Electronic Supplementary Material (ESI) for Nanoscale.

Supporting information

Coupling Interconnected MoO_3/WO_3 Nanosheets within Graphene Framework as Highly Efficient Anode for Lithium-Ion Battery

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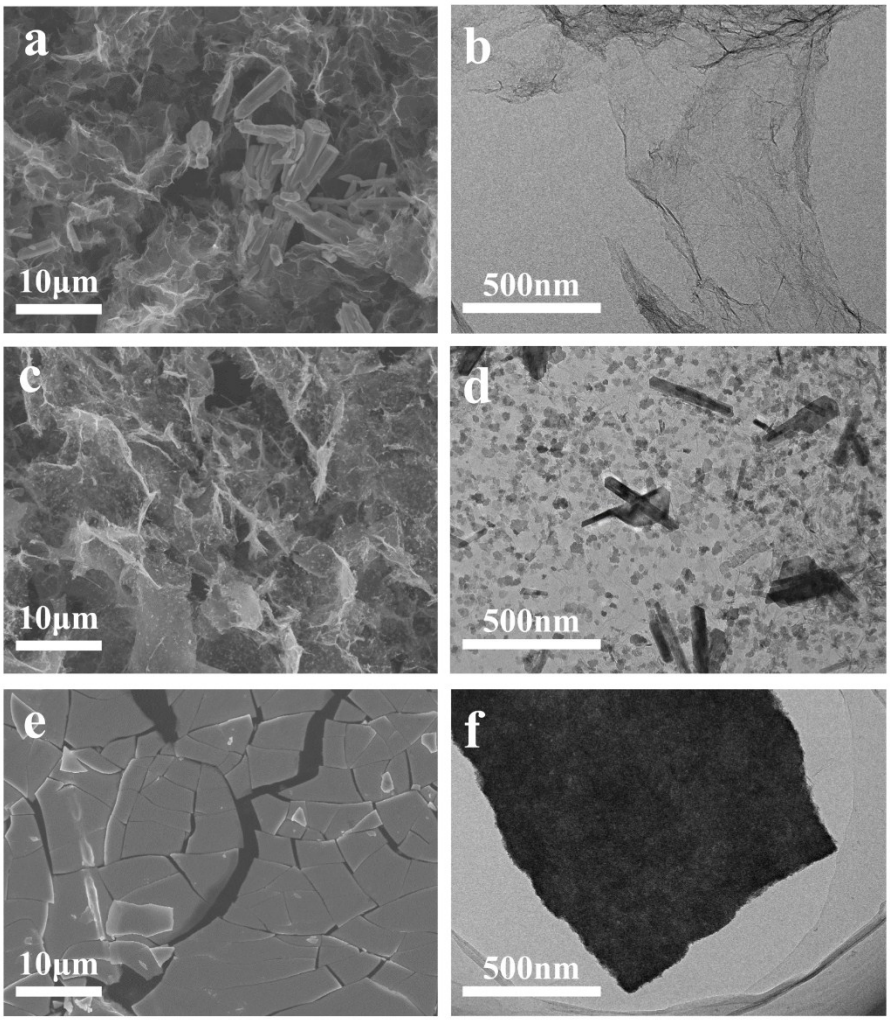

Fig. S1 The scanning (SEM) and transmission electron microscopy (TEM) images of the as-prepared (a, b) MoO_3-GF, (c, d) WO_3-GF and (e, f) MoO_3/WO_3.

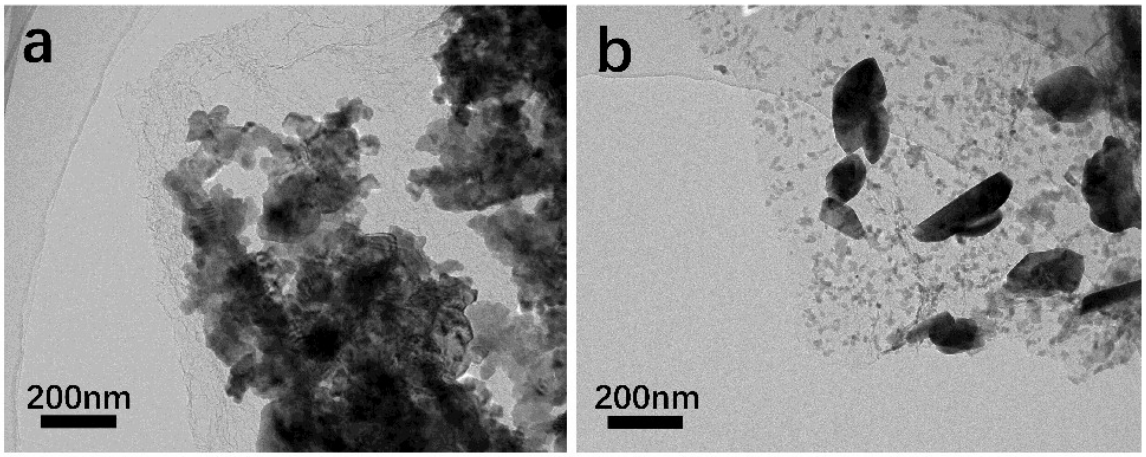

Fig. S2 The TEM images of the as-prepared (a) MoO_3/WO_3-GF-2/1 and (b) MoO_3/WO_3-GF-1/2, respectively.

