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

Supplementary Information

Electrochemically Induced High Ion Conductive Porous Scaffold to Stabilize Lithium Deposition for Lithium Metal Anodes

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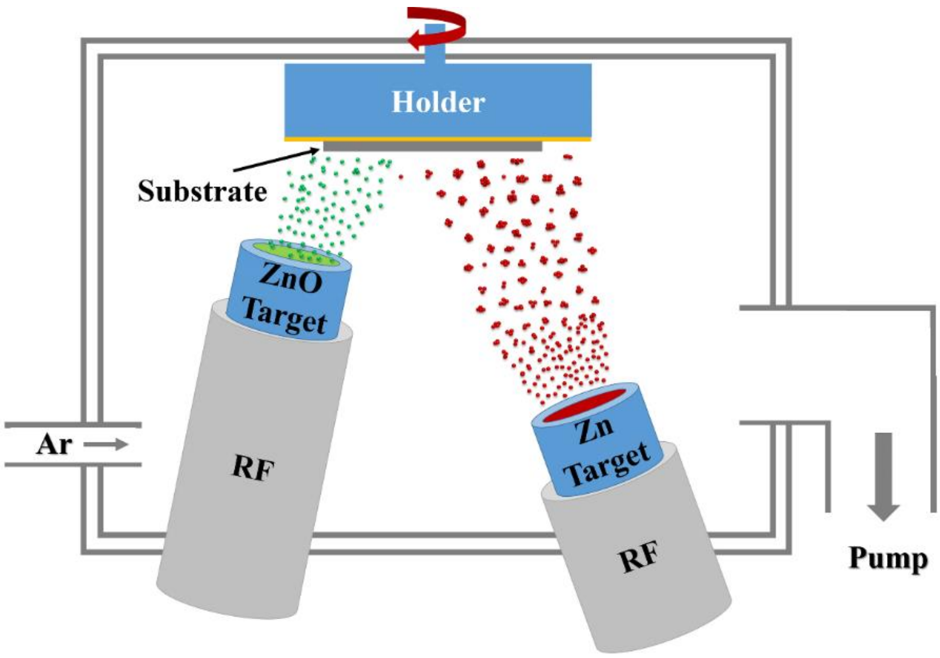

Fig. S1. Schematic illustration for the synthesis (Oblique angle deposition, configuration) of porous Zn/ZnO scaffold.

A three-target magnetron sputtering system is consists of a stainless high vacuum chamber equipped with three plasma sources: two radio frequency (RF) magnetron sputtering sources and a direct current (DC) sputtering power source. In this work, only two RF magnetron sputtering sources are used sequently to synthesis the Zn/ZnO scaffold. In order to synthesizing Zn particles, the distance between the Zn target and substrate is enlarged to reduce the velocity energy of Zn particles, so that the diffusion of Zn can be reduced and form porous scaffold.[1]

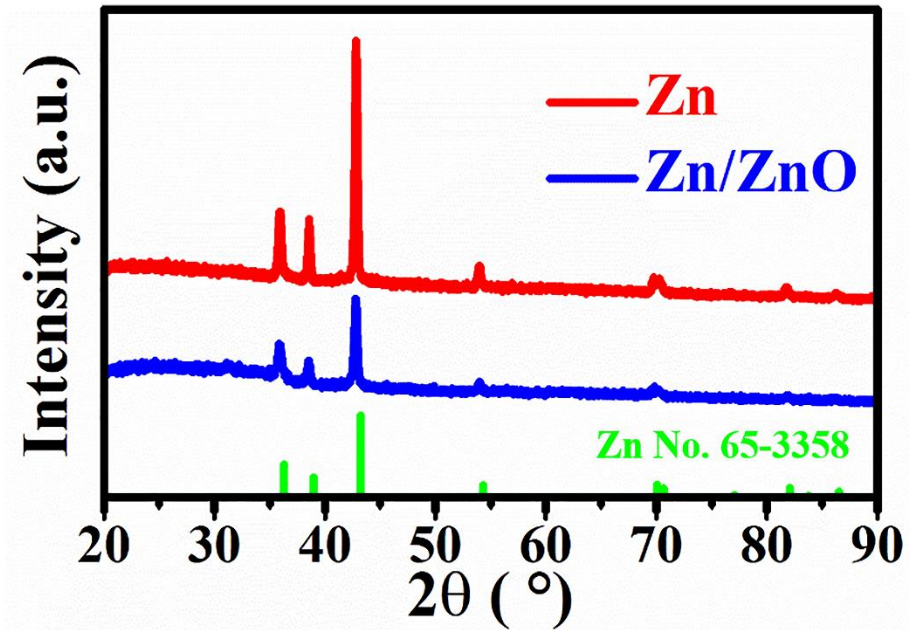

Fig. S2. XRD patterns of the Zn and Zn/ZnO films.

