Supporting Information

Structure Interlacing and Pore Engineering of Zn_2GeO_4 Nanofibers for Achieving High Capacity and Rate Capability as an Anode Material of Lithium Ion Batteries

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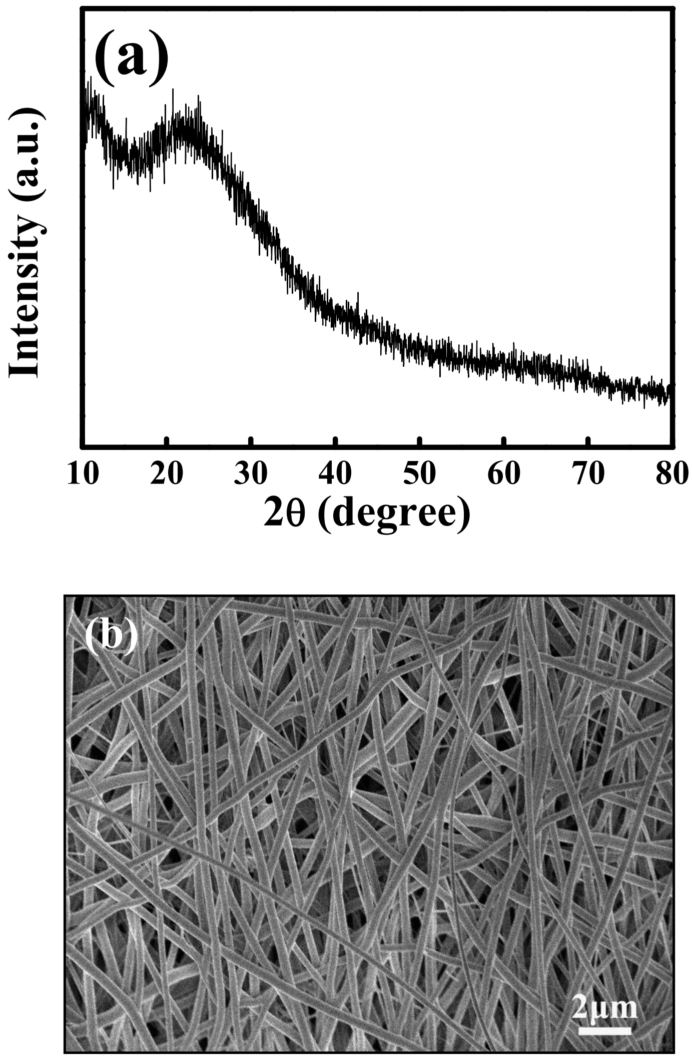

Figure S1 (a) XRD pattern and (b) SEM image of as-electrospun Zn-Ge-PVP precursor.

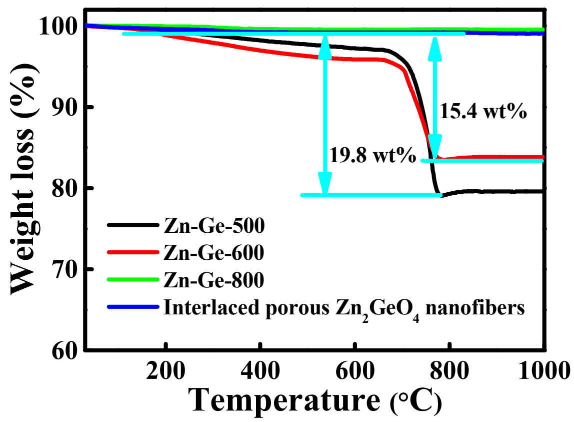

Figure S2 TG curve of the interlaced porous Zn_2GeO_4 nanofiber electrode as well as Zn-Ge-500, Zn-Ge-600, Zn-Ge-800 in air.

