Electronic Supporting Information

Two-dimensional metallic VTe_2 for demonstrating fast ion diffusion as aqueous Zinc ion battery cathode

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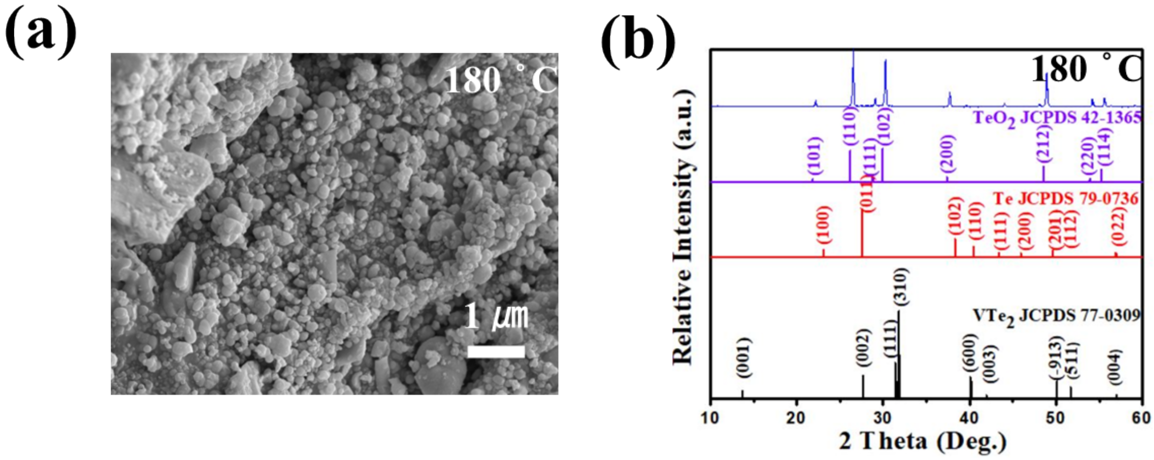

Figure S1 (a) Formation of VTe_2 nanoparticles at temperature 180 °C. (b) The corresponding XRD spectrum.

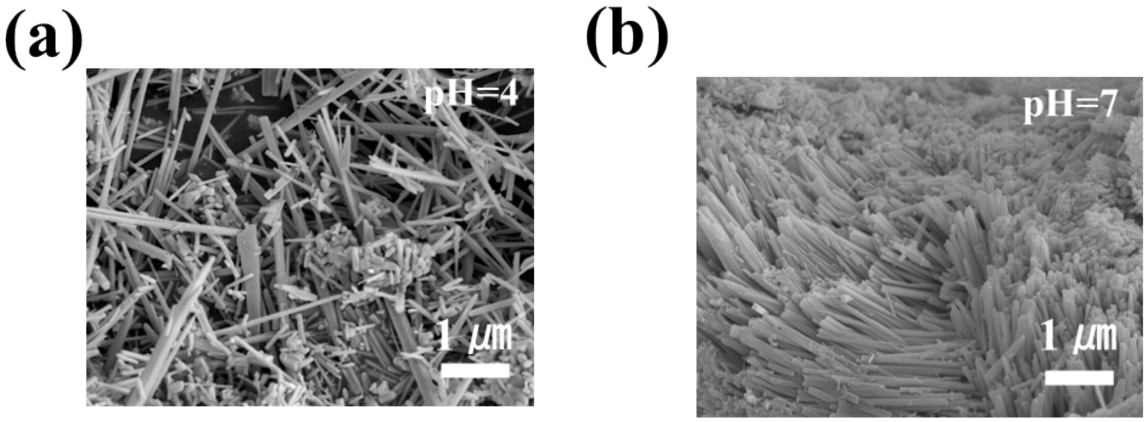

Figure S2 SEM image of VTe_2 synthesized at (a) pH=4 and (b) pH=7.