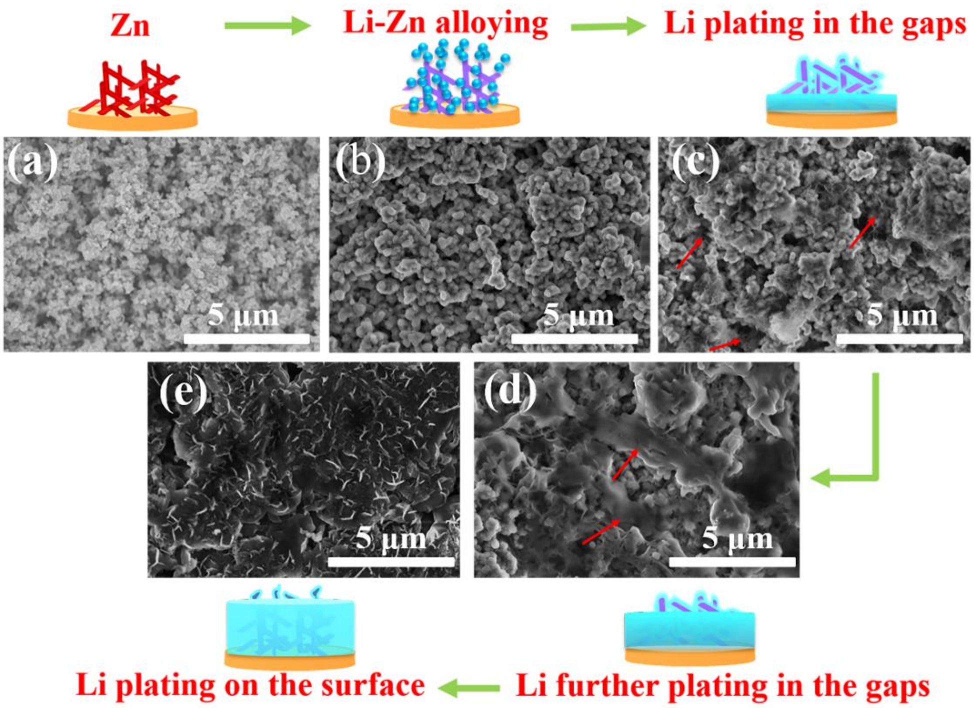

Fig. S3. SEM images of 3D Zn porous scaffold with different amount of Li deposition, no Li deposition (a), 0.1 mAh cm^{-2} (b), 0.2 mAh cm^{-2} (c), 0.5 mAh cm^{-2} (d), 1 mAh cm^{-2} (e) of Li deposition.

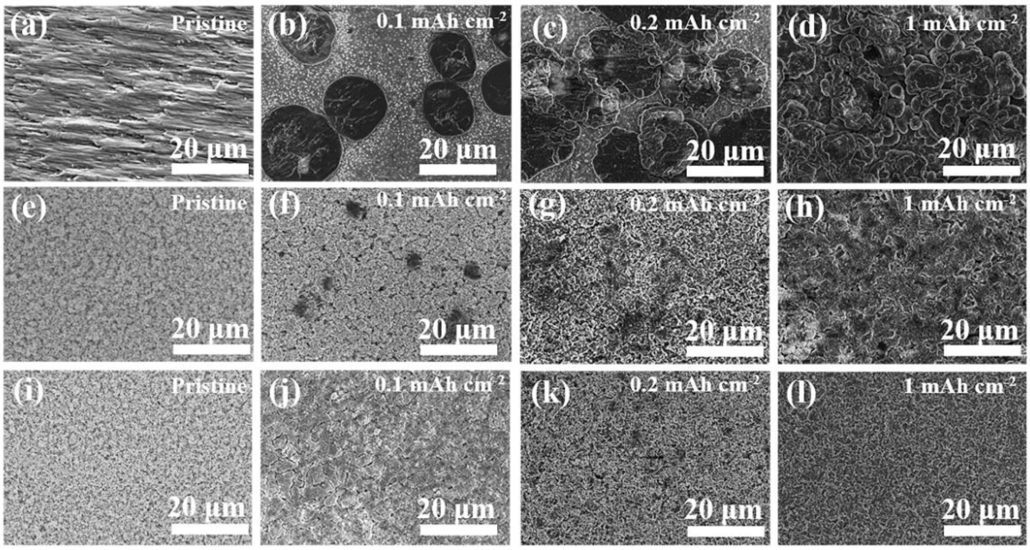

Fig. S4. Low magnification SEM images of the deposited Li on Cu foil (a-d), porous Zn scaffold (e-h) and porous Zn/ZnO scaffold (g-i) with different amount of Li capacity.