For quantifying the amount of carbon in the products, TGA was carried out in air. The samples were heated from 25 to 1000 °C at a rate of 10 °C min^{-1}. **Figure S2** shows the TGA curve of the interlaced porous Zn_2GeO_4 nanofiber electrode as well as Zn-Ge-500, Zn-Ge-600, Zn-Ge-800. A slight weight loss observed before 200 °C was assigned to water absorbed on the surface and in the inner of the nanofibers. The large weight loss between 450 °C and 800 °C was the eliminating of carbon from the products. As can be seen from equation (1), the carbon content in the composite was all burned out into CO_2 during the heating process, while the Zn_2GeO_4 was decomposed into ZnO and GeO_2 after 800 °C with no weight loss. So, the final weight entirely corresponds to ZnO and GeO_2, from which the weight of carbon can be calculated. By using the equation (2), it was estimated that the amount of carbon in the Zn-Ge-500 and Zn-Ge-600 were about 19.8 wt% and 15.4 wt%, respectively. While for the interlaced porous Zn_2GeO_4 nanofiber and Zn-Ge-800, there is no carbon in the samples.

$$Zn_2GeO_4\text{-Carbon } (\sim 1000^{\circ}C) \longrightarrow 2ZnO + GeO_2 + CO_2 \uparrow \quad (1)$$

$$\text{Carbon (wt\%)} = 100\% \times \frac{\text{initial weight} - \text{final weight}}{\text{initial weight}} \quad (2)$$

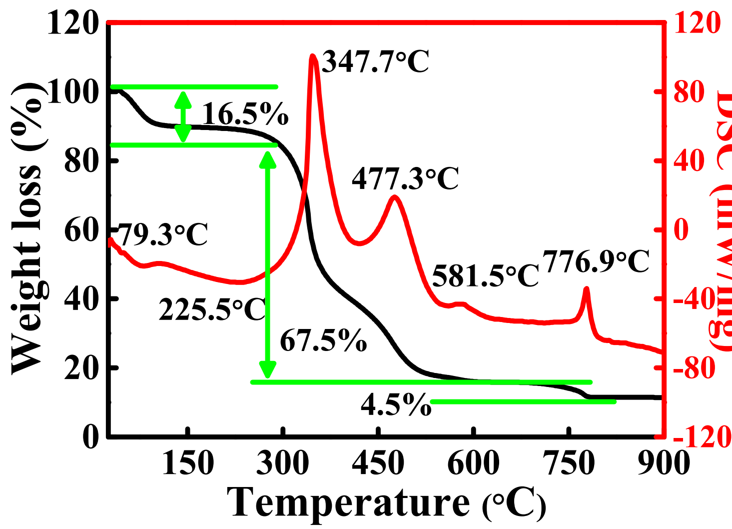

Figure S3 TG-DSC curves of Zn-Ge-PVP precursor recorded in air atmosphere.

As can be clearly seen, the initial 16.5% weight loss in the low temperature range (25−300 °C) can be assigned to the adsorbed water and residual solvent (DMF).The sharp peak at 347.7°C is assigned to the decomposition of PVP, while the prominent peaks at around 477.3°C and 581.5 °C correspond to the formation of Zn_2GeO_4 with 67.5% total weight loss (300−600 °C). And it can be seen that there is almost no weight loss between 600 °C and 700 °C. As the temperature continues to increase, a peak at about 776.9 °C is detected that is related to the partial decomposition of the Zn_2GeO_4 phase and the emergence of GeO_2 accompanies by 4.5% weight loss (700−900°C).

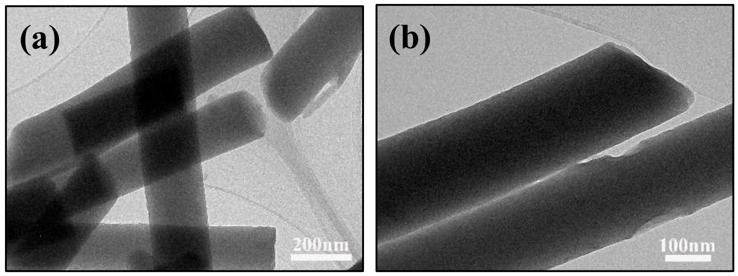

Figure S4 (a,b) TEM images of Zn-Ge-600 with different magnifications.

