Supporting Information

Highly Flexible and Self-Healable Rechargeable Fibrous Zn-MnO_2 Battery

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Calculation

The specific volumetric capacity of the fiber battery is calculated based on the results of the GCD curves by the following formula (1):

$$C = \frac{I \cdot \Delta t}{S \cdot L} \quad (1)$$

Where C means the specific volumetric capacity, I means the charging or discharging current, Δt means the charging or discharging time, S and L mean the cross-sectional area and the length of the fibers, respectively.

The formulas for calculating the volumetric energy density and power density of Zn-MnO_2 fiber battery are expressed as following (2) and (3):

$$D_E = \int_0^{\Delta t} \frac{I \cdot V(t)}{S \cdot L} dt = \int_0^{\Delta Q} \frac{V(q)}{S \cdot L} dq \quad (2)$$

$$D_P = \frac{D_E}{\Delta t} \quad (3)$$

Where D_E and D_P respectively means the volumetric energy density and power density, Δt means the discharging time, I means the discharging current, ΔQ means the discharging capacity, V means the working voltage, S and L mean the cross-sectional area and the length of the fibers, respectively.

The Coulombic efficiency (CE) and capacitance retention (CR) are calculated from the equations (4) and (5), respectively:

$$CE = \frac{\Delta t_d}{\Delta t_c} \quad (4)$$

$$CR = \frac{\Delta t}{\Delta t_0} \quad (5)$$

Where Δt_d and Δt_c are respectively discharging and charging time in the same cycle, Δt is the discharging time of different cycles and Δt_0 means the first discharging time.

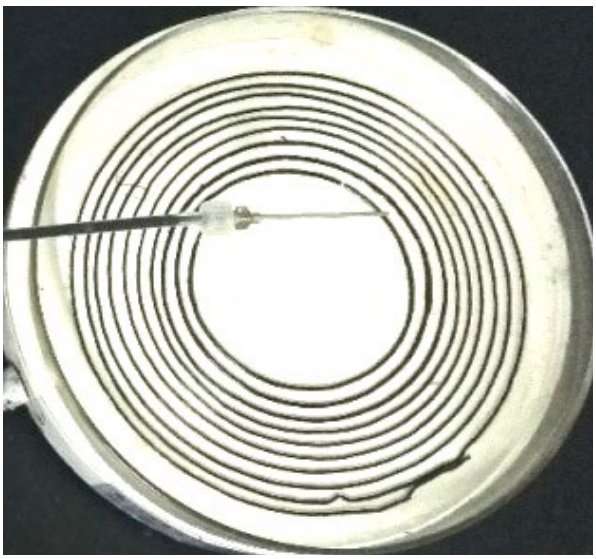

Figure S1. Photograph of the wet spinning process.

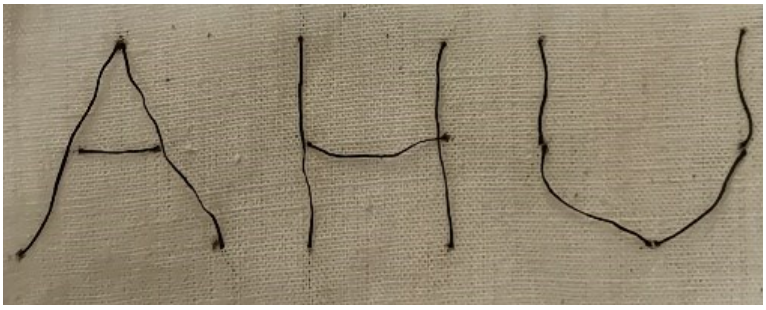

Figure S2. Photograph of the fibers woven on textile.

