Supporting Information

Highly Aligned Molybdenum Trioxide Nanobelts for Flexible Thin-Film Transistors and Supercapacitors: Macroscopic Assembly and Anisotropic Electrical Properties

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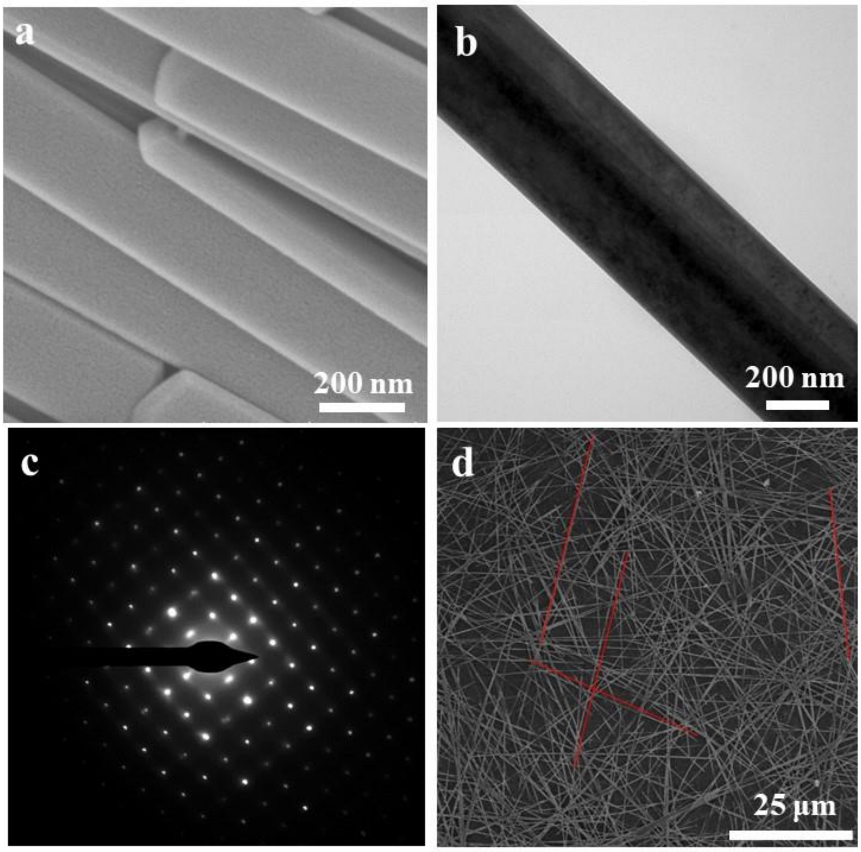

Figure S1. (a) High-magnification FESEM image of as-synthesized MoO_3 nanobelts. (b) TEM images of the as-synthesized MoO_3 nanobelts. (c) Selected-area electron diffraction (SAED) pattern of individual MoO_3 nanobelts. (d) Low-magnification FESEM image of MoO_3 nanobelts. Red lines indicate the length of individual nanobelt.

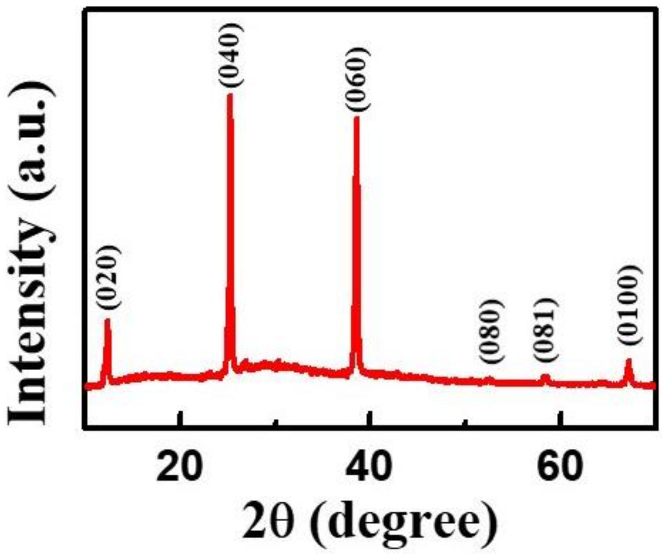

Figure S2. XRD pattern of MoO_3 nanobelts.

