

## Supplementary Information

### **Green and Tunable Fabrication of Graphene-Like N-Doped Carbon on 3D Metal Substrate as Binder-Free Anodes for High-Performance Potassium-Ion Batteries**

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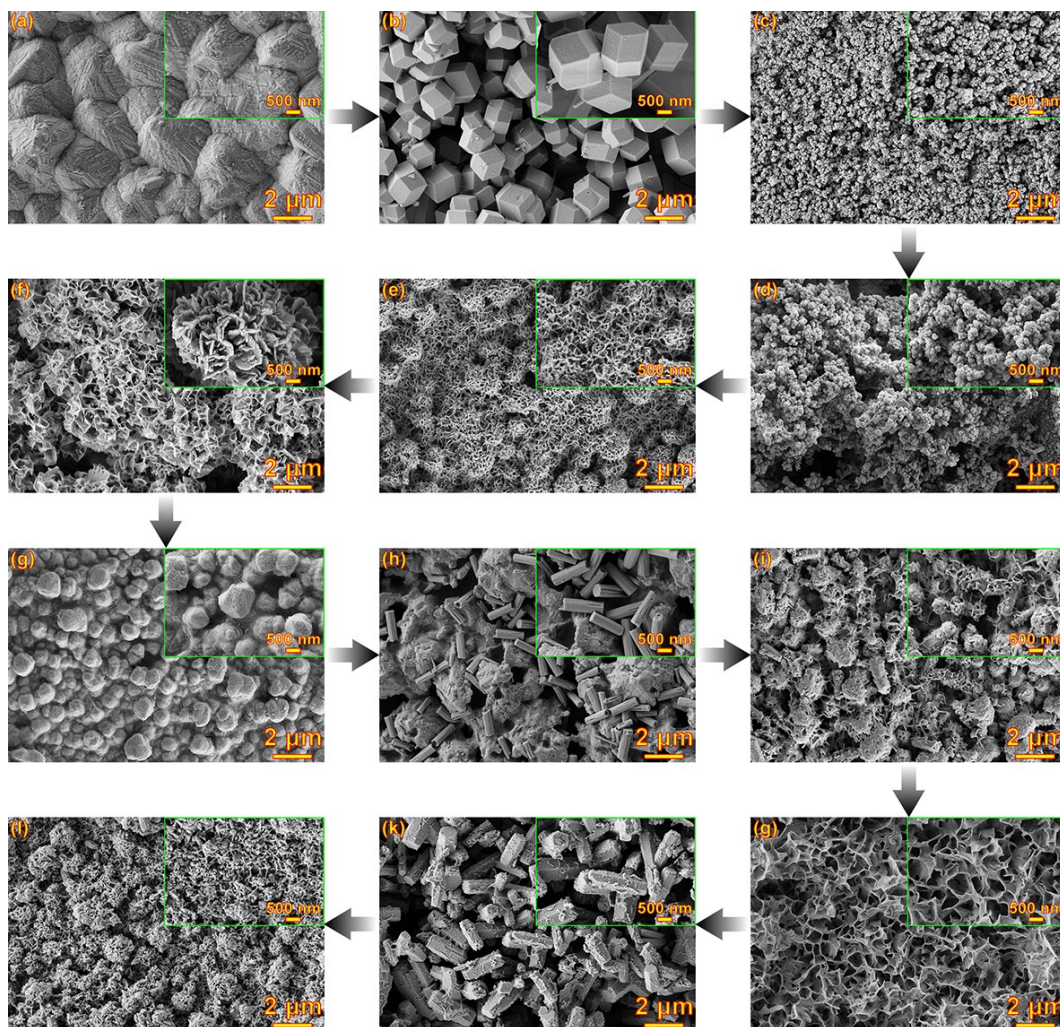
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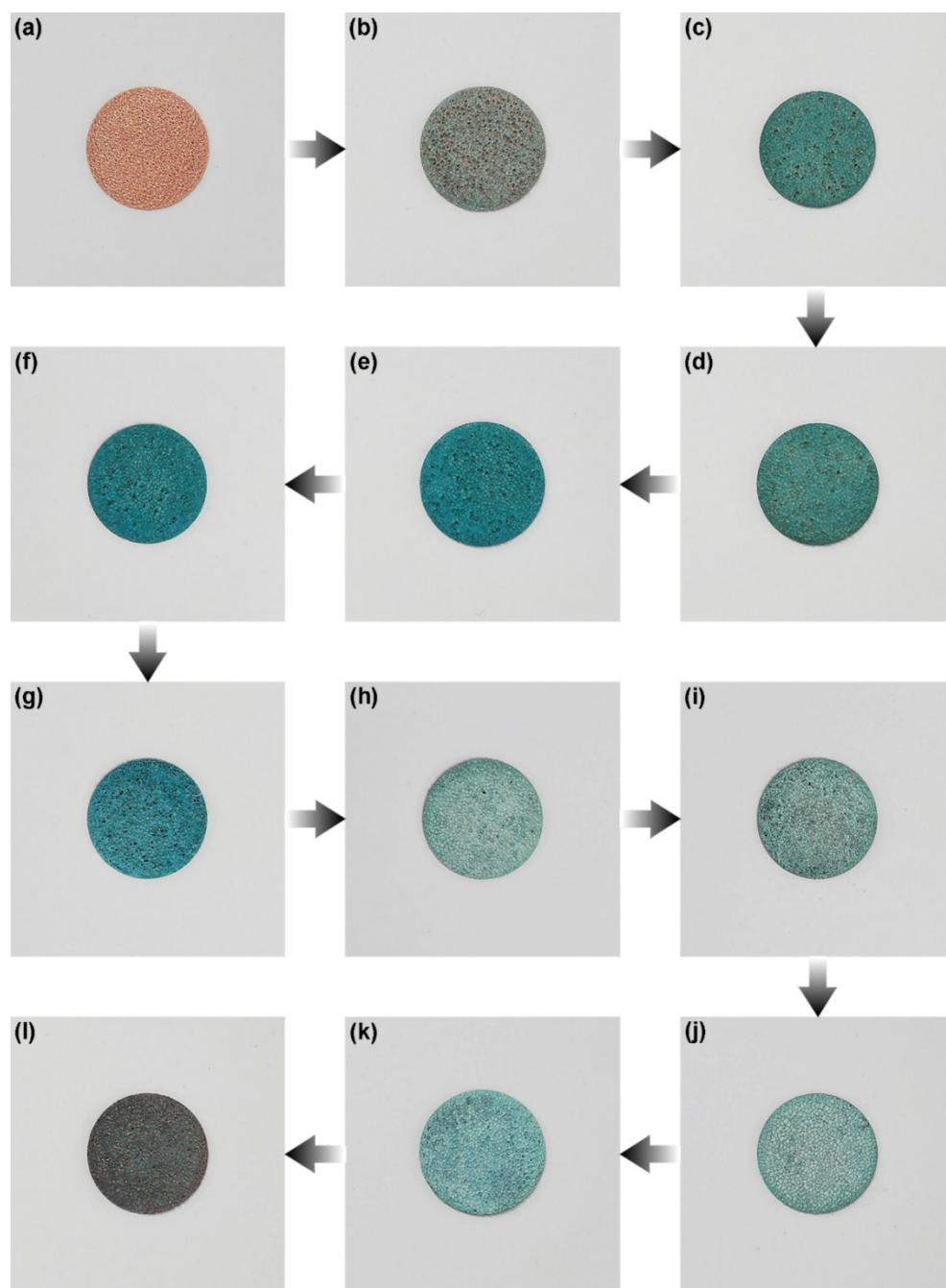
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**Fig. S1.** The morphology evolution of ZIF-8/Cu precursor with different volume ratio of DMF and H<sub>2</sub>O. (a) Blank Cu foam, (b) 1:0, (c) 9:1, (d) 4:1, (e) 7:3, (f) 3:2, (g) 1:1, (h) 2:3, (i) 3:7, (j) 1:4, (k) 1:9, (l) 0:1.