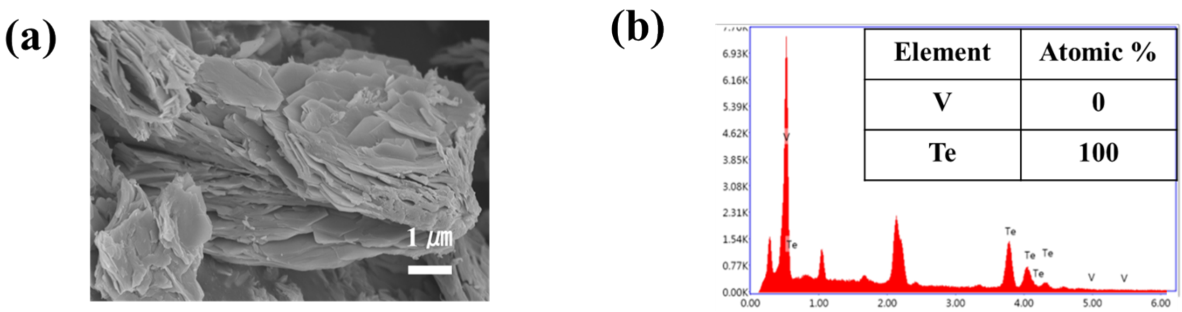

Figure S3 (a) A SEM image of tellurene (2D-Te) synthesized at pH=13 (b) A corresponding SEM-EDX results.

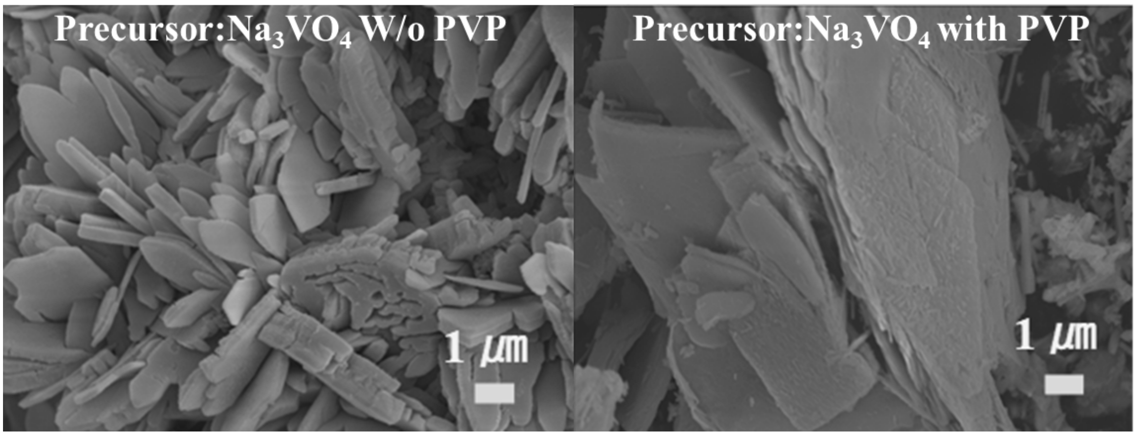

Figure S4 Comparison of SEM image of VTe_2 synthesized W/o PVP adding (left) and with PVP adding (right).

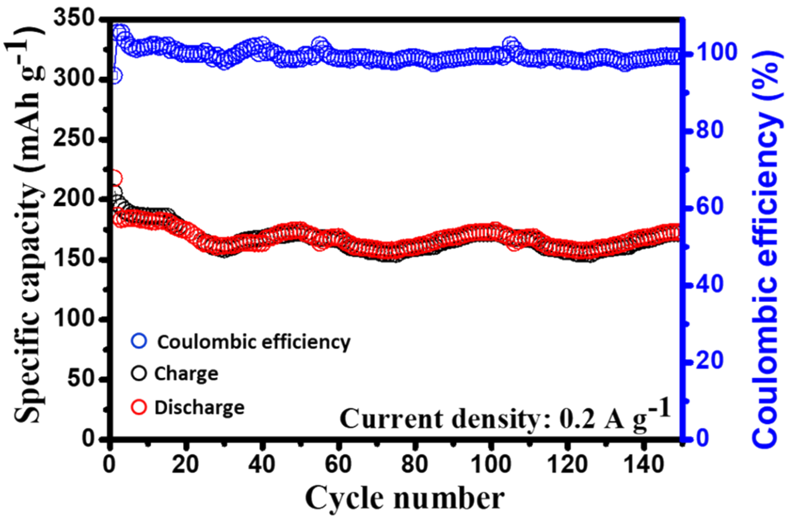

Figure S5 Cycling performance at a current density of 0.2 A g^{-1}.

