Supplementary information

Flexible C-Mo_2C fiber film with self-fused junctions as a long cyclability anode material for sodium-ion battery

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Supplementary Figures, Tables and related discussion

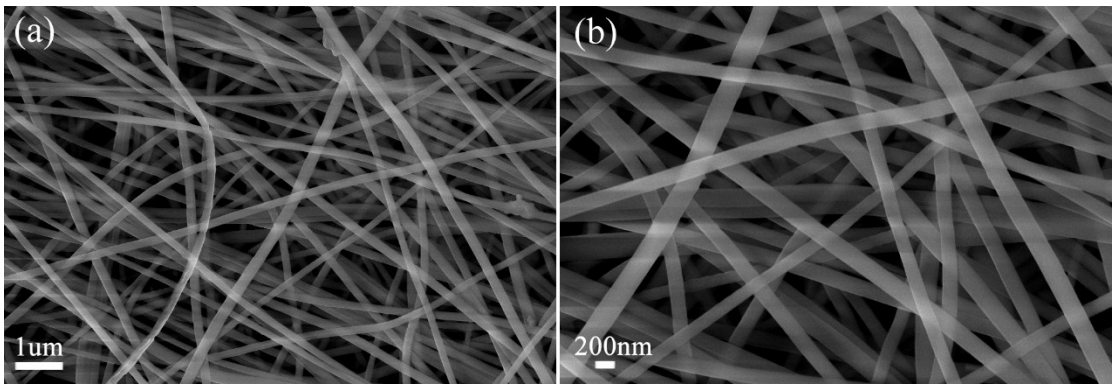

Fig. S1. SEM images of electrospun precursor PAN/$(NH_4)_6Mo_7O_{24}.4H_2O$ fiber film.

In electrospinning, DMF is evaporated in flight and the solidified PAN, $(NH_4)_6Mo_7O_{24}.4H_2O$ forms a intersecting fiber film. Fig. S1 shows the SEM images of precursor PAN/$(NH_4)_6Mo_7O_{24}.4H_2O$ fibers, the fibers have a smooth surface with a diameter of 120-250 nm.

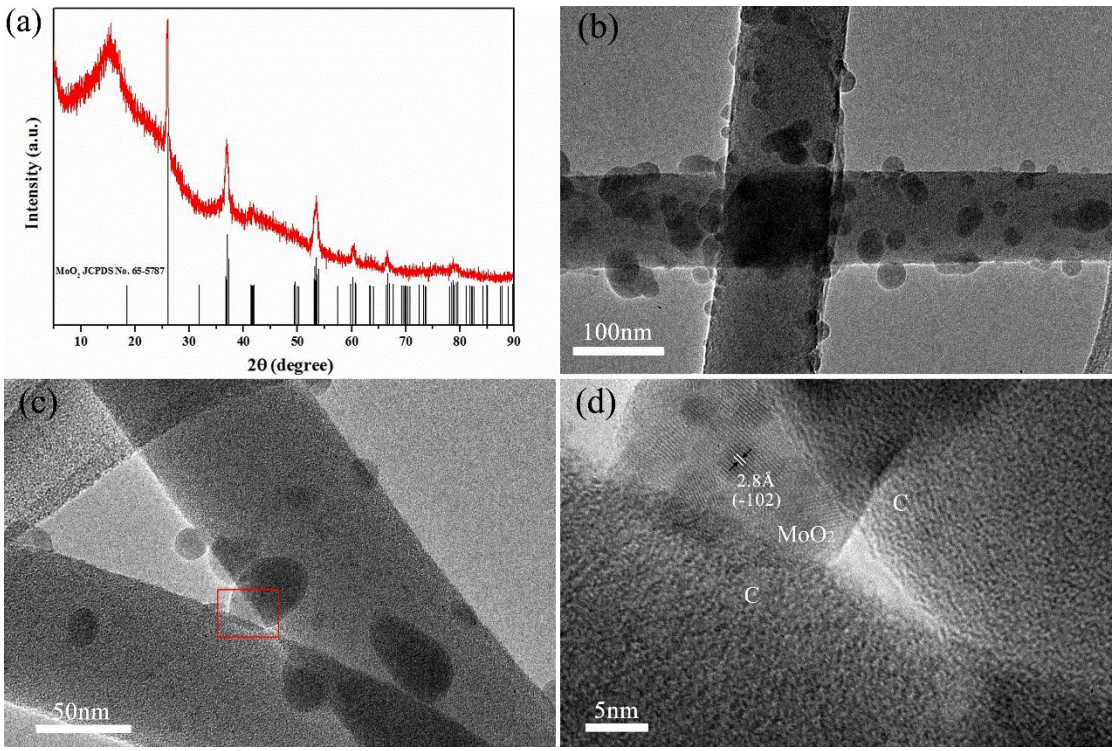

Fig. S2. (a) XRD pattern, (b-c) TEM images of precursor fiber carbonized at 600 °C for 1h, (d) HRTEM image of the region in the red frames of (c).

Before the carbonization temperature reaches 800 °C, the $(NH_4)_6Mo_7O_{24}.4H_2O$ in the precursor fiber will first decompose into MoO_2 and form the high active C-MoO_2-C interface at the fiber junction. Fig. S2 shows the XRD pattern and TEM images of precursor fiber carbonized at 600 °C. The XRD result shows the characteristic peaks can be readily indexed to be monoclinic MoO_2 (JCPDS No. 65-5787). The TEM and HRTEM images show that the MoO_2 particles dispersed on the carbon fiber and form the obvious C-MoO_2-C interface at the fiber junction, while the junctions have not yet fused. The set of lattice fringes with an interplane spacing of 2.8 Å corresponds to the (100) planes of monoclinic MoO_2 (Fig. S2d).

