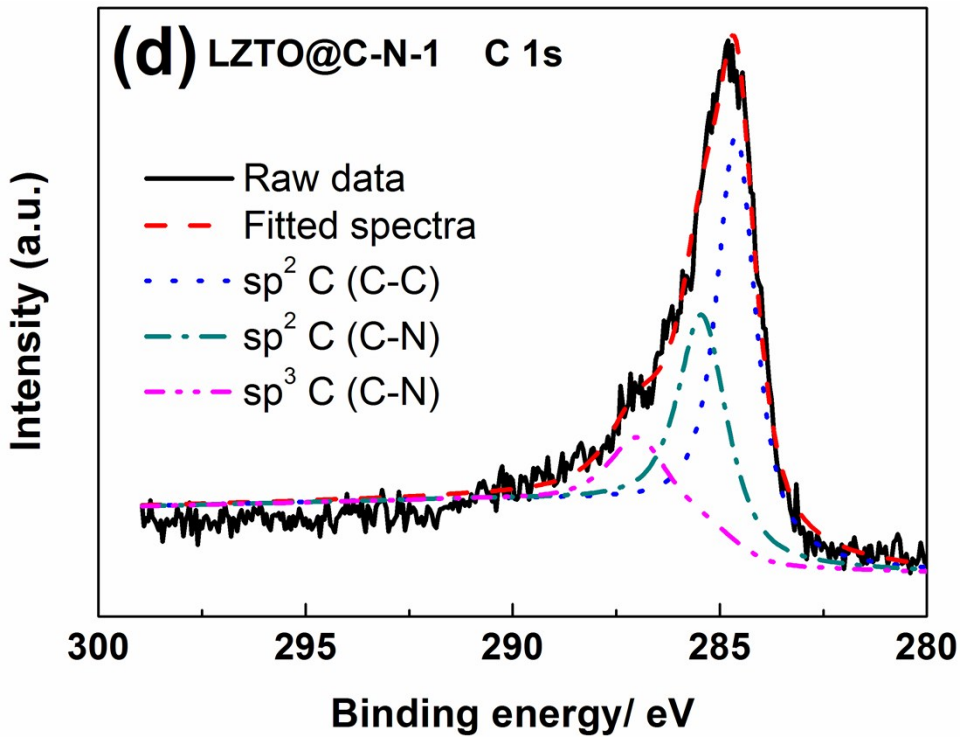


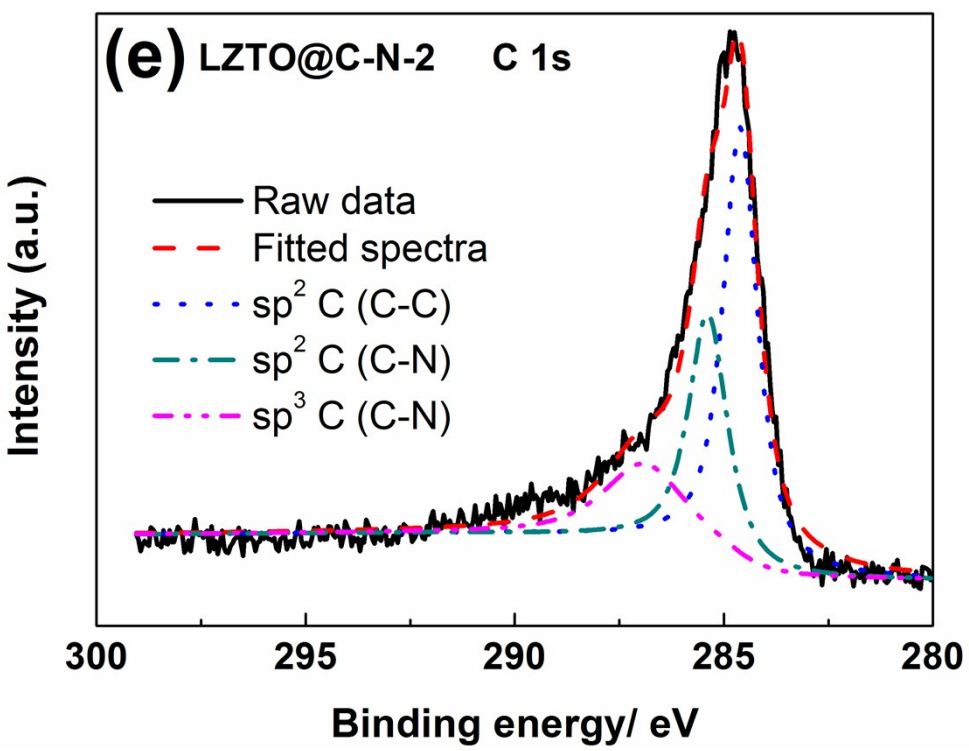
Fig. S1 N_2 adsorption-desorption isotherms of (a) LZTO, (b) LZTO@C-N-1, (c) LZTO@C-N-2 and (d) LZTO@C-N-3. Insets, the pore size distributions of the LZTO and LZTO@C-N anode materials.