**Fig. S2.** The digital photograph of ZIF-8/Cu precursor with different volume ratio of DMF and H<sub>2</sub>O. (a) Blank Cu foam, (b) 1:0, (c) 9:1, (d) 4:1, (e) 7:3, (f) 3:2, (g) 1:1, (h) 2:3, (i) 3:7, (j) 1:4, (k) 1:9, (l) 0:1.

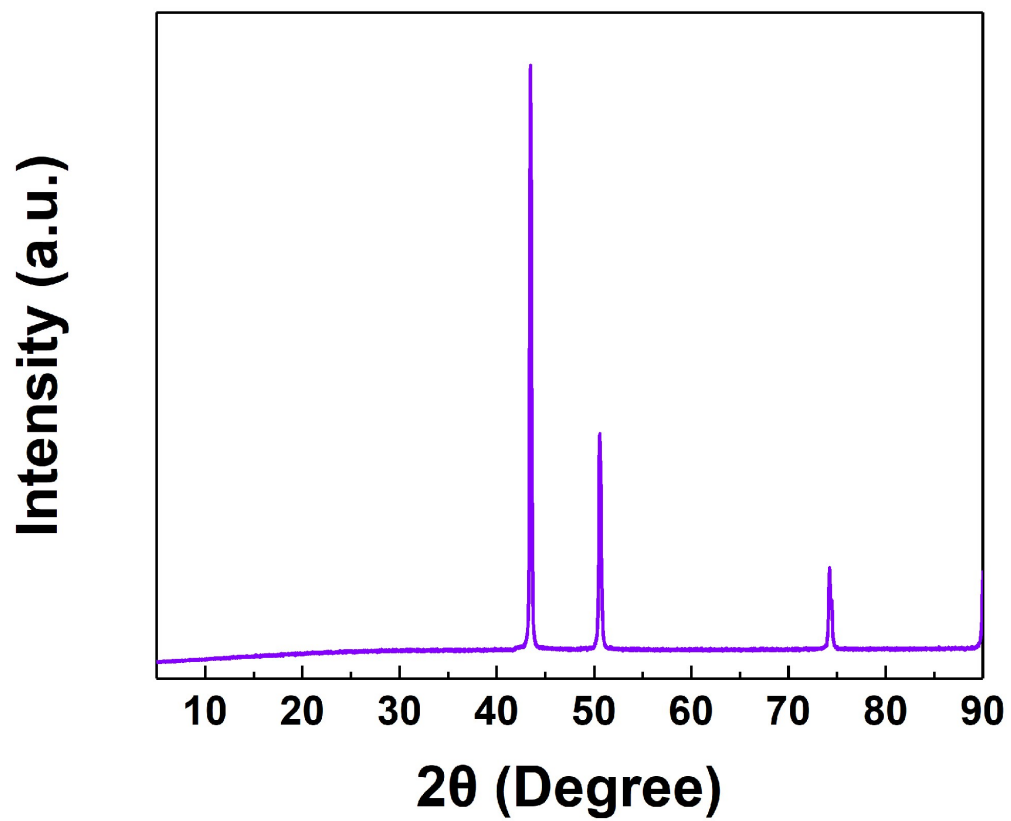
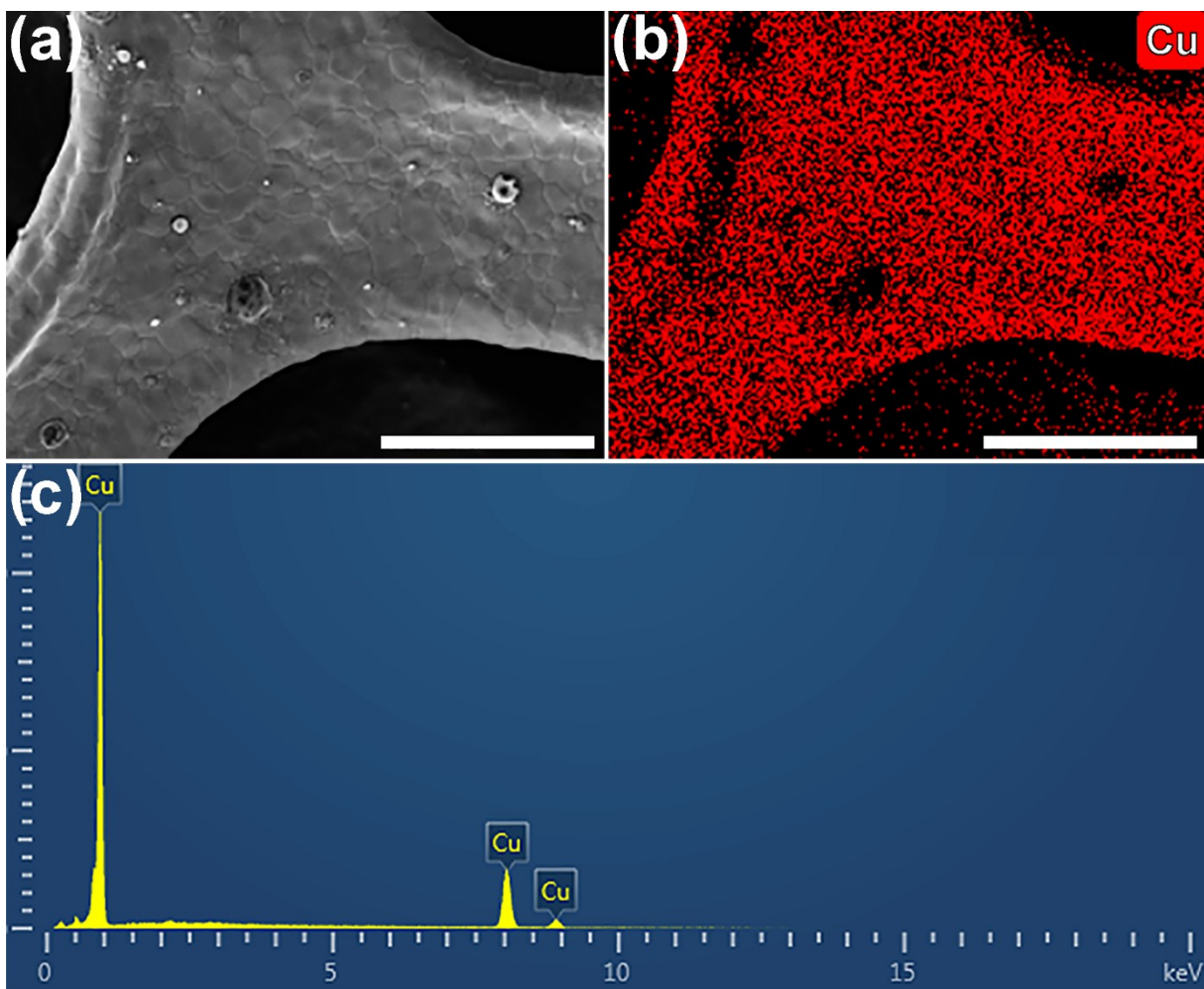
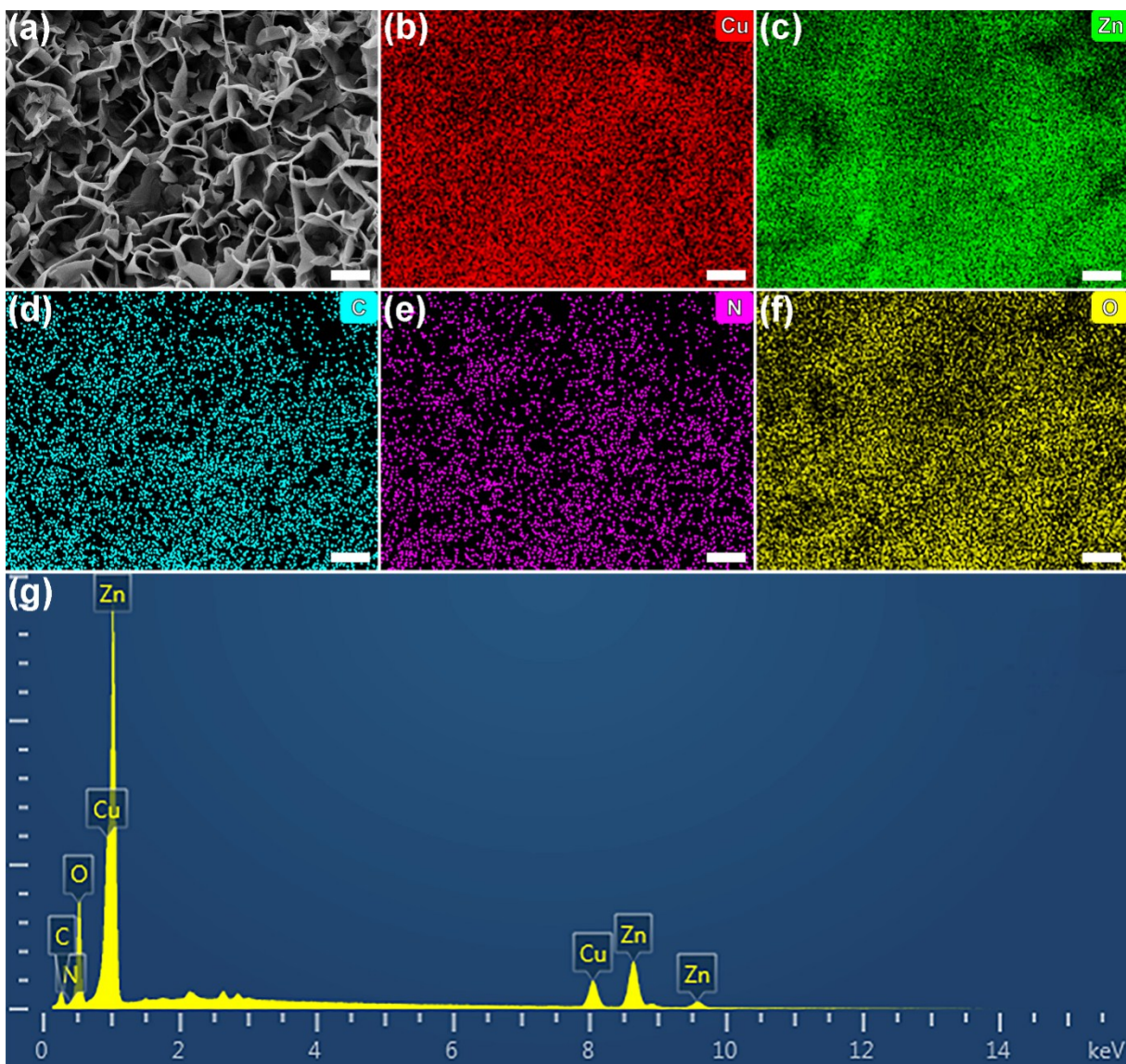