Figure S3. Digital photograph of nanobelts after self-assemble process.

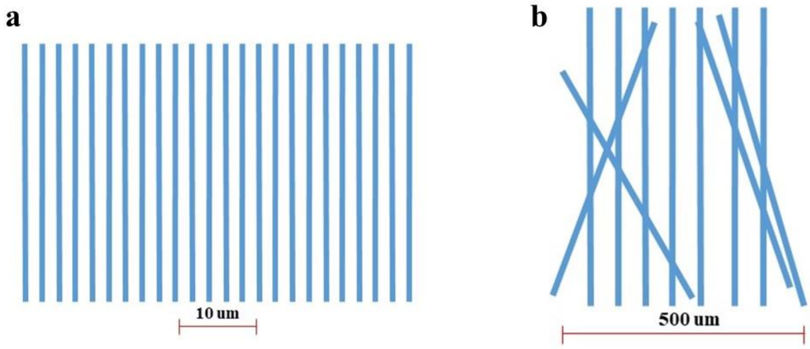

Figure S4. Schematic diagram of the calculation of nanobelts compactness (a) and alignment ratio (b).

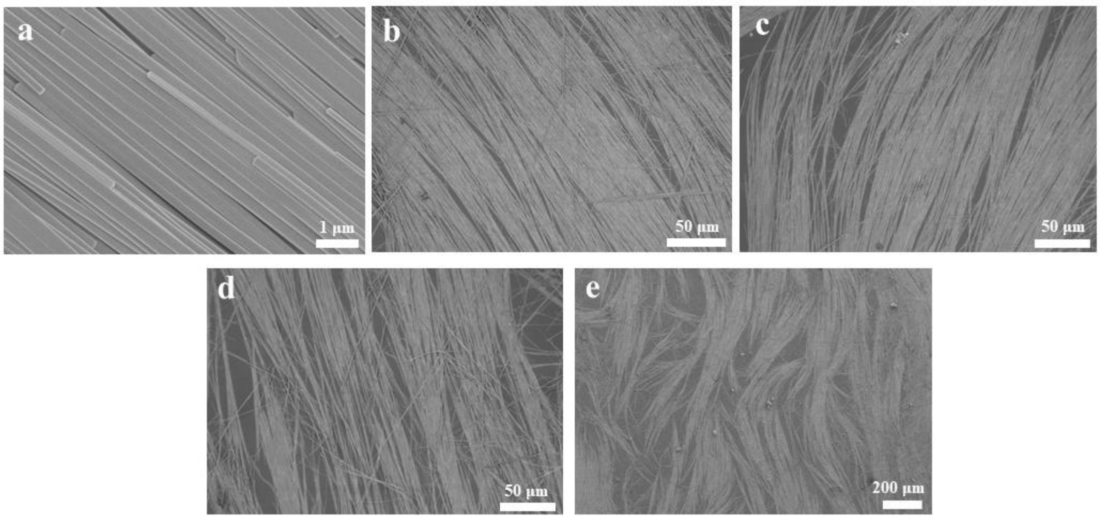

Figure S5. FESEM images showing the assembly conditions in different areas. (a) Central ring area. 0.4 cm (b) 0.8 cm (c)1.2 cm (d)1.6 cm (e) from the central area.