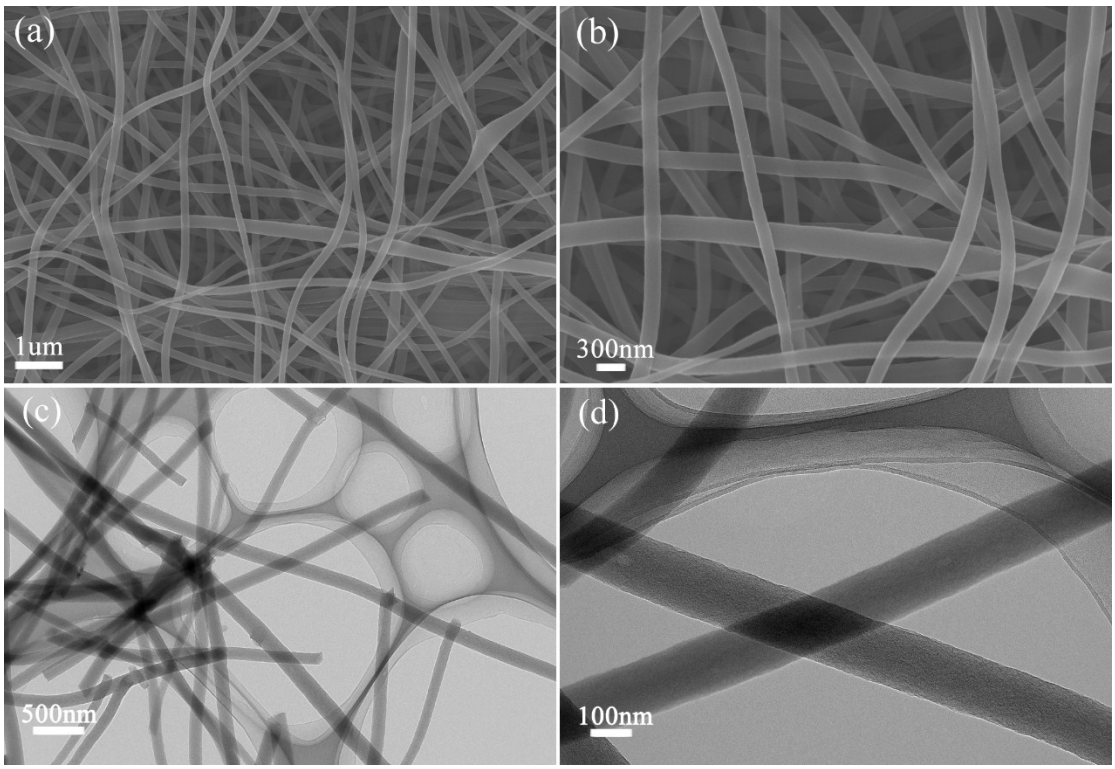

Fig. S3. (a-b) SEM images, (c-d) TEM images of C fiber film.

Fig. S3 shows the SEM and TEM images of C fiber film. The C fiber film is obtained by carbonizing pure PAN fibers at 800 °C for 5h in Ar atmosphere. The fibers intersect each other, while the junctions are not fused.

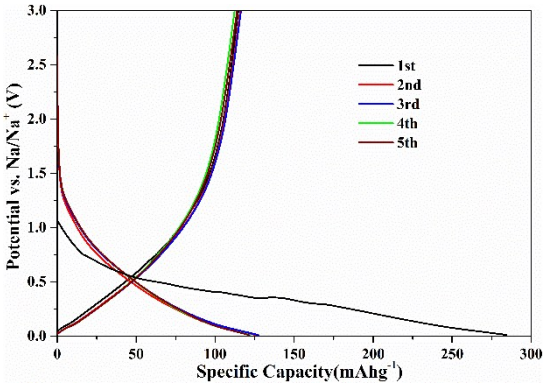

Fig. S4. Charge/discharge curves of C fiber film for the initial three cycles at 20 mA g^{-1}.

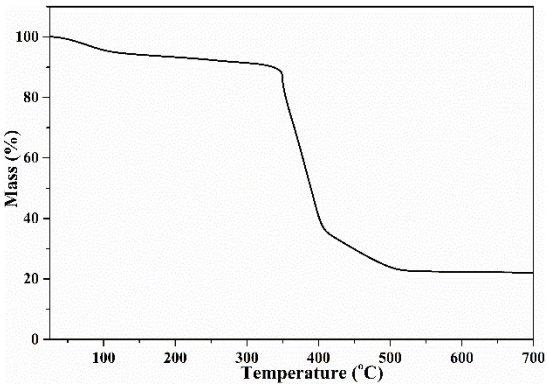

Fig. S5. TGA curve of C-Mo_2C fiber film.

Fig. S5 shows the TGA curve of C-Mo_2C fiber film under Air at a heating rate of 10 °C min^{-1}. The Mo_2C content in the C-Mo_2C fiber film is calculated to be about 22 wt% from the TGA curve.

The carbon fiber content in the C-Mo_2C fiber film is about 78 wt% (Fig. S5). The C-Mo_2C fiber film and C fiber film exhibit capacity of 212 and 121 mAh g^{-1} at 50 mA g^{-1}, respectively. The contribution of carbon fiber on whole capacity of Mo_2C/C composites could be calculated from the following equation:

M (carbon fiber) = 78%*121/212 ≈ 44.5%