Fig. S3. XRD pattern of Cu foam.



**Fig. S4.** (a) SEM, (b) mapping image, and (c) EDS result of Cu foam. Scale bars: 50  $\mu\text{m}$  (a-b).





**Fig. S5.** (a) SEM, (b-f) mapping images of (b) Cu, (c) Zn, (d) C, (e) N, (f) O elements, and (g) EDS result of ZIF-8/Cu precursor. Scale bars: 1  $\mu\text{m}$  (a-f).

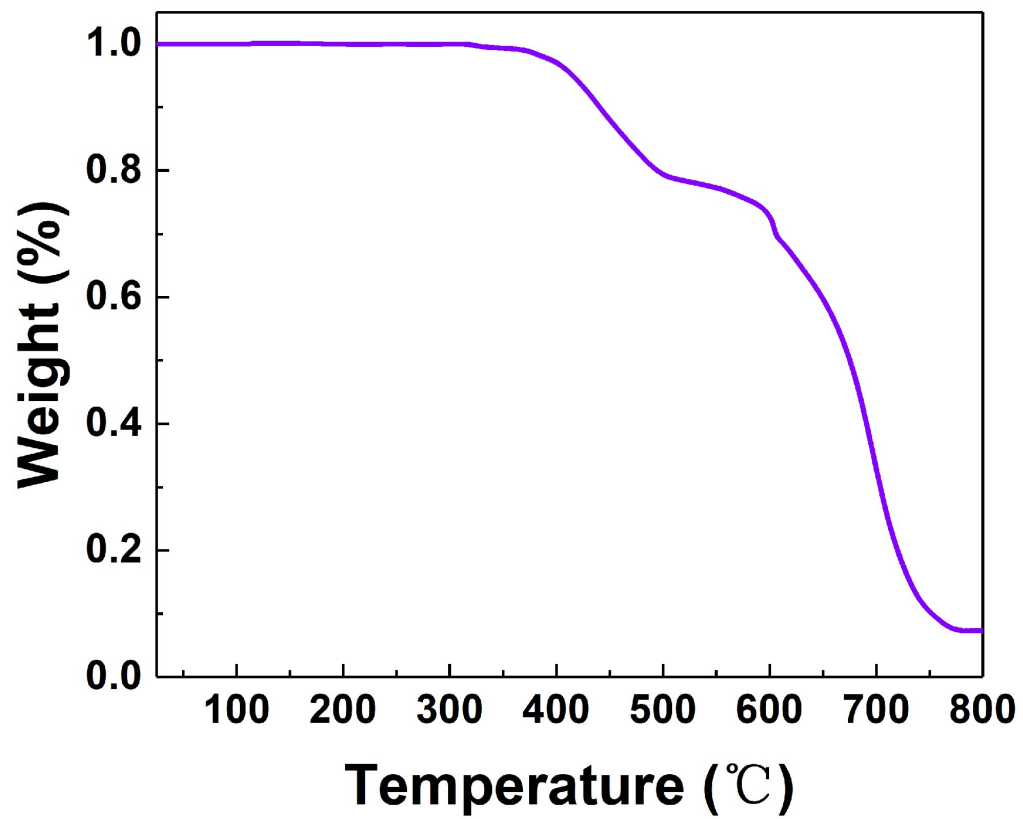
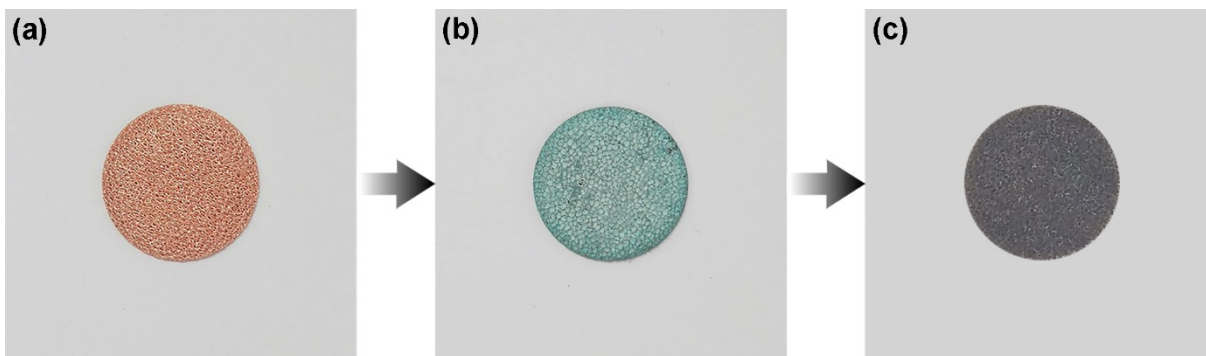
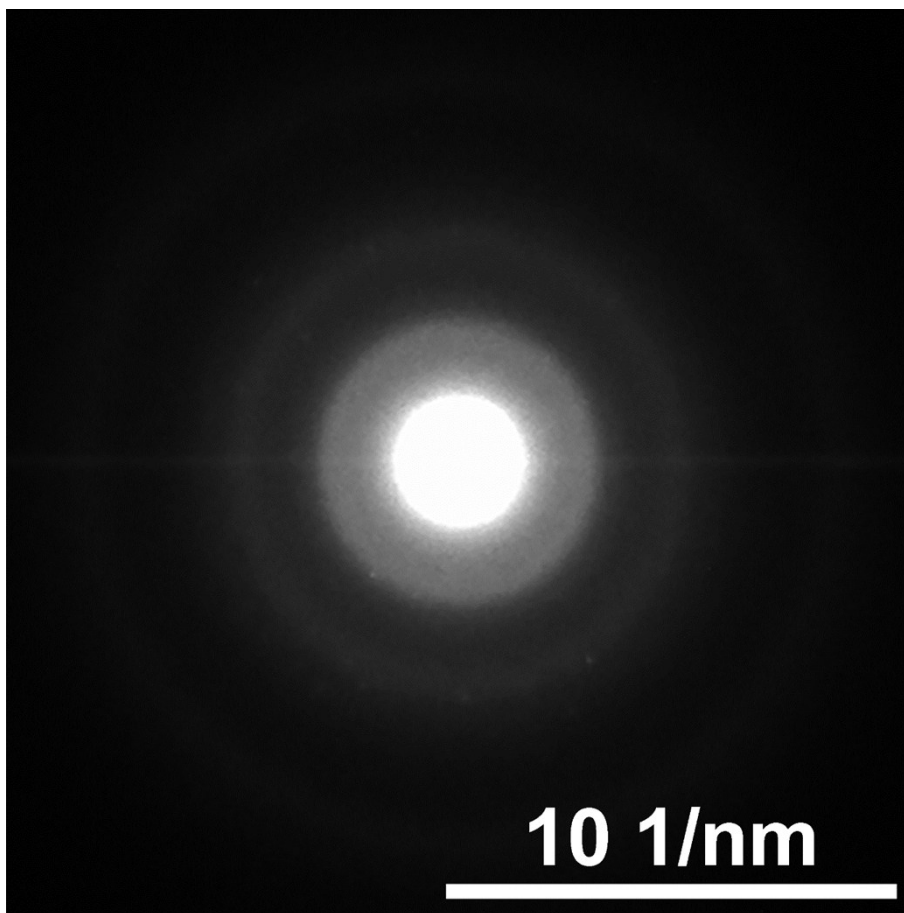


Fig. S6. TGA curve of NPC sample.

