

## Supporting information

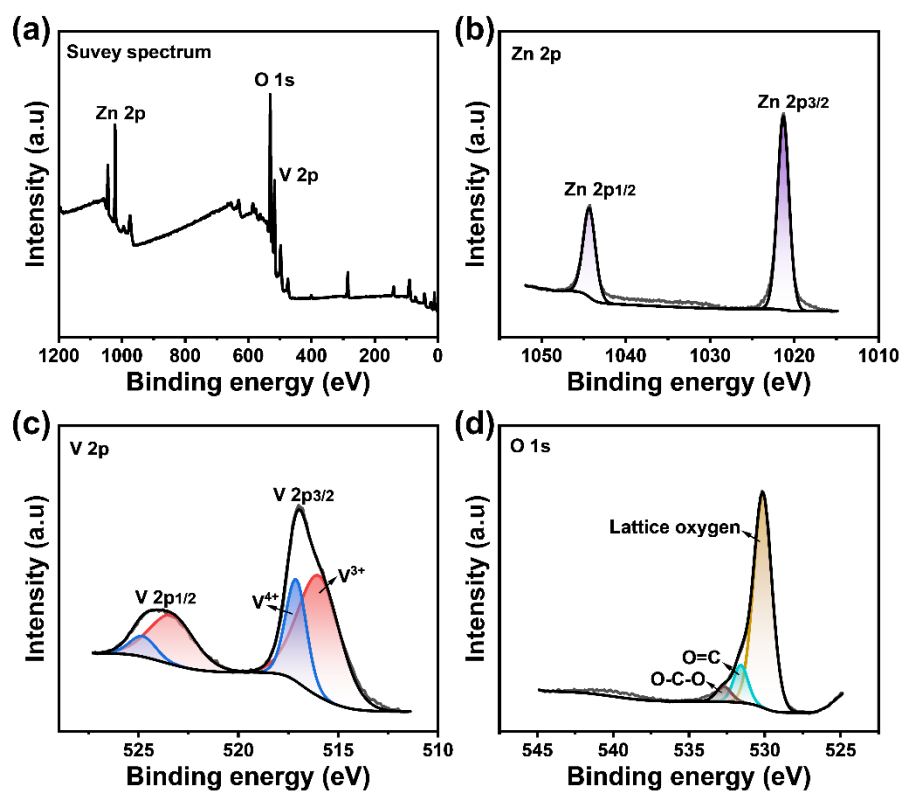


Fig. S1. (a) Survey XPS spectra of ZVO; (b) V 2p XPS spectra of ZVO; (c) Zn 2p XPS spectra of ZVO; (d) O 1s XPS spectra of ZVO.

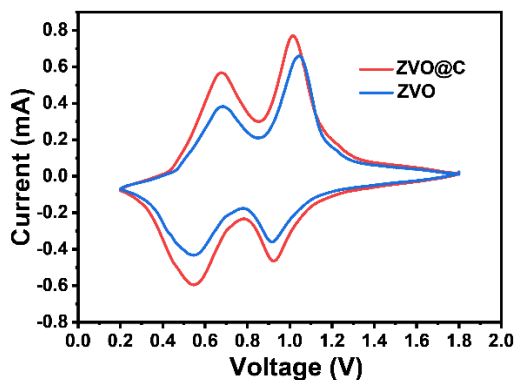


Fig. S2. The third CV curves of ZVO and ZVO@C at the scan rate of 0.1 mV s<sup>-1</sup>.

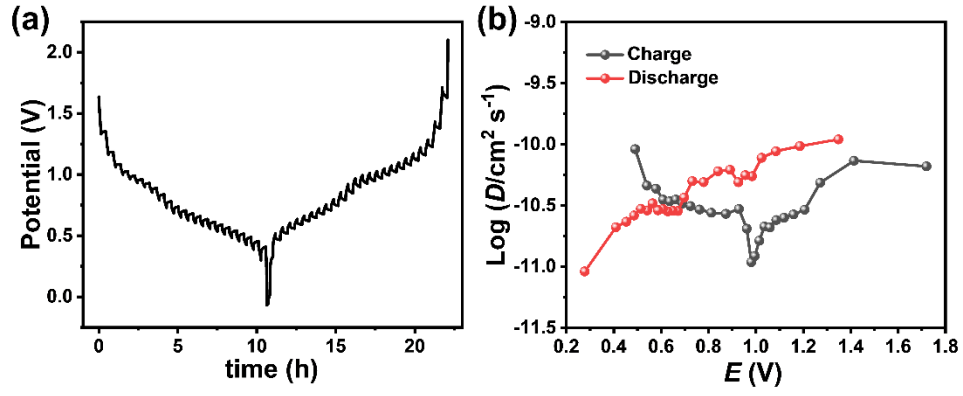


Fig. S3. (a, b) The GITT curves and the related diffusion coefficient of  $\text{Zn}^{2+}$  for the ZVO electrode.

**Table S1.** Electrochemical impedance  $R_s$  and  $R_{ct}$  values for ZVO and ZVO@C.

Cathode	$R_s$ ( $\Omega$ )	$R_{ct}$ ( $\Omega$ )
ZVO-Before	0.581	486.9
ZVO@C-Before	0.757	268.5
ZVO-10th	0.417	122.0
ZVO@C-10th	0.742	63.0