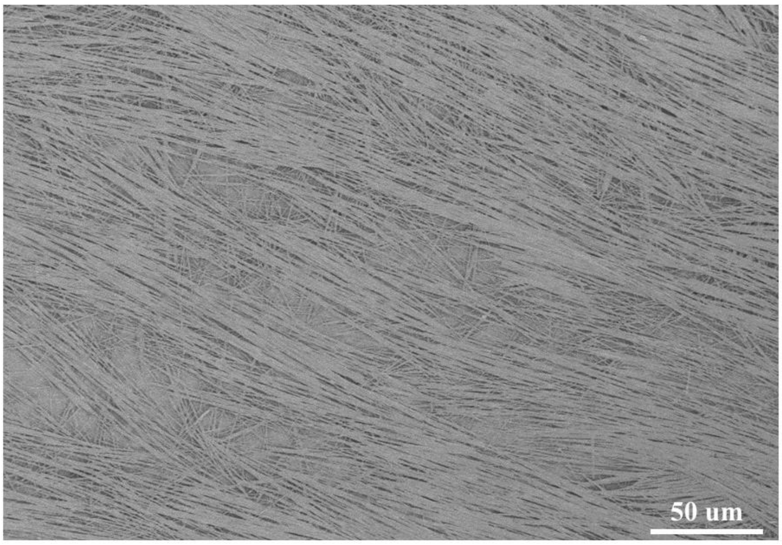

Figure S6. FESEM image of assembled MoO_3 nanobelts using $CHCl_3$ as underlying solvent. The experimental condition is similar to that using CH_2Cl_2 as underlying solvent except the solvent type. (2 mg/mL MoO_3 nanobelts dispersion, 20 mL solvent in a 60 mL baker)

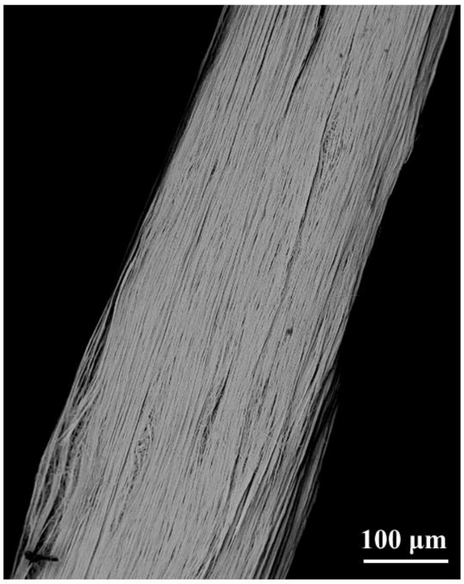

Figure S7. FESEM image of aligned MoO_3 nanobelts yarn.

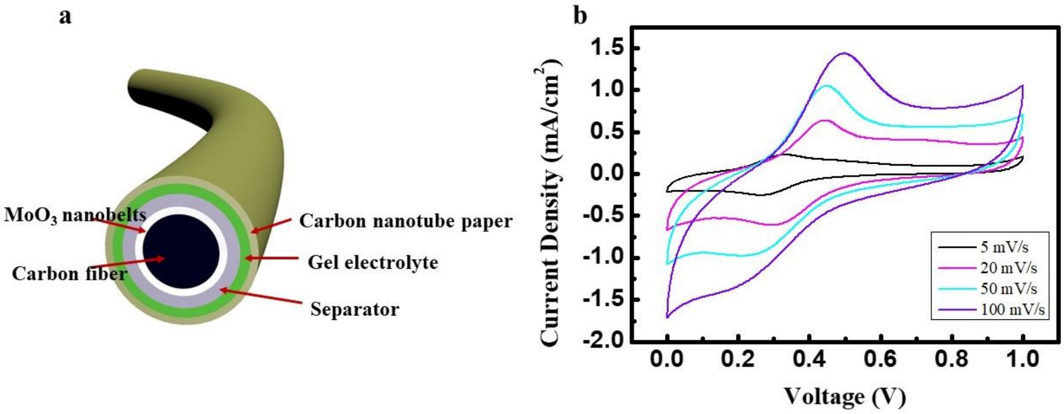

Figure S8. (a) Schematic diagram of the fiber-shaped supercapacitor. (b) Cyclic voltammetry (CV) curves of fiber-shaped supercapacitor at scan rates from 5 to 100 mV/s.