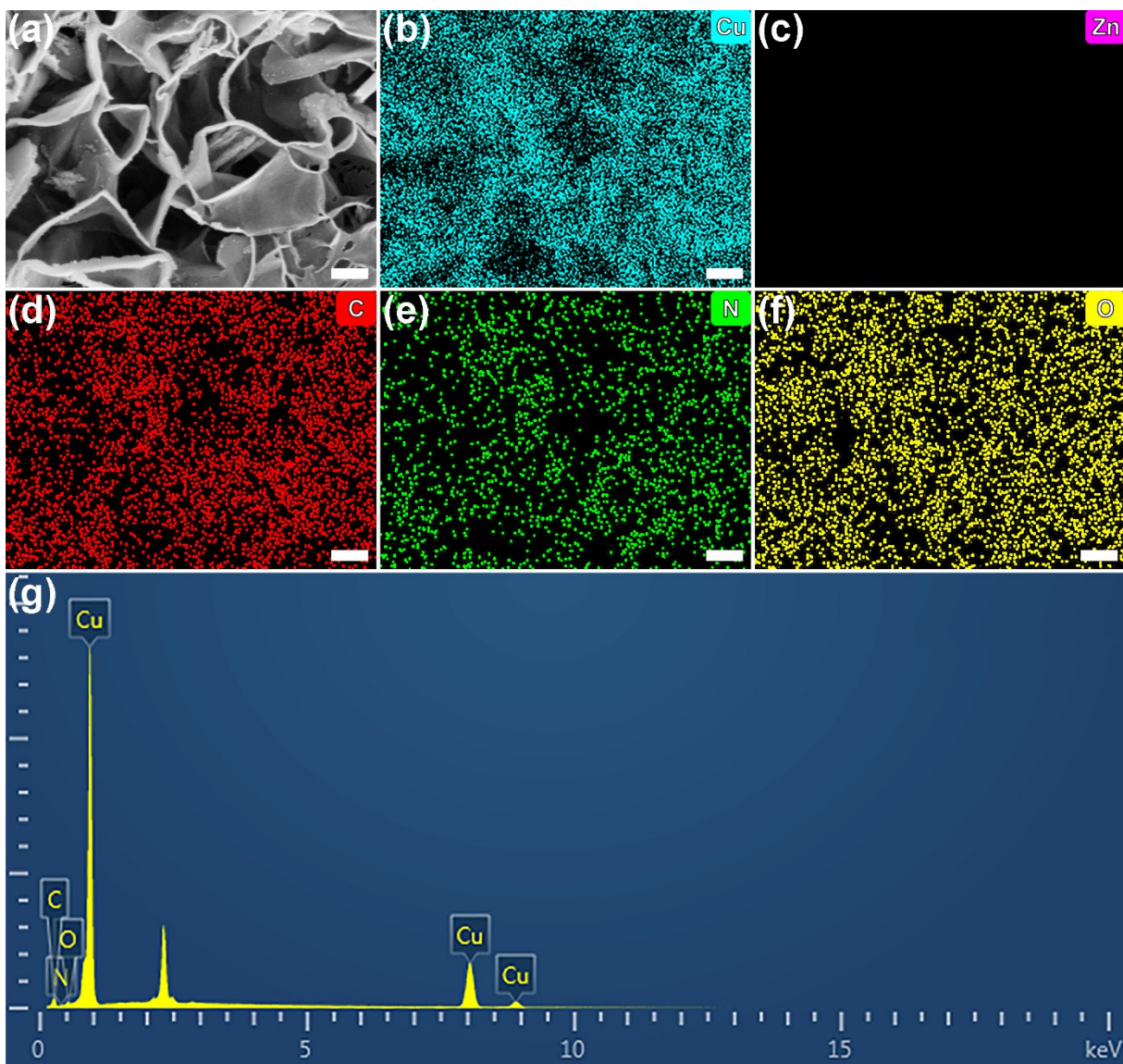


**Fig. S7.** (a-c) The digital photograph of (a) Cu foam, (b) ZIF-8/Cu, and (c) NPC/Cu.

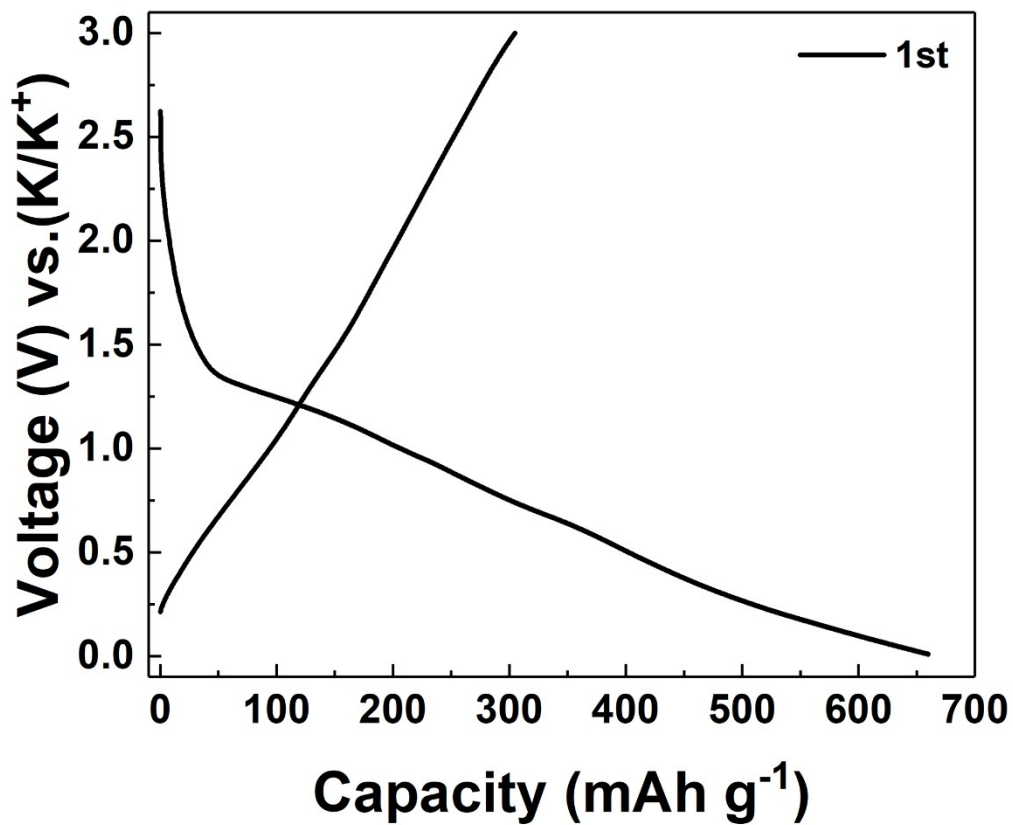




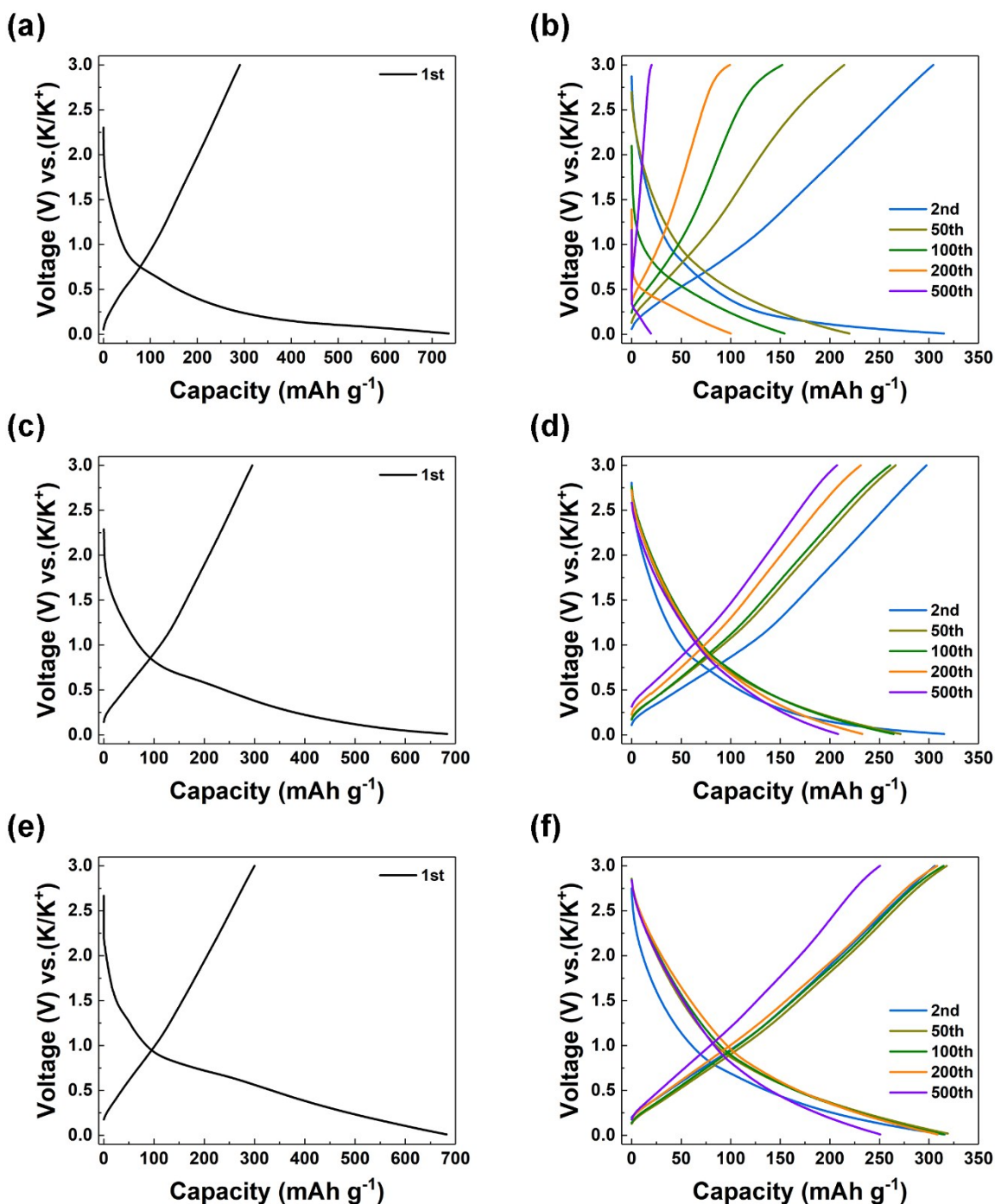