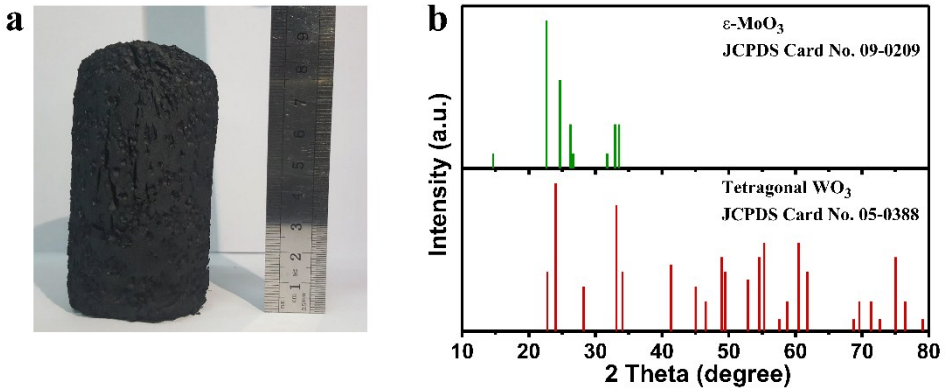

Fig. S3 (a) The digital image of MoO_3/WO_3-GF after hydrothermal treatment in a 300 mL Teflon-line autoclave. (b) Standard PDF card of ε-MoO_3 and tetragonal WO_3.

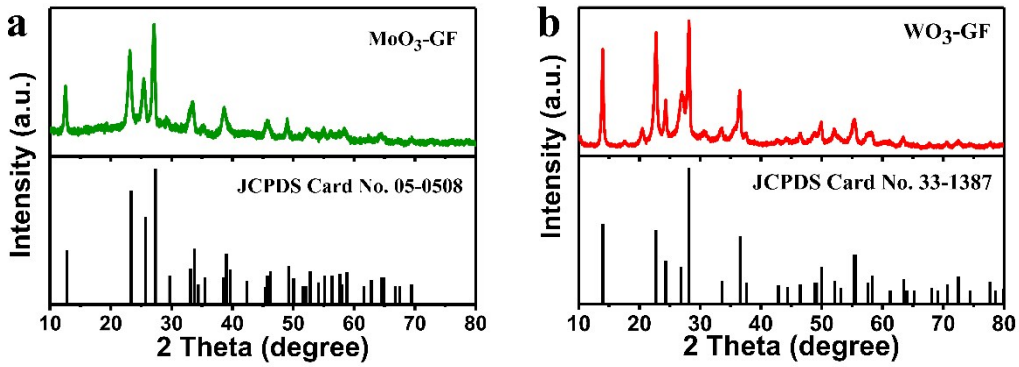

Fig. S4 X-ray diffraction (XRD) patterns of (a) MoO_3-GF and (b) WO_3-GF.

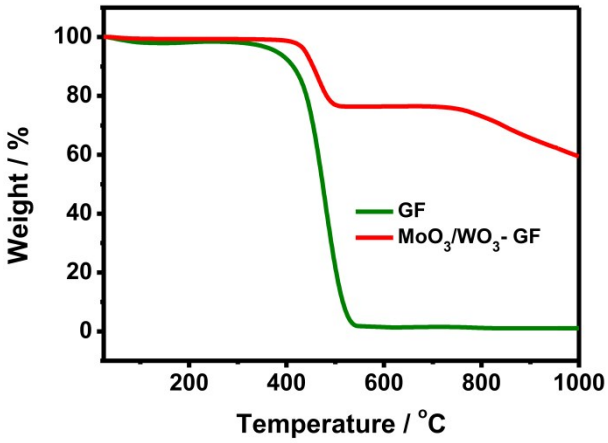

Fig. S5 The thermogravimetric analysis (TGA) curves of the MoO_3/WO_3-GF and GF in air from 25 to 1000 °C with a temperature ramping rate of 10 °C min^{-1}.