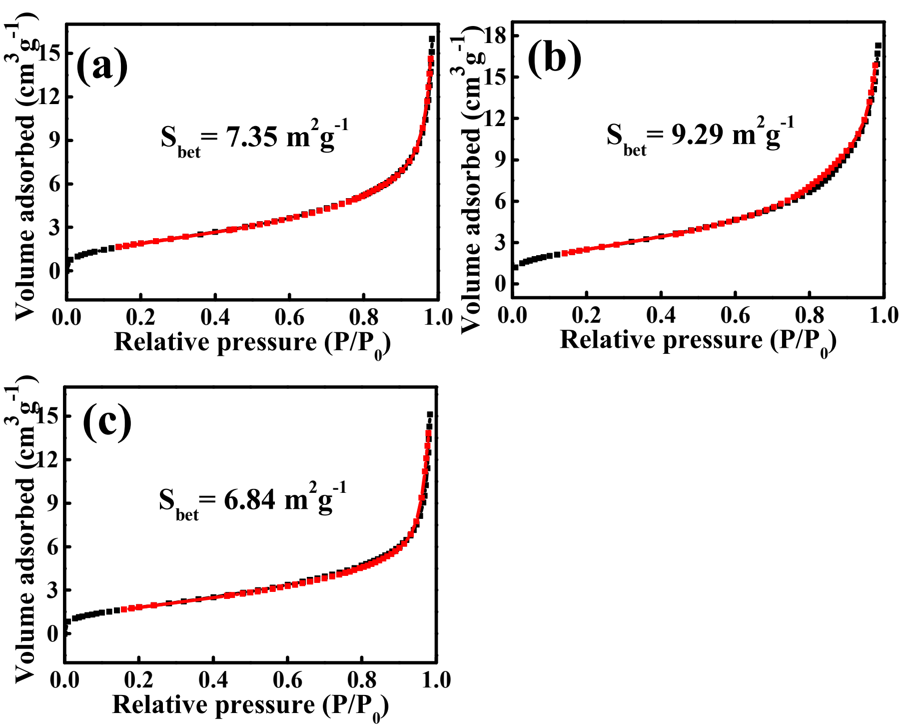

Figure S5 Nitrogen adsorption-desorption isotherms of Zn-Ge-500 (a), Zn-Ge-600 (b) and Zn-Ge-800 (c).

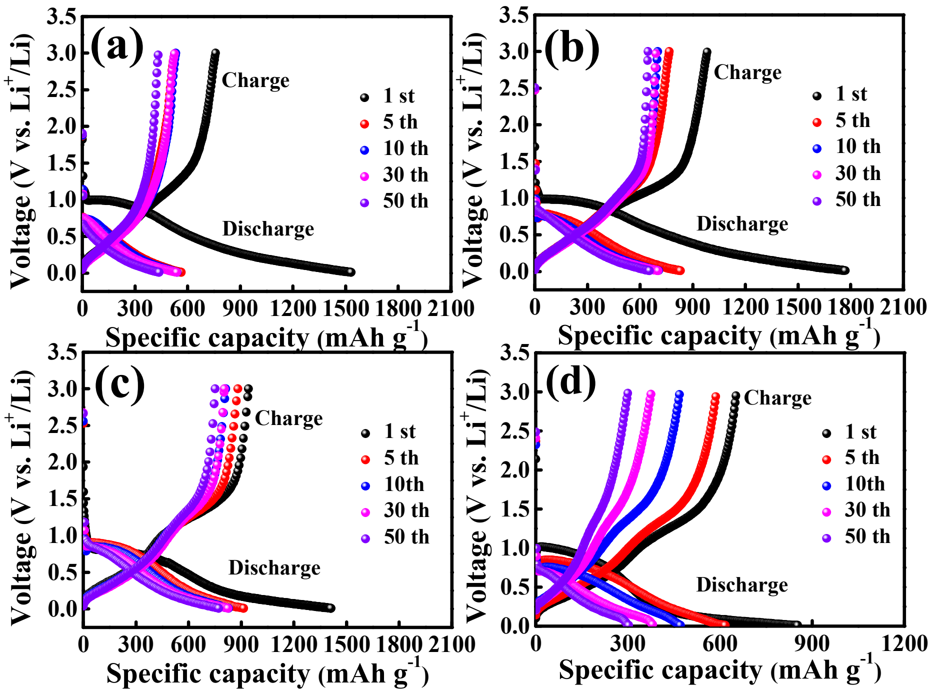

Figure S6 Discharge and charge profiles of Zn-Ge-500 (a), Zn-Ge-600 (b), Zn-Ge-800 (c), and Zn_2GeO_4 nanorods (d) at a current density of 100 mA g^{-1} between 0.01 and 3.00 V for 1st, 5th, 10th, 30^{th} and 50th cycles.