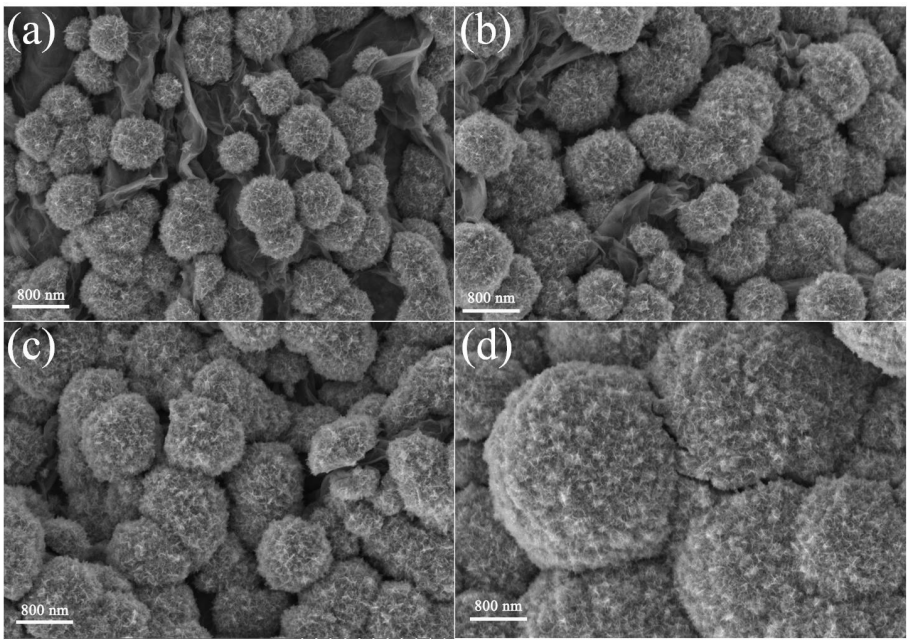

Figure S3. The high magnification surface SEM images of RGO-MWCNTs-MnO_2 fibers with various MnO_2 electrodeposition times. (a) 15 min, (b) 30 min, (c) 45 min and (d) 60 min.

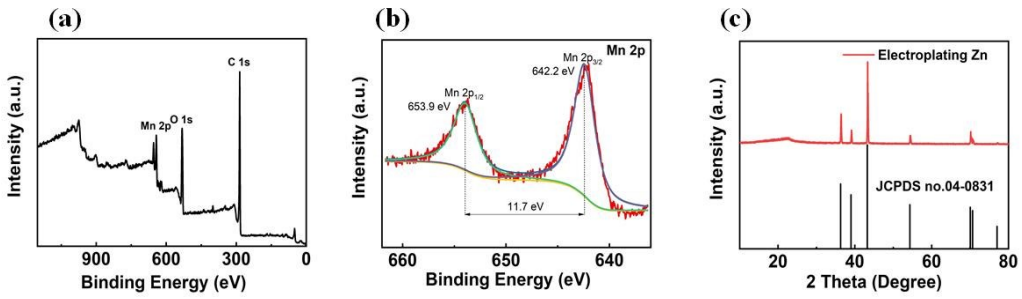

Figure S4. (a) The Full XPS spectrum and (b) Mn 2p XPS spectrum of the RGO-MWCNTs-MnO_2 fibers. (c) The XRD pattern of the RGO-MWCNTs-Zn fiber.