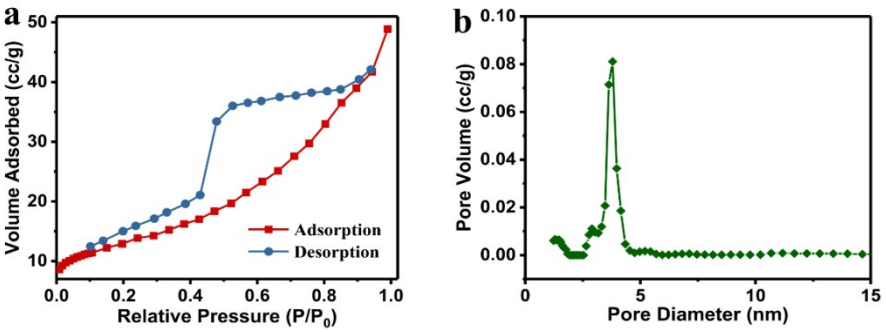

Fig. S6 The N_2 adsorption-desorption isotherm of (a) MoO_3/WO_3-GF and (b) the corresponding pore-size distribution.

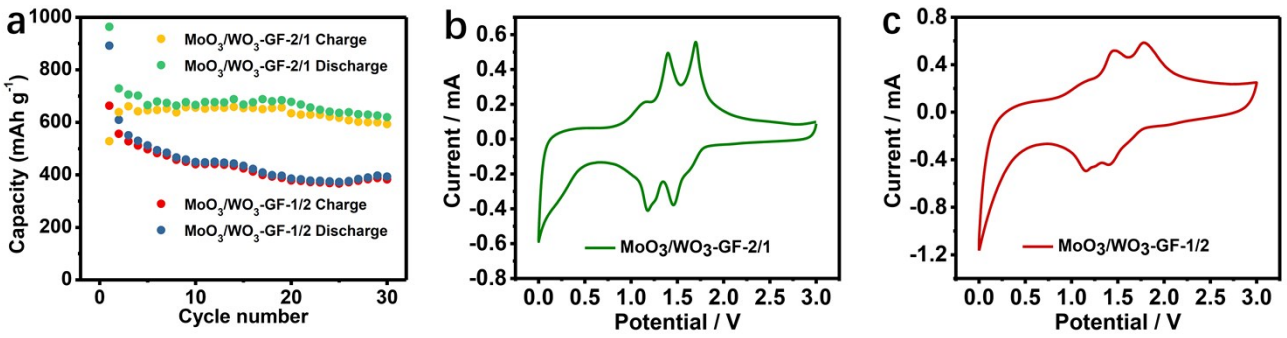

Fig. S7 Cycling performances of (a) MoO_3/WO_3-GF-2/1 and MoO_3/WO_3-GF-1/2 at 200 mA g^{-1}, and the stable CV curves of (b) MoO_3/WO_3-GF-2/1 and (c) MoO_3/WO_3-GF-1/2 at a scan rate of 0.2 mV s^{-1}, respectively.

As shown in Fig. S7a, the reversible discharge capacities of MoO_3/WO_3-GF-2/1 and MoO_3/WO_3-GF-1/2 are 619.8 and 393.1 mA h g^{-1} at 200 mA g^{-1} over 30 cycles, which are far lower than the as-prepared MoO_3/WO_3-GF material (Fig. 4b). The corresponding CV curves are shown in Fig. S7b and c. Both the MoO_3/WO_3-GF-2/1 and MoO_3/WO_3-GF-1/2 exhibit more significant redox peaks than MoO_3/WO_3-GF (Fig. 5a) at range of 1.0 ~ 2.0 V. This can be ascribed to that the large MoO_3/WO_3 crystal size and disordered structures may lead to the enhanced of redox peaks, according to previous studies on morphology-dependent electrochemical performances.[1,2]