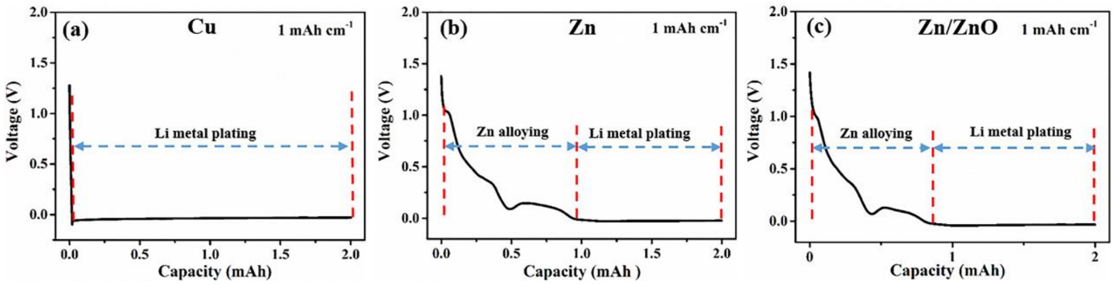

Fig. S5. The voltage profiles of bare Cu foil, Zn and Zn/ZnO at first cycle are measured at a current density of 0.5 mA cm^{-2} in the potential window of 0.01-1.5 V with a fixed amount of 1 mA h cm^{-2} of Li deposition.

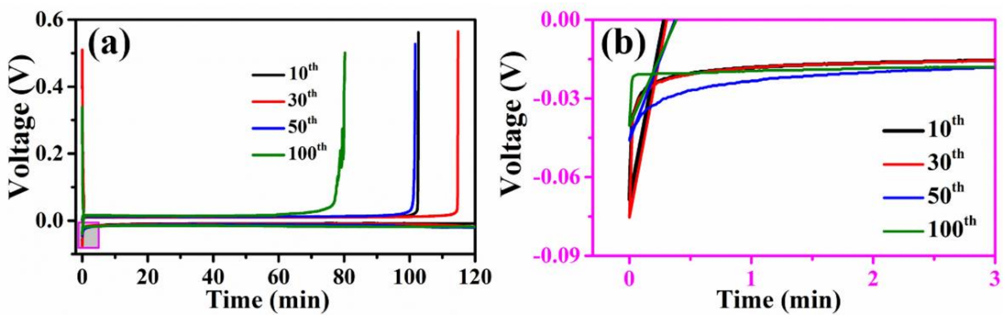

Fig. S6. Voltage profiles of bare Cu foil at different cycles.