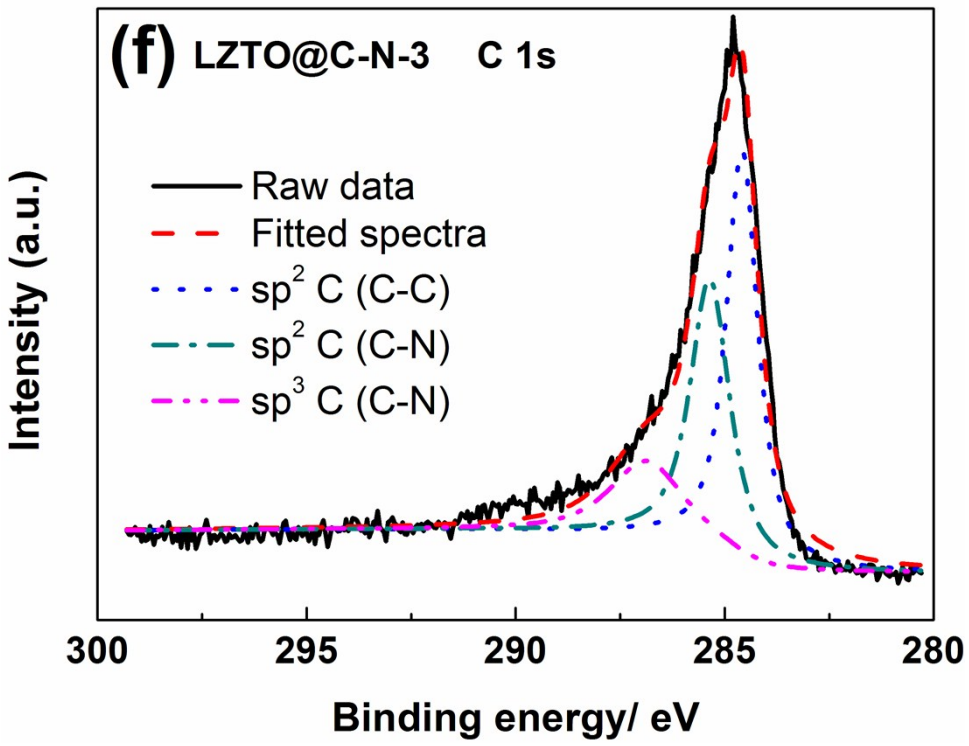

(a) LZTO@C-N-1
O 1s
Zn 2p3
Ti 2p
C 1s
N 1s
Intensity (a.u.)
1400 1200 1000 800 600 400 200 0
Binding energy/ eV