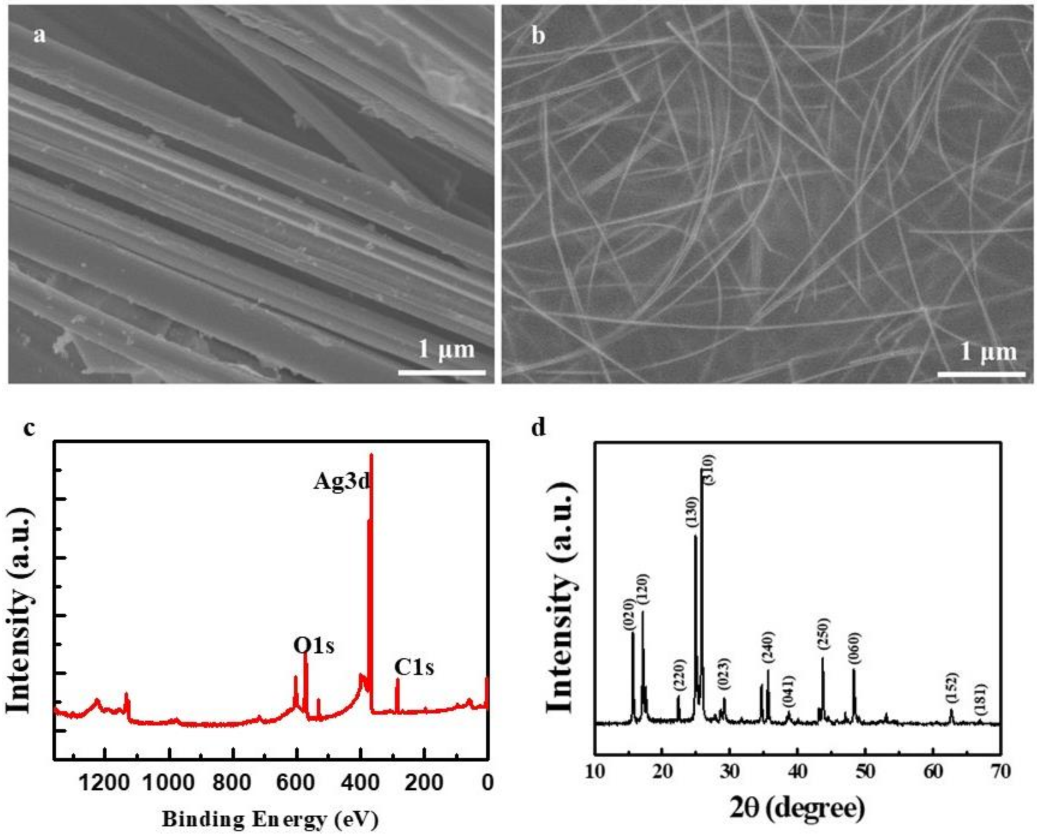

Figure S9. FESEM images of wire-like particles of bismuth sulfide nanobelts (a) and silver nanowires (b) after drying. (c) X-ray photoelectron spectroscopy (XPS) of silver nanowires. (d) XRD pattern of Bi_2S_3 nanobelts.