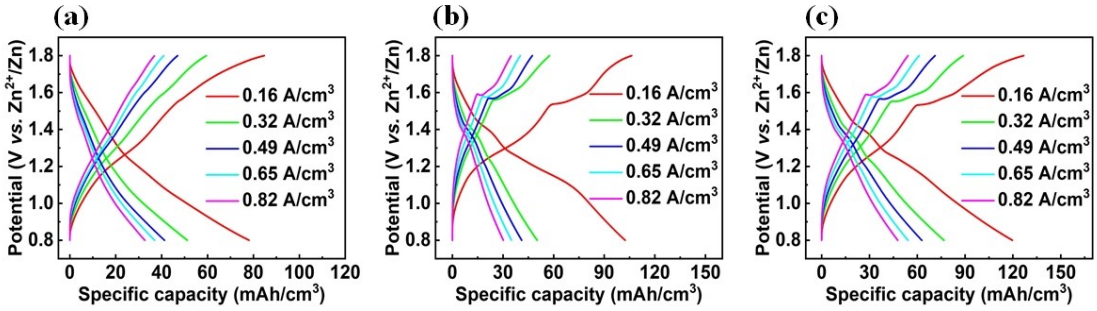

Figure S5. The GCD curves of RGO-MWCNTs-MnO_2 fibers under various MnO_2 electrodeposition times. (a) 15 min, (b) 30 min and (c) 60min.

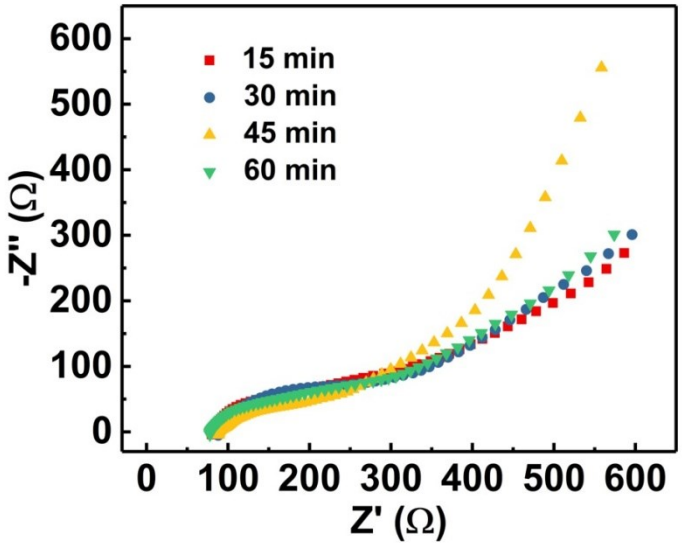

Figure S6. The EIS of RGO-MWCNTs-MnO_2 fibers under various MnO_2 electrodeposition times.

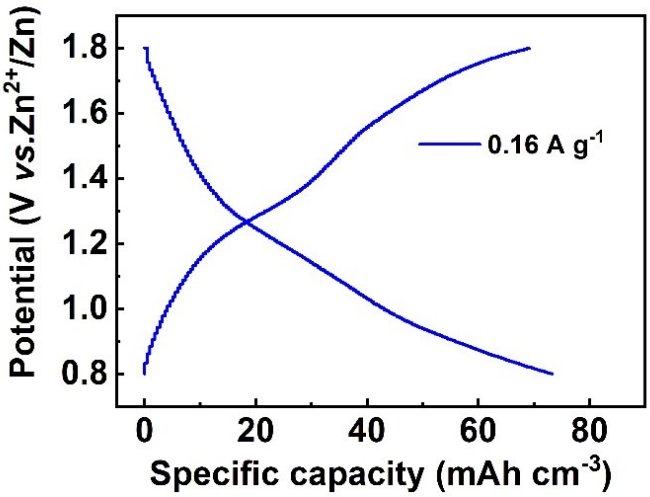

Figure S7. The GCD curve of the pure RGO-MWCNTs fiber under the selected mass ratio in aqueous electrolyte.