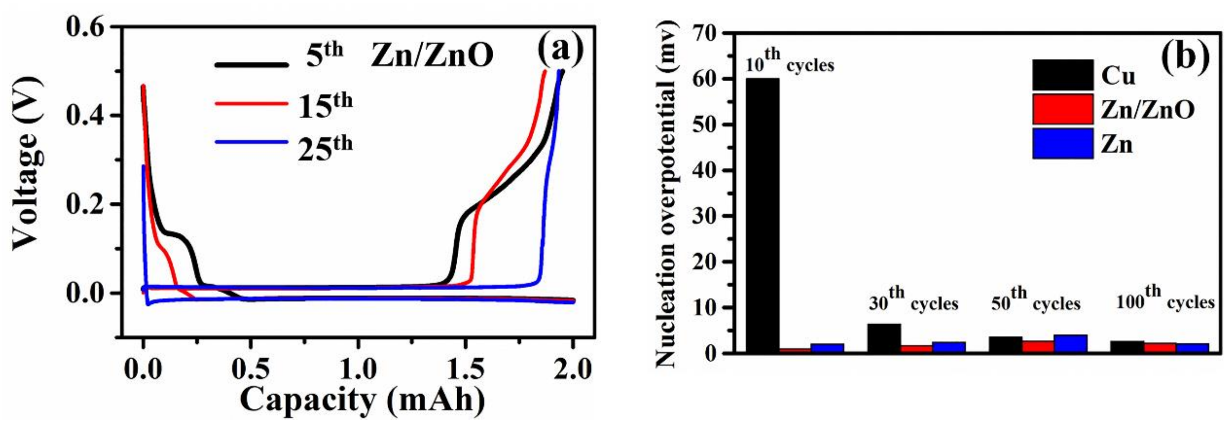

Fig. S7. Voltage profiles porous Zn/ZnO scaffold at different cycles with a current density of 0.5 mA cm^{-2} for total 1 mAh cm^{-2} of Li (a). And Li nucleation overpotential on Cu foil, porous Zn film and porous Zn/ZnO scaffold (b).

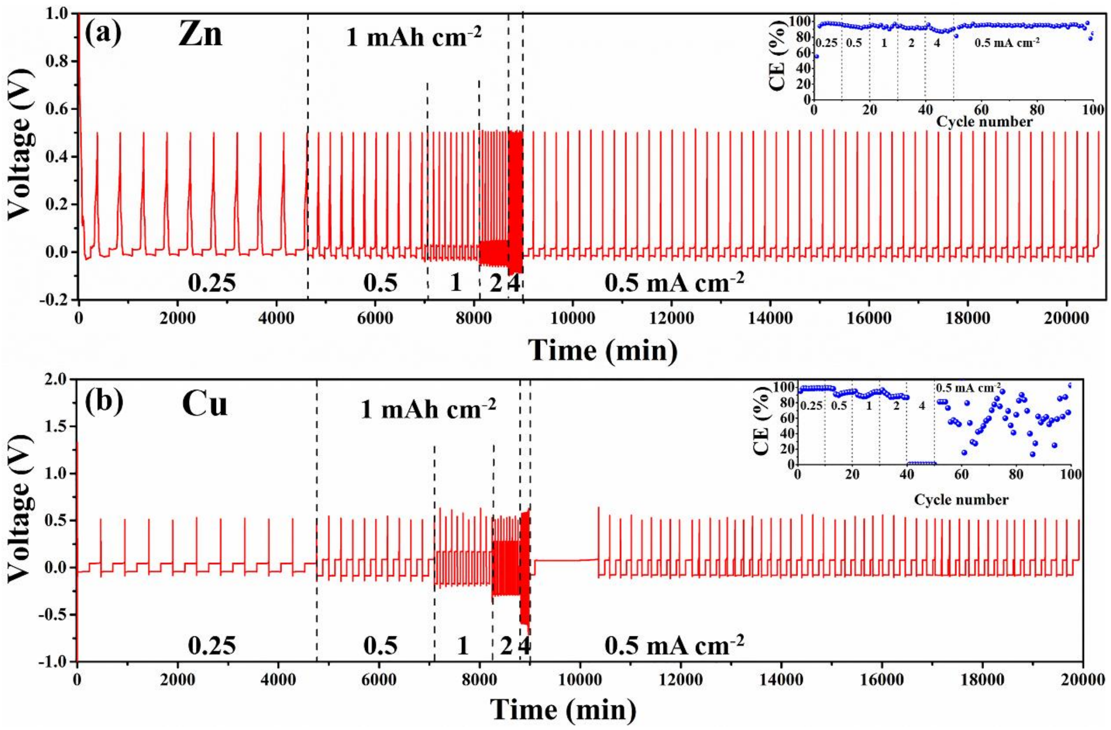

Fig. S8. Rate performances of porous Zn scaffold (a) and Cu foil (b) current collectors with current densities from 0.25 to 4 mA cm^{-2} for total 1 mAh cm^{-2} of Li.