**Fig. S8.** Selected area electron diffraction (SAED) pattern of NPC/Cu.



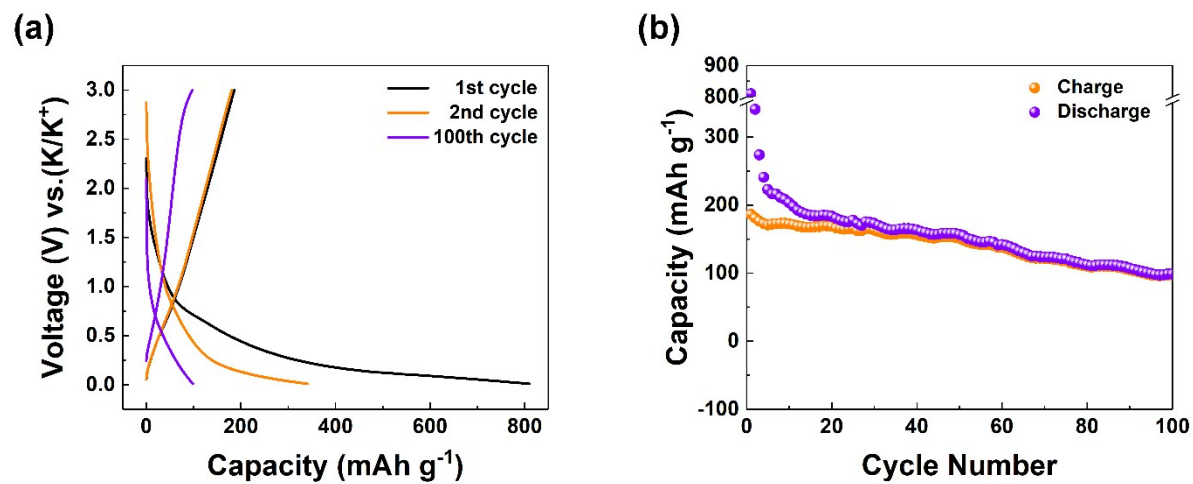
**Fig. S9.** (a) SEM, (b-f) mapping images of (b) Cu, (c) Zn, (d) C, (e) N, (f) O elements, and (g) EDS result of NPC/Cu. Scale bars: 200 nm (a-f).