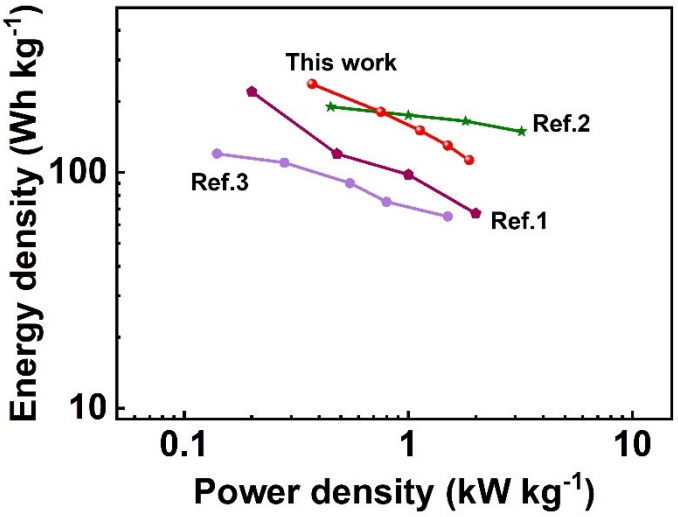

Figure S8. The comparison of the energy and power densities of the fibrous Zn-MnO_2 battery with previous reported Zn-MnO_2 batteries.[1–3]

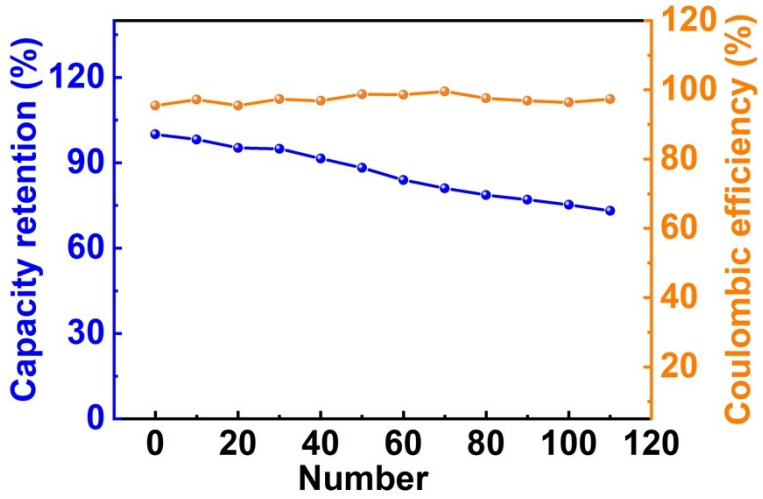

Figure S9. The capacity retention and Coulombic efficiency of the fiber battery under repeated bending cycles.

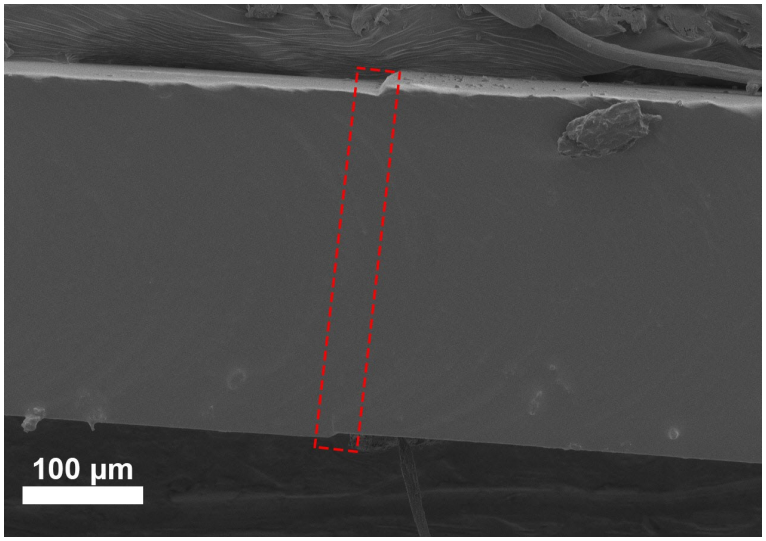

Figure S10. The cross-sectional SEM image of the self-healing PU.

References

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2 Y. Zhang, S. Deng, Y. Li, B. Liu, G. Pan, Q. Liu, X. Wang, X. Xia and J. Tu, *Energy Storage Materials*, 2020, **29**, 52–59.

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