

## Supporting information

### Three-Dimensional Hollow ZnS/MXene Heterostructure with Stable Ti-O-Zn Bonding for Enhanced Lithium-Ion Storage

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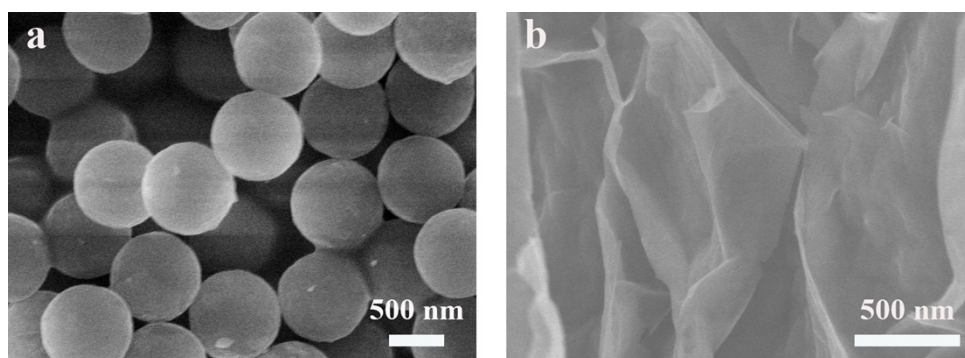


Fig. S1. (a) SEM image of PS spheres. (b) SEM image of MXene nanosheets.

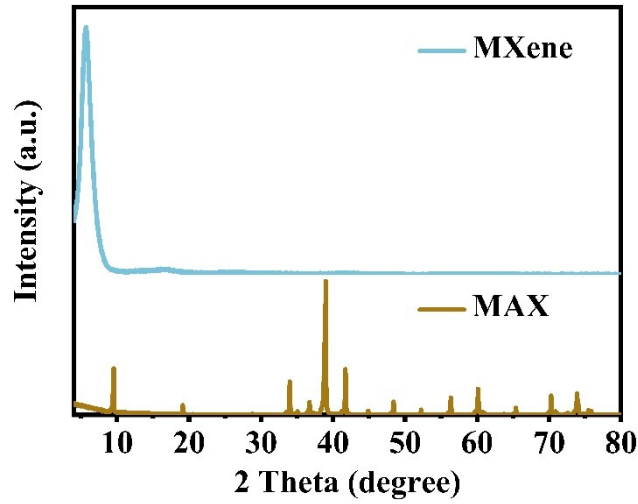


Fig. S2. XRD patterns of MXene and MAX.

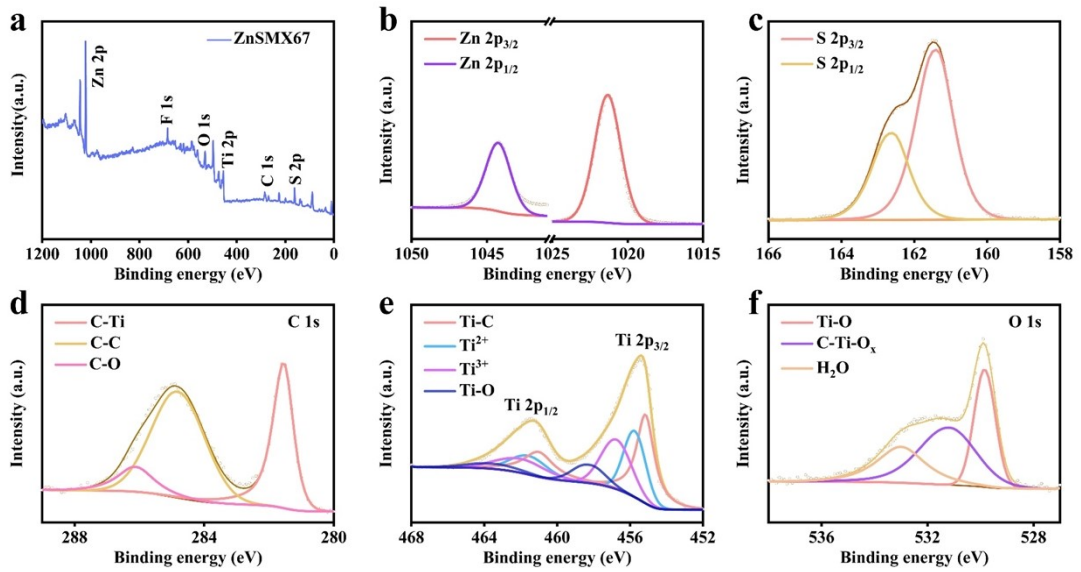


Fig. S3. (a) XRD patterns of MXene and MAX. (b, c) High-resolution XPS spectra of Zn 2p and S 2p for ZnSMX67. (d-f) High-resolution XPS spectra of C 1s, Ti 2p, and O 1s for MXene.