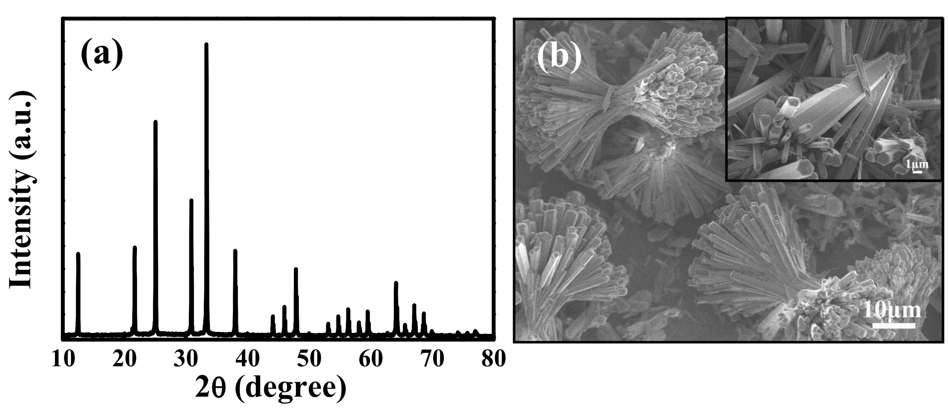

Figure S7 (a) XRD pattern and (b) SEM image of pure Zn_2GeO_4 nanorods.

Equivalent electrical circuit

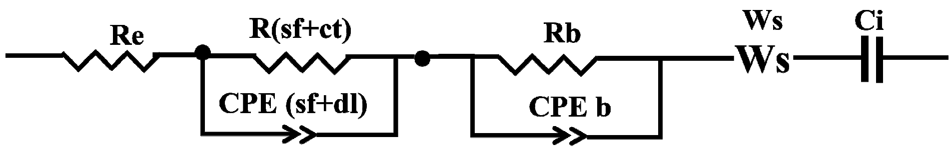

Figure S8 Equivalent electrical circuit corresponding to the results in Figure 5d.

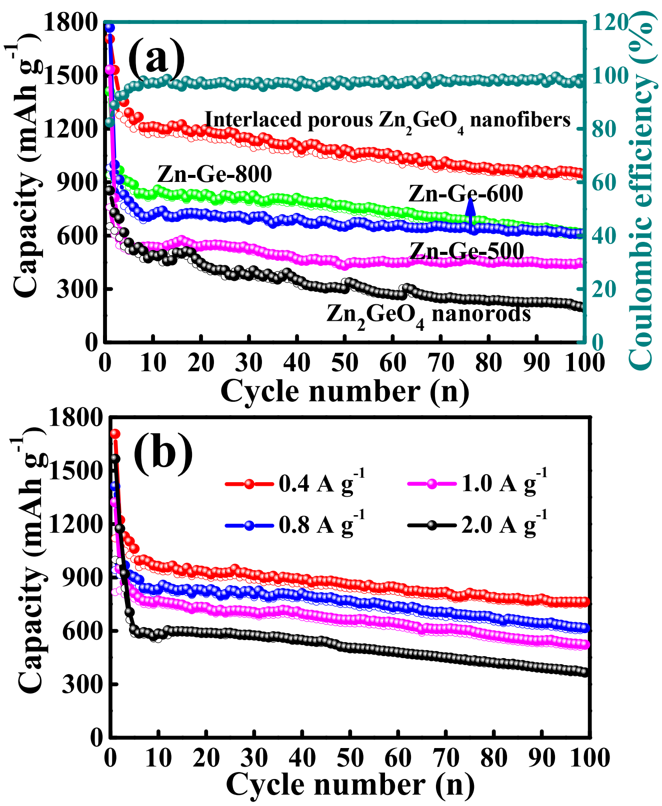

Figure S9 (a) Comparison of cycle performance of the interlaced porous Zn_2GeO_4 nanofiber electrode as well as Zn-Ge-500, Zn-Ge-600, Zn-Ge-800 and Zn_2GeO_4 nanorods cycled at 0.2 A g^{-1} for 100 cycles. (b) The cycling performance of interlaced porous Zn_2GeO_4 nanofiber electrode at 0.4, 0.8, 1.0 and 2.0 A g^{-1} for 100 cycles.