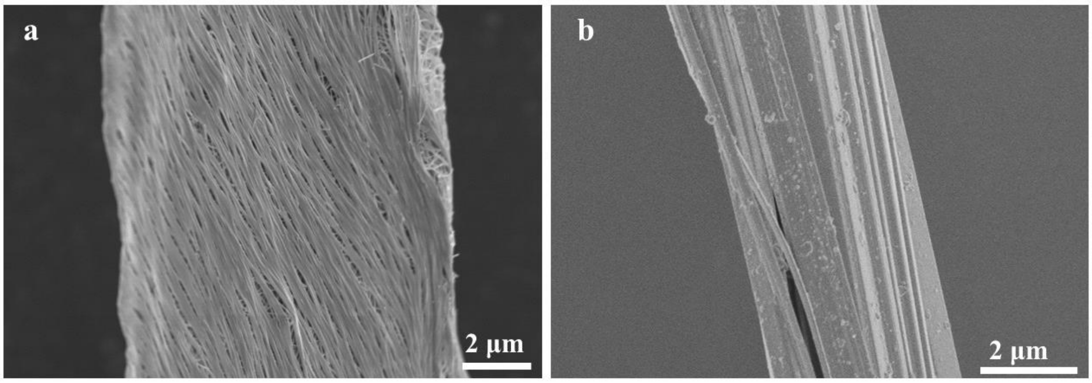

Figure S10. FESEM images of silver nanowires yarn (a) and bismuth sulfide nanobelts yarn (b).

Note S1:

$$\text{Compactness} = \frac{n}{l}$$

where n is the number of nanobelts, l is the counting distance.

$$\text{Alignment ratio} = \frac{N}{L}$$

where N is the number of nanobelts parallel to alignment direction, L is the total number of nanobelts in 500 um.

Note S2:

The surface tension is calculated by the formula

$$\gamma = \frac{\rho g h r}{2cos\theta}$$

where r is the surface tension, ρ is the density, g is the gravity constant, h is the height in capillary tube, r is the diameter of capillary, and θ is 46.5 for capillary tube. Through measurement, h_{water} and h_{CH2Cl2} are 1.55 cm and 2.85 cm. After calculation, surface tensions of water and CH_2Cl_2 phase are 25.16 mN/m, and 50.72 mN/m. According to Antonoff law, surface tension in water-CH_2Cl_2 interface is 25.56 mN/m.

Through experimental observation, MoO_3 nanobelts in water phase is well-dispersed for a few days, in which the forces acting on the nanobelt are in equilibrium. Therefore, the gravity is greater than the electrostatic interaction because of the buoyancy effect ($F_{gravity} > F_{electrostatic}$).

According to the formula,

$$F_{gravity} = pvg$$

where ρ is the density, v is the volume, and g is the gravity constant. For molybdenum trioxide nanobelts, ρ = 4.692 g/cm^3, v = 50 um × 0.3 um × 0.05 um = 0.75 um^3. g = 9.8 mN/g. $F_{gravity} = 3.45 \times 10^{-11}$ mN. Therefore, $F_{electrostatic} < 3.45 \times 10^{-11}$ mN.

The self-assembled ordered structure was realized in air-water-CH_2Cl_2 phase, in which interfacial force is the main driving factor of self-assembled ordered structure. The surface tension is calculated by formula,

$$\gamma = \frac{\rho g h r}{2cos\theta}$$

where r is the surface tension, ρ is the density, g is the gravity constant, h is the height in capillary tube, r is the diameter of capillary, and θ is 46.5 for capillary tube. Through measurement, h_{water} and h_{CH2Cl2} are 1.55 cm and 2.85 cm. After calculation, surface

tensions of water and CH_2Cl_2 phase are 25.16 mN/m, and 50.72 mN/m. According to Antonoff law (*J. Phys. Chem.*, **1948**, 52, 969-975), surface tension in water-CH_2Cl_2 interface is 25.56 mN/m. Therefore, capillary force of MoO_3 nanobelt ($F_{capillary}$) = 25.56 mN/m × 50 um = 1.28×10^{-3} mN.

From the concrete numerical value of capillary force (= 1.28×10^{-3} mN) and electrostatic interaction (< 3.45×10^{-11} mN), capillary force is the main driving force for the MoO_3 nanobelts assembly.