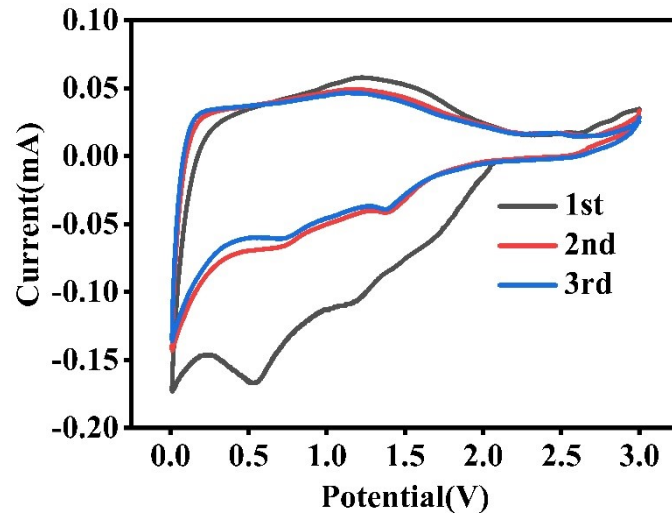


Fig. S4. CV curves of 3D ZnSMX67 electrode at  $0.2 \text{ mV s}^{-1}$  for the first three cycles.

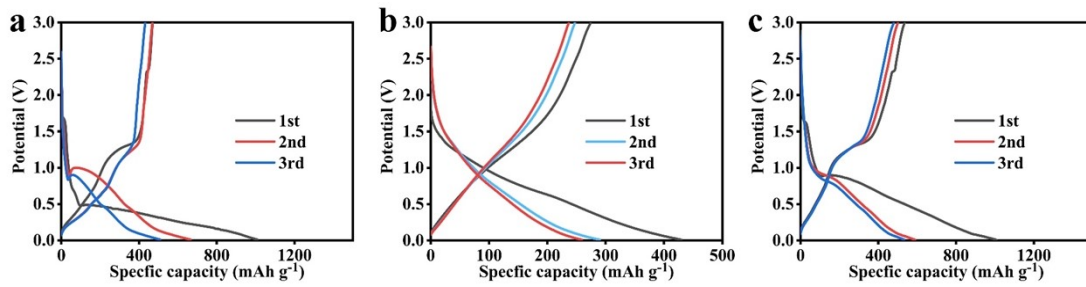


Fig. S5. (a-c) GCD profiles of ZnS, MXene, and 2D ZnSMX67 at  $0.2 \text{ A g}^{-1}$  for the initial three cycles.

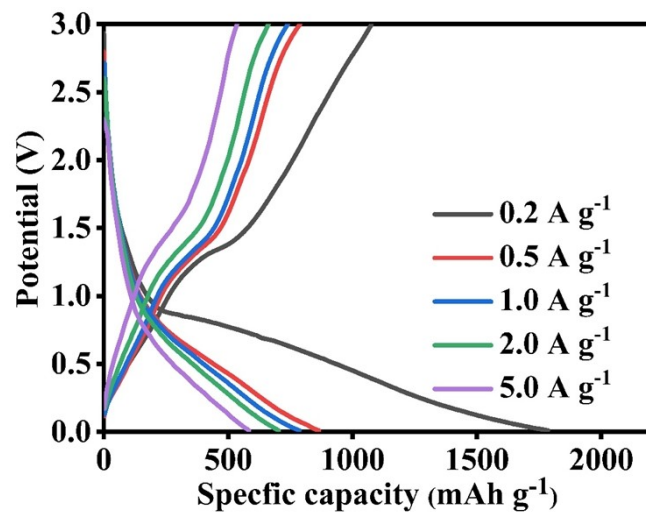


Fig. S6 GCD profiles of 3D ZnSMX67 at different densities.

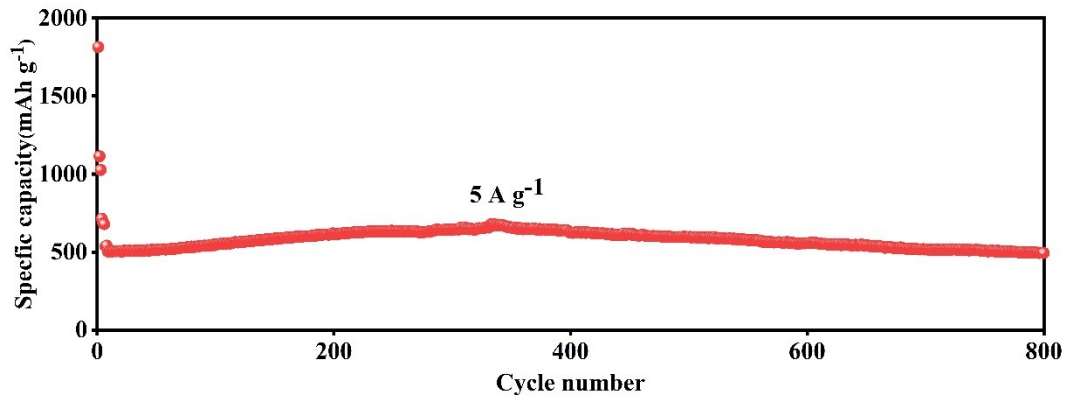


Fig. S7. Long-term cycling performance of 3D ZnSMX67 at 5 A g<sup>-1</sup>.