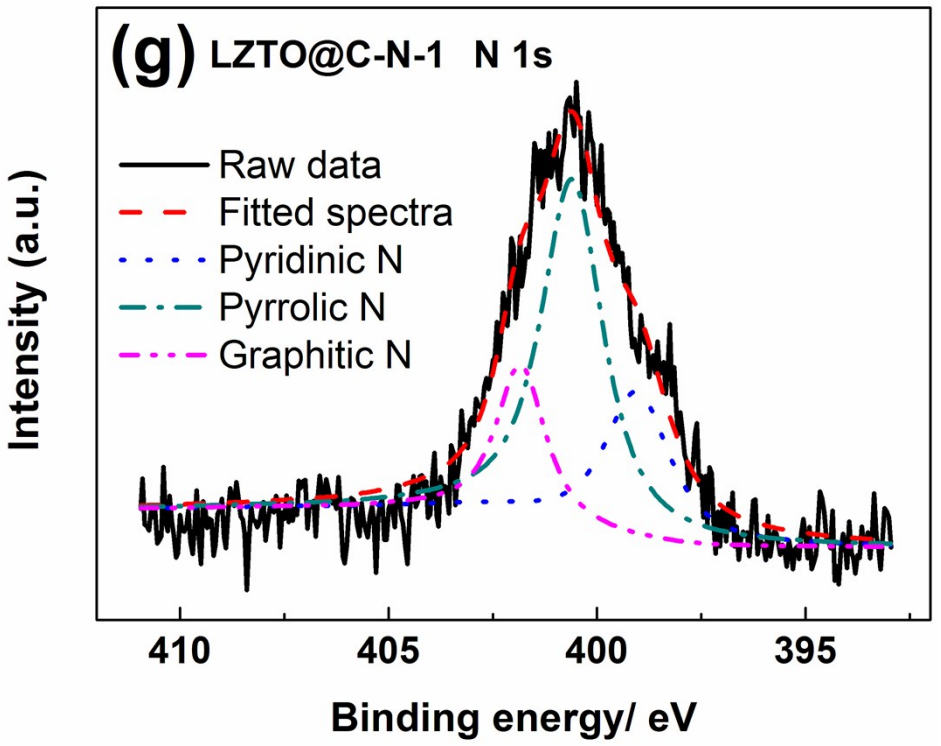

(b) LZTO@C-N-2
O 1s
Zn 2p3
Ti 2p
C 1s
N 1s
Intensity (a.u.)
1400 1200 1000 800 600 400 200 0
Binding energy/ eV

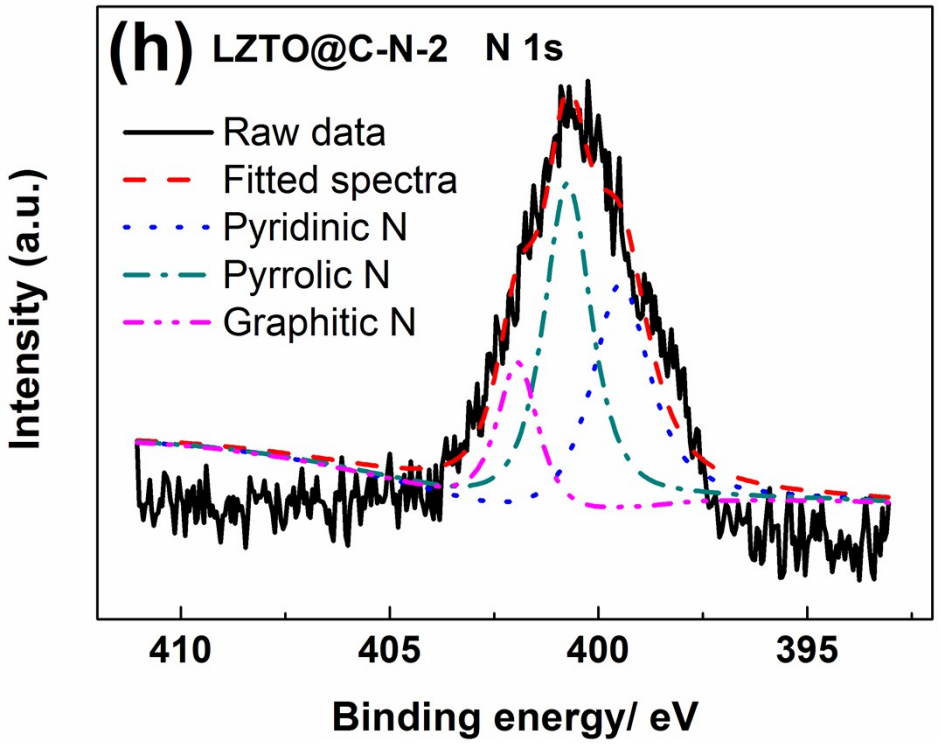

(c) LZTO@C-N-3
O 1s
Zn 2p3
Ti 2p
C 1s
N 1s
Intensity (a.u.)
1400
1200
1000
800
600
400
200
0
Binding energy/ eV


(d) LZTO@C-N-1 C 1s
Raw data
Fitted spectra
sp2 C (C-C)
sp2 C (C-N)
sp3 C (C-N)
Intensity (a.u.)
300
295
290
285
280
Binding energy/ eV