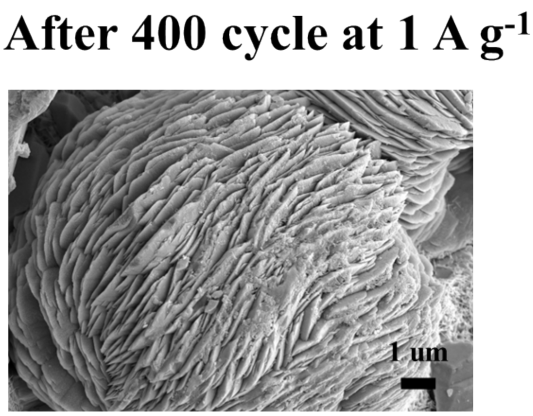

Figure S6 A SEM image of VTe_2 after 400 cycling test of discharge/charge.

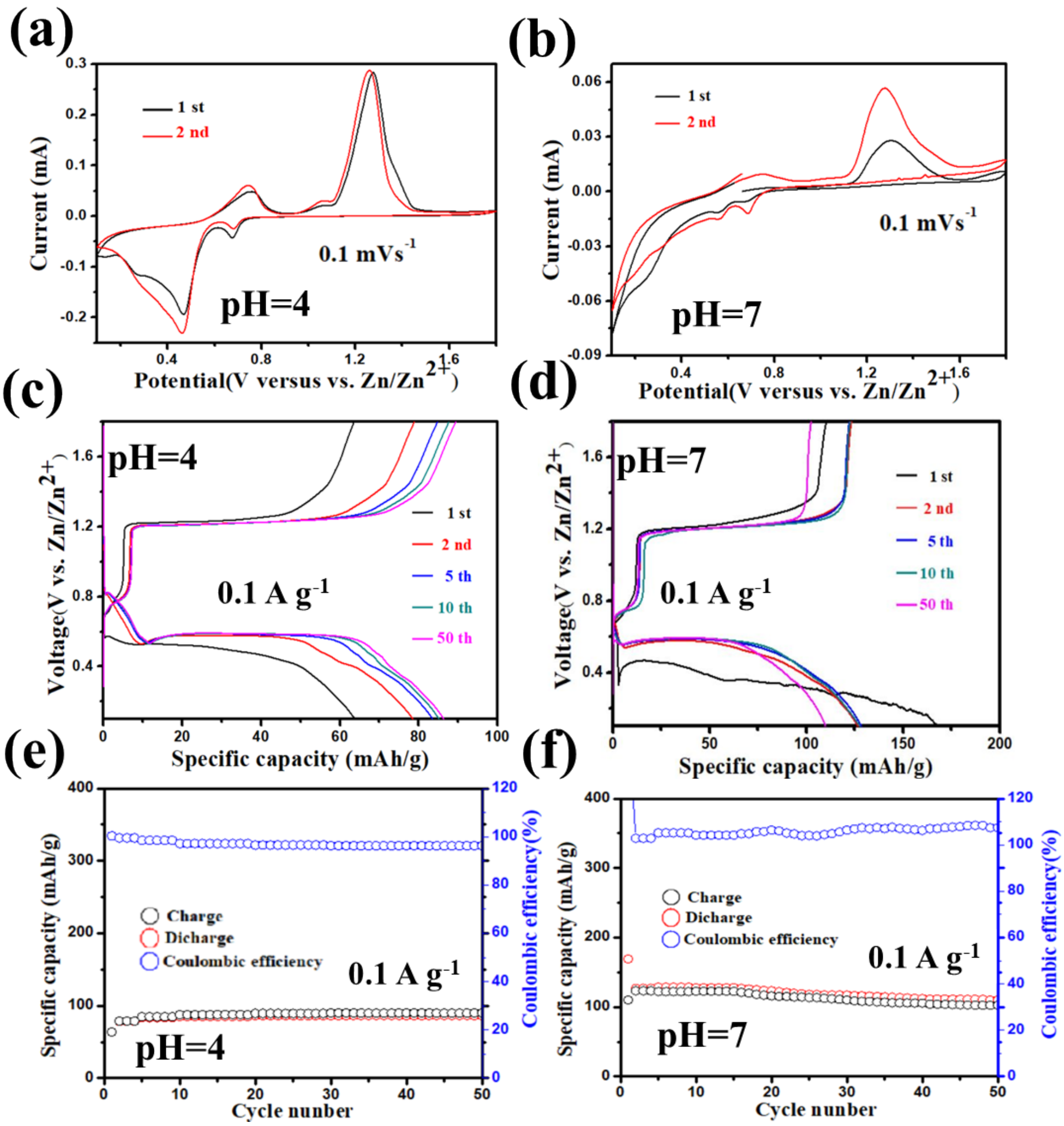

Figure S7 CV curves of (a) nanorod(@ pH 4) VTe_2 AZIB, (b) nanobelt (@ pH 7) VTe_2 AZIB. The galvanostatic charge-discharge profiles of (c) nanorod (@ pH 4) VTe_2 AZIBs, (d) nanobelt (@ pH 7) VTe_2 AZIBs. Cycling test of (e) nanorod (@ pH 4) VTe_2 AZIBs, (f) nanobelt (@ pH 7) VTe_2 AZIBs.

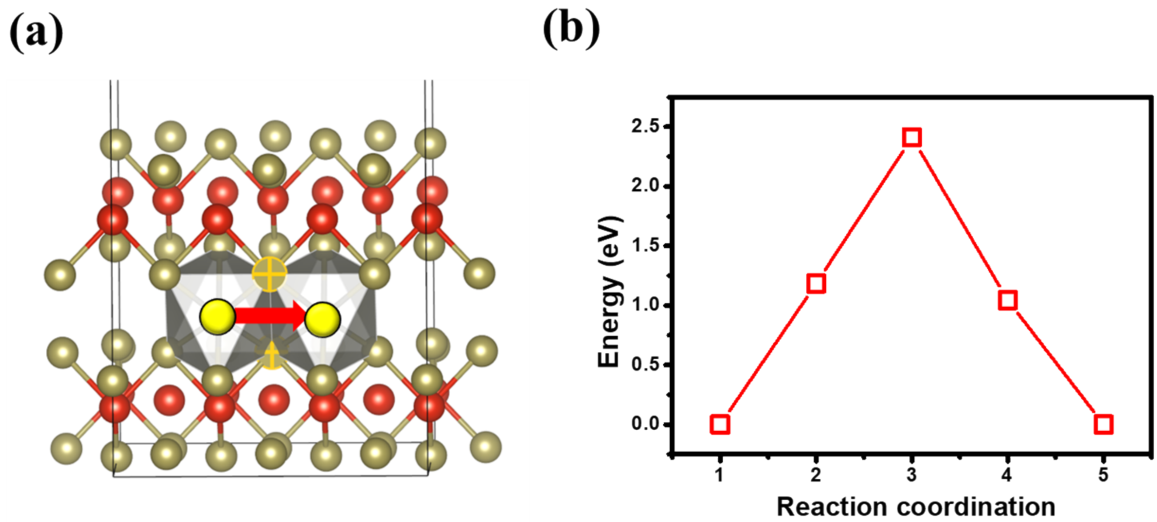

Figure S8 The predicted path along O site-Osite. (b) Corresponding migration barrier along O site-O site.

Table S1. Comparison of VTe_2 as cathode for AZIB and other reported potential materials as cathode.

Materials	**Specific capacity at X mA g^{-1}**	**Capacity retention after n cycles at y mA g^{-1}**	**References**
$Cu_3[Fe(CN)_6]_2$	61 (x=60)	83% (n=500, y=300)	[1]
$Zn_3[Fe(CN)_6]_2$	69.1 (x=60)	93% (n=100, y=300)	[2]
α-MnO_2 nanorod	210 (x=105)	77% (n=100, y=300)	[3]
$Li_3V_3O_8$	280 (x=16)	75% (n=65, y=133)	[4]
$Na_3V_2(PO_4)_3$/C	92 (x=50)	74% (n=200, y=50)	[5]
VO_2 nanoplates	394 (x=100)	81.2% (n=1200,y=3000)	[6]
VS_2	190 (x=50)	98 % (n=200, y=500)	[7]
VS_2	220 (x=100)	86.7% (n=2000, y=2000)	[8]
VSe_2	200 (x=200)	83 % (n=800, y=2000)	[9]
VSe_2	130 (x=100)	75.3 % (n=500, y=500)	[10]
VTe_2	274 (x=50)	95 % (n=400, y=1000)	This work

Supplementary References

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