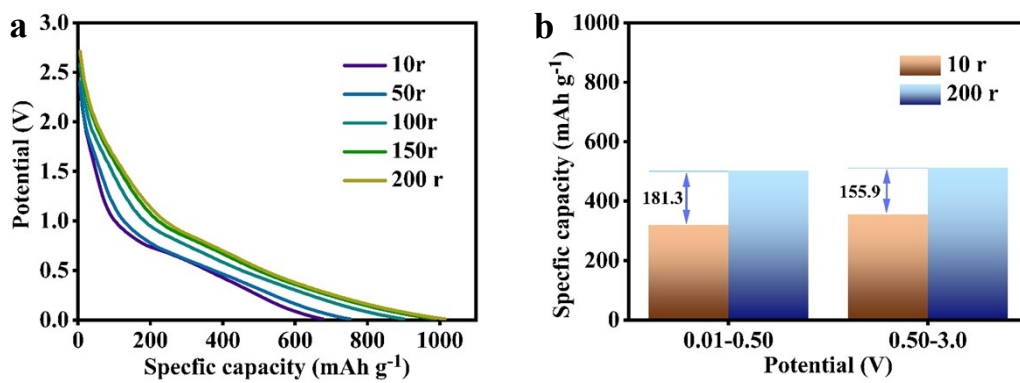


Fig. S8. (a) GCD profiles of 3D ZnSMX67 at different cycles. (b) The capacity changes of 3D ZnSMX67 in two voltage ranges at current densities of 2 A g<sup>-1</sup>.

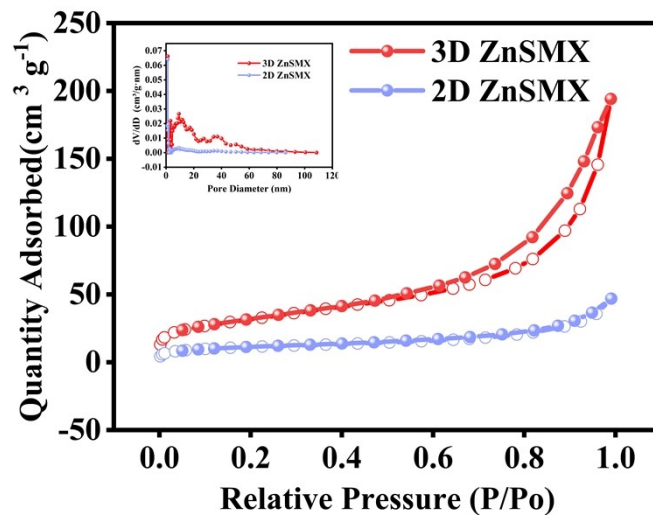


Fig. S9 N<sub>2</sub> adsorption-desorption plots and the corresponding pore size distribution of 3D ZnSMX and 2D ZnSMX.

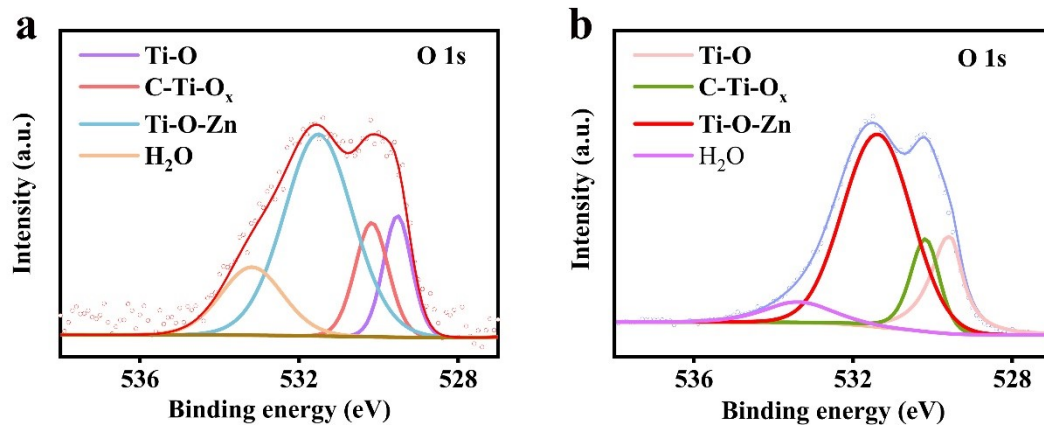


Fig. S10 (a, b) High-resolution XPS spectra of O1s before and after 350 cycles at a current density of 2 A g<sup>-1</sup>.