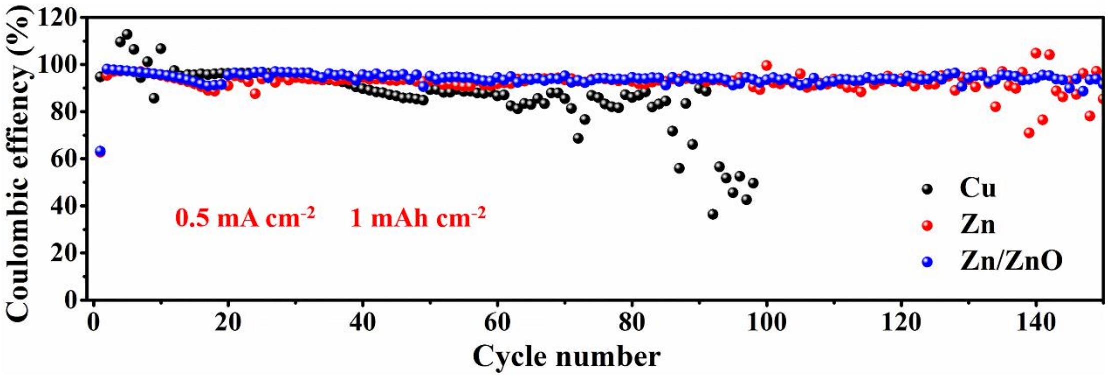

Fig. S9. CEs of Li deposition on Cu foil, porous Zn, and porous Zn/ZnO scaffolds.

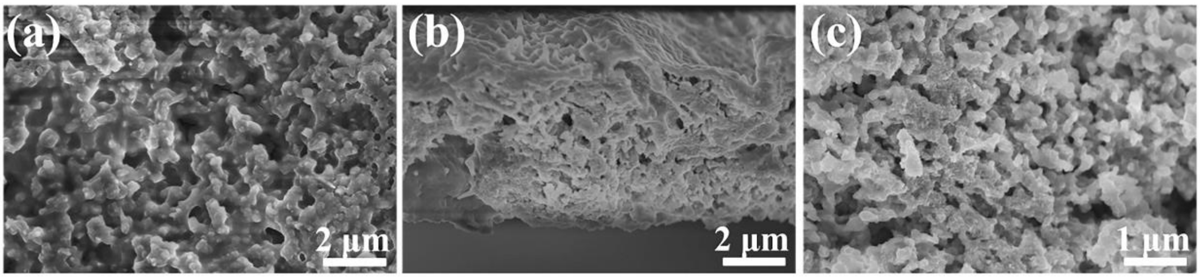

Fig. S10. Top view SEM micrograph (a), cross section view SEM micrographs (b,c) of Zn/ZnO scaffold after 80 cycles.

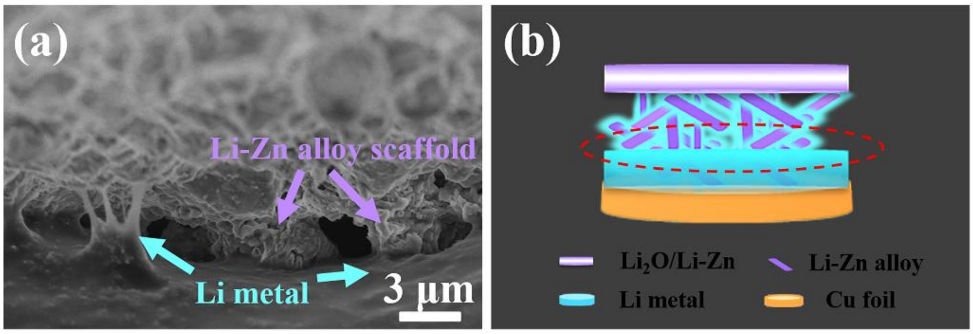

Fig. S11. SEM image of the interface between Zn/ZnO scaffold and Cu foil (a), and the schematic diagrams (b).

Table S1. The fitting data of EIS and the calculated diffusion coefficients of Li^+ for porous Zn/ZnO scaffold, porous Zn scaffold and Cu foil current collectors after 1 cycles and 50 cycles.

R/sample	Zn/ZnO	Zn	Cu
$R_{s\,(1)}$ (Ω)	7.57	7.62	7.19
$R_{s\,(50)}$ (Ω)	8.96	11.15	32.1
$R_{ct\,(1)}$ (Ω)	1.97	5.09	83.44
$R_{ct\,(50)}$ (Ω)	15.17	34.21	21.19
$D_{Li(1)}$ ($cm^2\ s^{-1}$)	3.89×10^{-12}	4.81×10^{-14}	1.21×10^{-17}
$D_{Li(50)}$ ($cm^2\ s^{-1}$)	2.77×10^{-11}	7.88×10^{-16}	2.50×10^{-16}

Reference:

[1] J. C. Ding, W. Dai, T. F. Zhang, P. Zhao, J. M. Yun, K. H. Kim, Q. M. Wang, *Thin Solid Films* **2018**, *663*, 159.