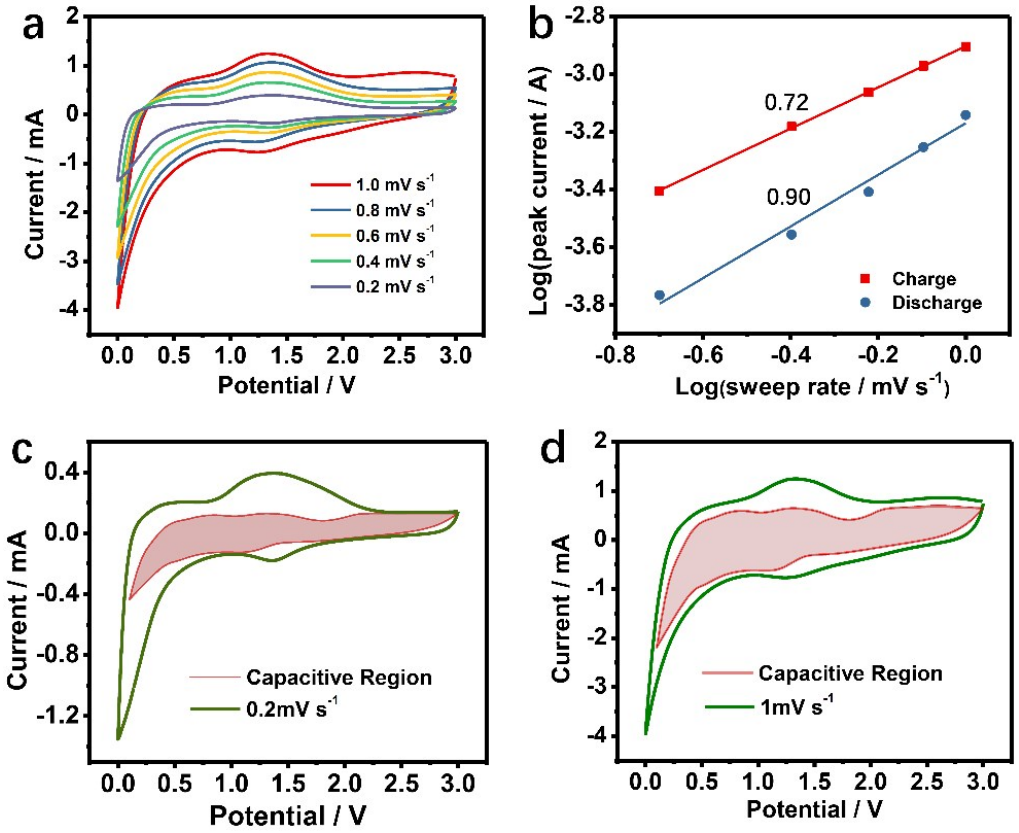

Fig. S8 (a) CV curves of MoO_3/WO_3-GF electrode with scan rate from 0.2 to 1 mV s^{-1}. (b) The corresponding log (peak current, i) versus log (sweep rate, v) plots of charge and discharge peak current with scan rate from 0.2 to 1 mV s^{-1}. (c) Voltammetric response at a scan rate of 0.2 mV s^{-1} and (d) 1 mV s^{-1} respectively. The capacitive contribution to the total current is shown by the shaded region.

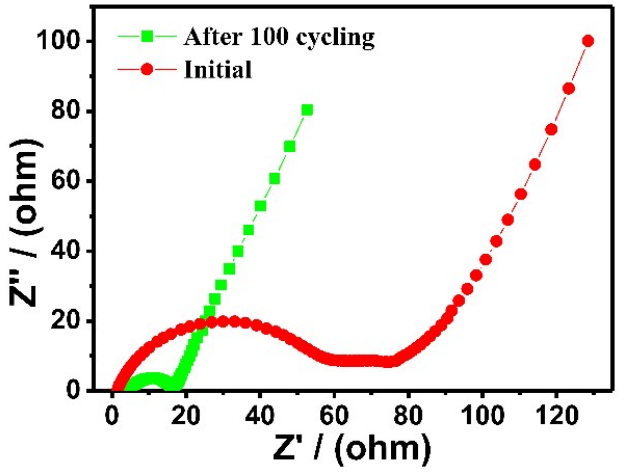

Fig. S9 Electrochemical impedance spectra (EIS) of MoO_3/WO_3-GF before and after cycling.

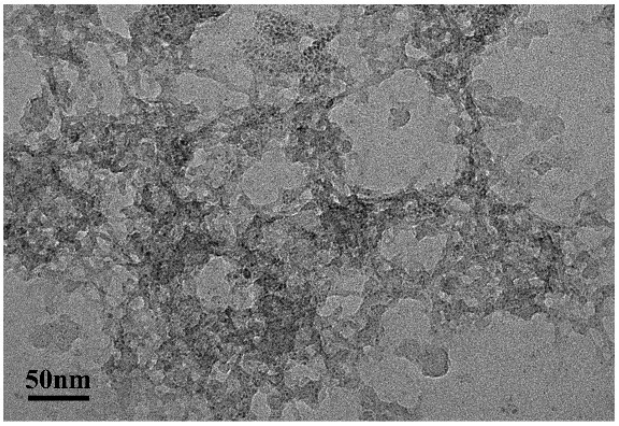

Fig. S10 The morphology of MoO_3/WO_3-GF after 100 cycles. This image gives the direct evidence of the structural stability of the material after cycling.

Reference

[1] Q. Xia, H. L. Zhao, Z.H. Du, J. Wang, T. H. Zhang, J. Wang and P. P. Lv, *J. Power Sources,* 2013, **226**, 107-111.

[2] M. Okubo, E. Hosono, Jedeok Kim, M. Enomoto, N. Kojima, T. Kudo, H. S. Zhou and I. Honma, *J. Am. Chem. Soc.,* 2007, **129**, 7444-7452.