(e) LZTO@C-N-2 C 1s
Raw data
Fitted spectra
sp2 C (C-C)
sp2 C (C-N)
sp3 C (C-N)
Intensity (a.u.)
300
295
290
285
280
Binding energy/ eV


(f) LZTO@C-N-3 C 1s
Raw data
Fitted spectra
sp2 C (C-C)
sp2 C (C-N)
sp3 C (C-N)
Intensity (a.u.)
300
295
290
285
280
Binding energy/ eV


(g) LZTO@C-N-1 N 1s
Raw data
Fitted spectra
Pyridinic N
Pyrrolic N
Graphitic N
Intensity (a.u.)
410
405
400
395
Binding energy/ eV


(h) LZTO@C-N-2 N 1s
Raw data
Fitted spectra
Pyridinic N
Pyrrolic N
Graphitic N
Intensity (a.u.)
410
405
400
395
Binding energy/ eV

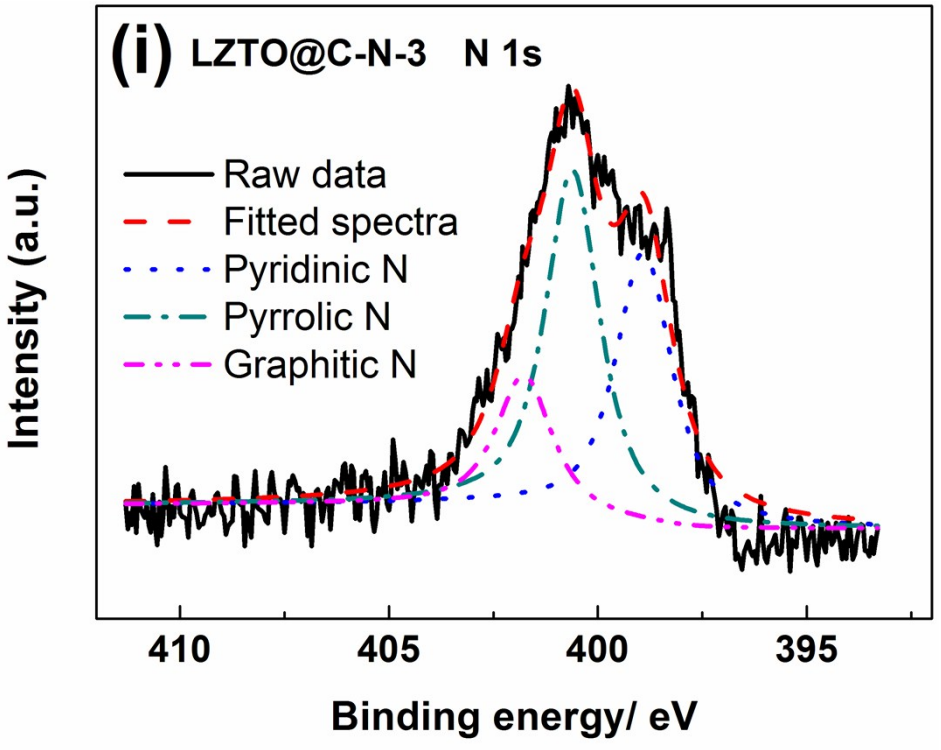
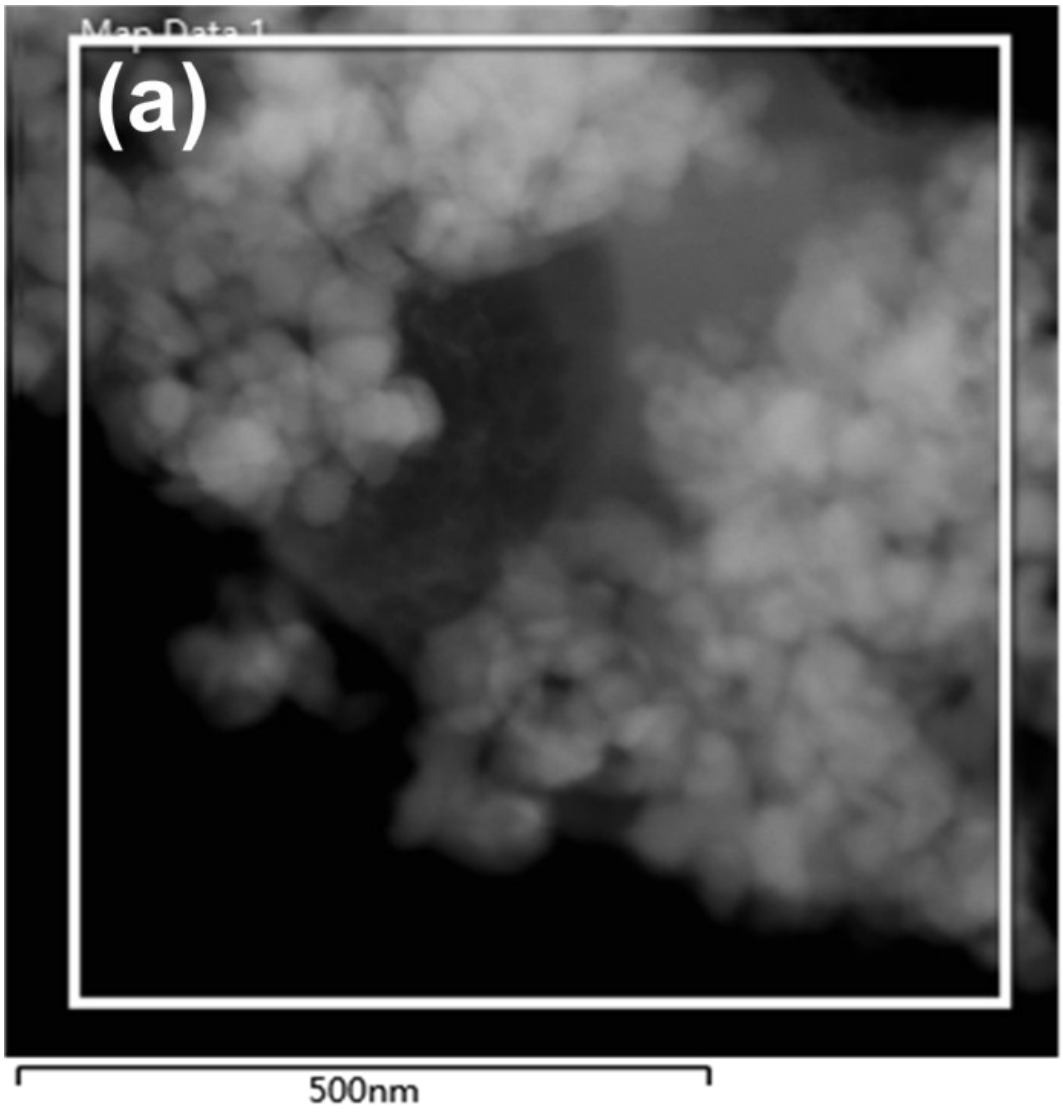
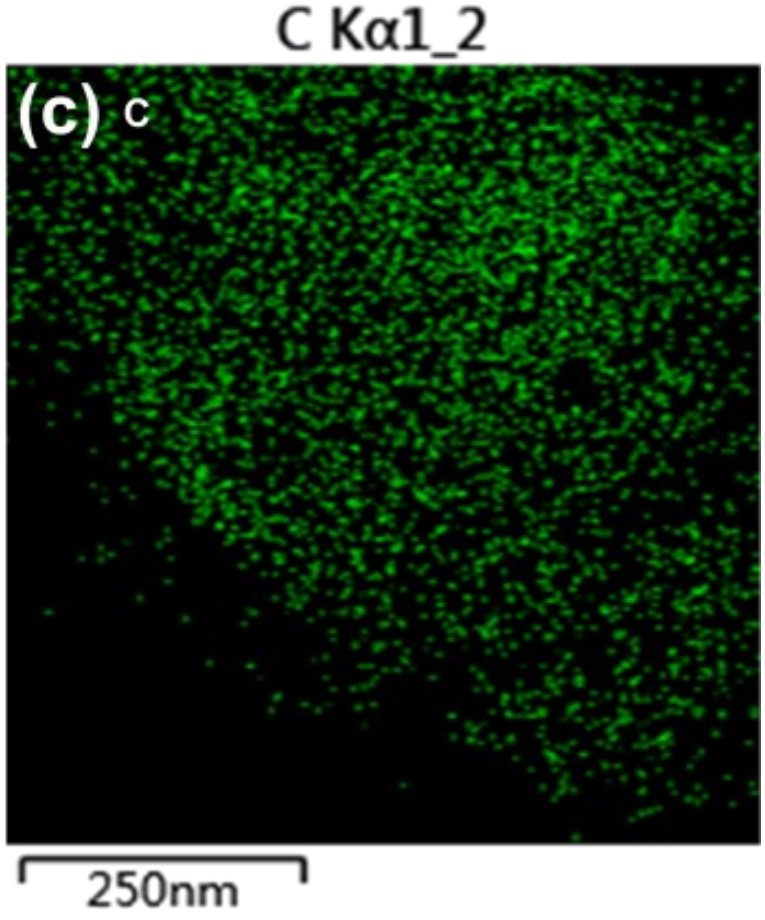
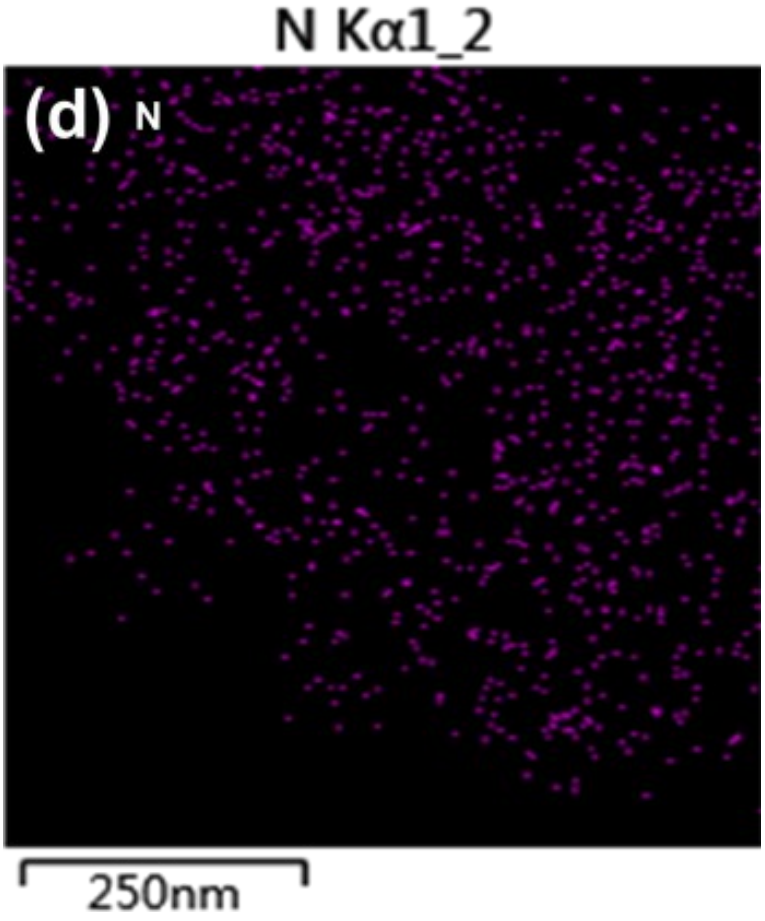
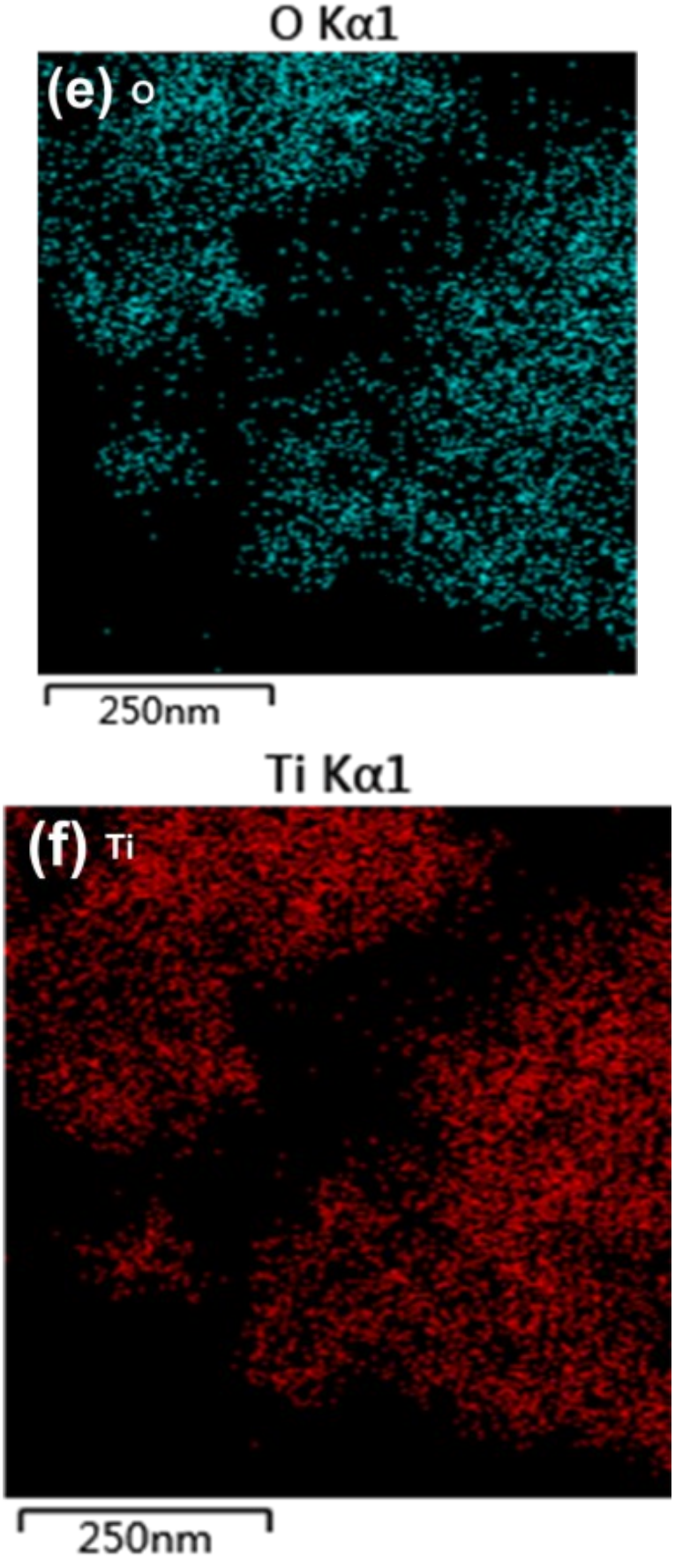