**Fig. S10.** Charge/discharge curves of NPC/Cu anode for KIBs with KFSI-DME-5M electrolyte at a current density of 50 mA g<sup>-1</sup>.



**Fig. S11.** (a-f) Charge/discharge curves of NPC/Cu anode for KIBs with three different electrolytes at a current density of 50 mA g<sup>-1</sup>. (a, b) KFP<sub>6</sub>-DEC/EC electrolyte. (c-d) KFSI-DEC/EC electrolyte. (e-f) KFSI-DME-0.8M electrolyte.



**Fig. S12.** Charge/discharge curves (a) and cyclability (b) of NPC anode for KIBs at 50 mA g<sup>-1</sup>.



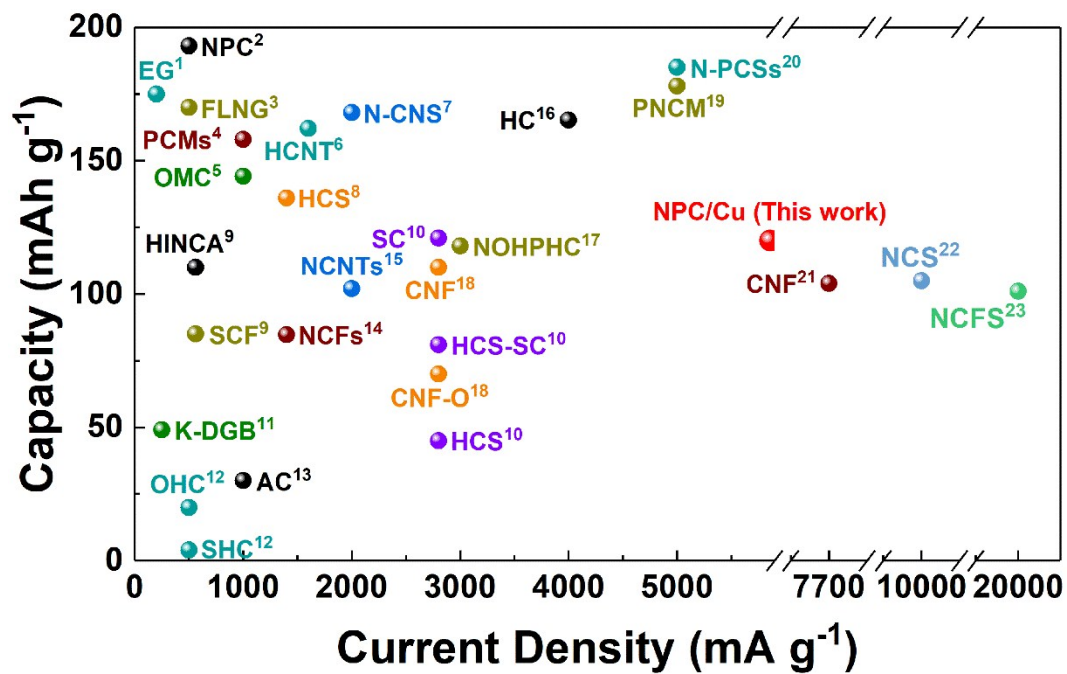
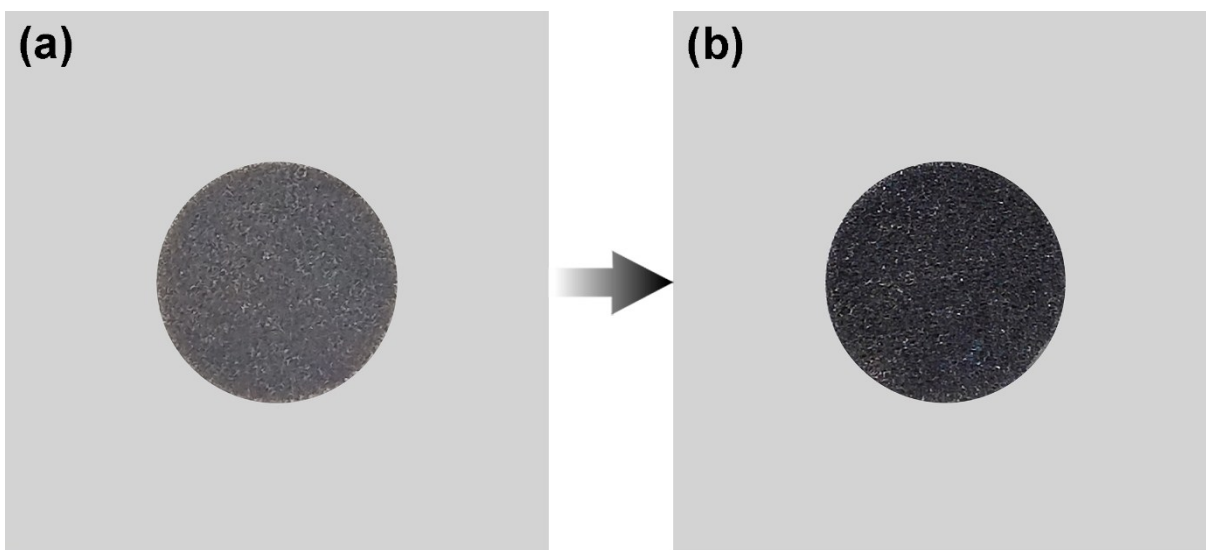


Fig. S13. Rate property of the NPC/Cu anode compared with some reported KIBs anodes.



**Fig. S14.** The digital photograph of NPC/Cu anode (a) before and (b) after 500 cycles.

## Reference

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