Fig. S2 XPS spectra of (a) LZTO@C-N-1, (b) LZTO@C-N-2 and (c) LZTO@C-N-3; high resolution C 1s XPS spectra of (d) LZTO@C-N-1, (e) LZTO@C-N-2 and (f) LZTO@C-N-3; high resolution N 1s XPS spectra of (g) LZTO@C-N-1, (h) LZTO@C-N-2 and (i) LZTO@C-N-3.


(a)
500nm
(b)
Cps/ eV
Energy/ KeV
C
O
N
Ti
Zn
Cu
keV


C Kα1_2
(c) C
250nm


N Kα1_2
(d) N
250nm


O Kα1
(e) O
250nm
Ti Kα1
(f) Ti
250nm

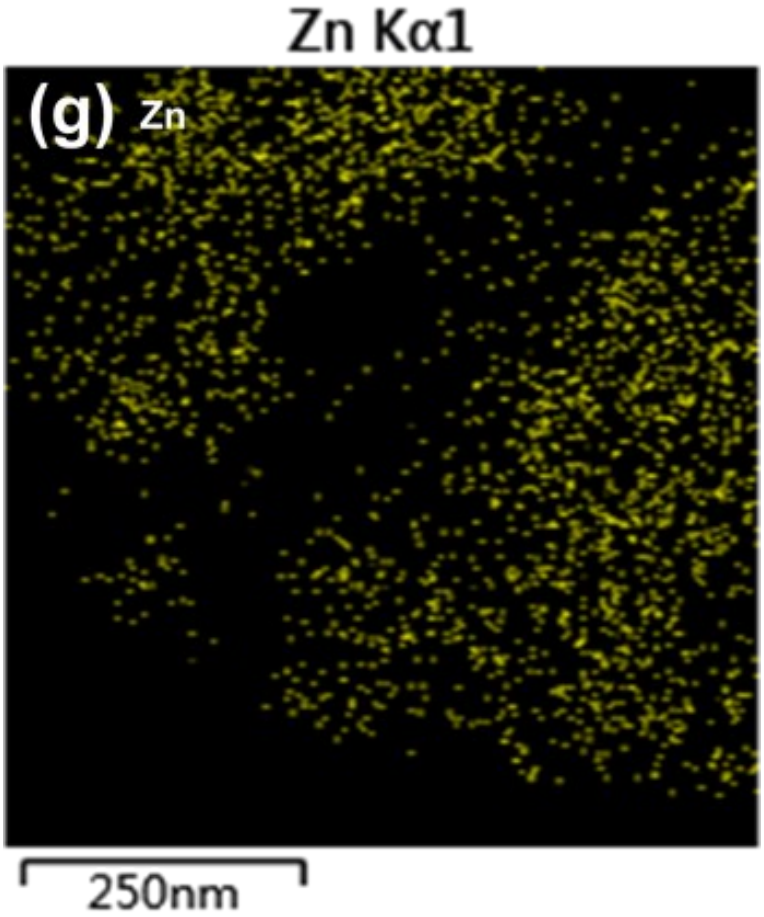


Fig. S3 (a) TEM image and (b) EDS spectrum of LZTO@C-N particles. Corresponding EDS element mappings of (c) C, (d) N, (e) O, (f) Ti and (g) Zn in the LZTO@C-N particles.

Table S1 Specific surface areas, total pore volumes and average pore diameters of LZTO, LZTO@-C-N-1, LZTO@C-N-2 and LZTO@C-N-3.

Samples	Specific surface area (m^2 g^{-1})	Total pore volume (mL g^{-1})	Average pore diameter (nm)
LZTO	21.1	0.107	18.4
LZTO@-C-N-1	38.3	0.268	22.7
LZTO@C-N-2	40.4	0.189	19.4
LZTO@C-N-3	64.1	0.234	29.4

Table S2 Content of N in the samples of LZTO@C-N-1, LZTO@C-N-2 and LZTO@C-N-3.

Samples	Content of N (%)
LZTO@C-N-1	0.2
LZTO@C-N-2	0.46
LZTO@C-N-3	0.86

Table S3 Electrochemical performance of LZTO in recent publications.

Material	Current density (A g^{-1})	Specific capacity (mAh g^{-1})	Reference
$Li_2ZnTi_3O_8$	2	73	[1]
$Li_2ZnTi_3O_8$/KCl	1.6	135.6	[5]
$Li_2ZnTi_3O_8$	3.2	130	[6]
$Li_2ZnTi_3O_8$	0.2	200	[7]
$Li_2ZnTi_3O_8$/$LiCoO_2$	3	151.6	[8]
$Li_2ZnTi_3O_8$	2	158.2	[9]
$Li_2ZnTi_3O_8$	3	173.1	[10]
$Li_2ZnTi_3O_8$/TiO_2	3	180.8	[11]
$Li_2ZnTi_3O_8$	0.454 (2 C)	172.7	[12]
$Li_2ZnTi_3O_8$	3	142.4	[13]
$Li_{1.95}V_{0.05}ZnTi_3O_8$	1.135 (5C)	84.7	[15]
$Li_{1.95}Na_{0.05}ZnTi_3O_8$	0.454 (2 C)	162.3	[17]
$Li_2ZnTi_3O_8$	0.1	190	[18]
$Li_2Zn_{0.9}Cu_{0.1}Ti_3O_8$	1	165.4	[19]
$Li_2ZnAg_{0.15}Ti_{2.85}O_8$	2	136.5	[21]
$Li_2ZnTi_3O_8$@Li_2MoO_4	2	112	[22]
$Li_2ZnTi_3O_8$/C	2	164	[25]
$Li_2ZnTi_3O_8$/C	2	145.6	[26]
$Li_2ZnTi_3O_8$/C	2	112.5	[27]
$Li_2ZnTi_3O_8$/C	2	120	[28]
$Li_2ZnTi_3O_8$/C	3	169.1	[29]
$Li_2ZnTi_3O_8$/C	5	154.1	[30]
$Li_2ZnTi_3O_8$@C-N	5	135	[31]
$Li_2ZnTi_3O_8$/La_2O_3	3	154	[44]
$Li_2ZnTi_3O_8$	5	133.3	[45]
$Li_2ZnTi_3O_8$	3	170.7	[46]
$Li_2ZnTi_3O_8$@C-N	2	208.7	The work
$Li_2ZnTi_3O_8$@C-N	3	187.2	The work
$Li_2ZnTi_3O_8$@C-N	5	165.3	The work