Electronic Supporting Information

Self-weaving WO_3 nanoflake films with greatly enhanced electrochromic performance

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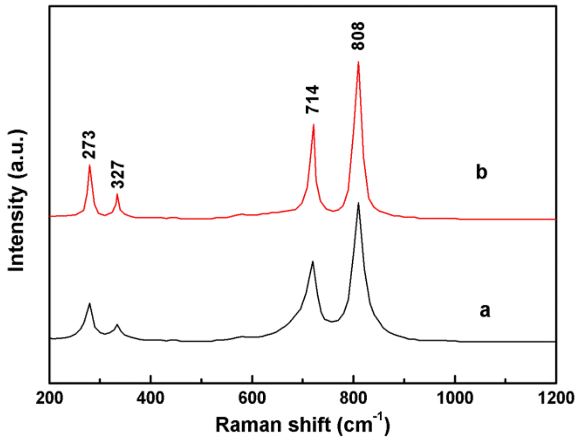

Fig. S1. Raman spectra of the films: (a) as-prepared and (b) annealed at 400 °C for 2 h.

Fig. S1 displays a Raman spectrum of the self-weaving WO_3 nanoflake films. The bands centered at 714 and 808 cm^{-1} arise from the O-W-O stretching vibrations of the bridging oxygen atoms, and the two bands located at 273 and 327 cm^{-1} belong to W-O-W bending modes. As shown in Figure S1, there are no distinct changes in the Raman spectra of the annealed and unannealed WO_3 films. Compared with the as-prepared WO_3 films, the Raman peaks intensity of the annealed WO_3 films increased a bit, which indicated that the crystallinity of WO_3 was improved. These results revealed that the samples were pure WO_3 with a hexagonal phase and no hydrated WO_3 was found.

Investigation of the growth process of the self-weaving WO_3 nanoflake revealed that two types of nanowire, along the (100) and (002) planes, respectively, were formed in the early stages. In the presence of oxalic acid and urea, these nanowires were then interwoven to give a flake-like nanofabric. To further understand the growth process of the WO_3 nanowire, a WO_3 film was prepared by the same process without the addition of oxalic acid and urea. As shown in Fig. S2, a WO_3 nanowire film was grown, and therefore Cl^- appears to be the growth-directing ion in forming the 1D nanowires.

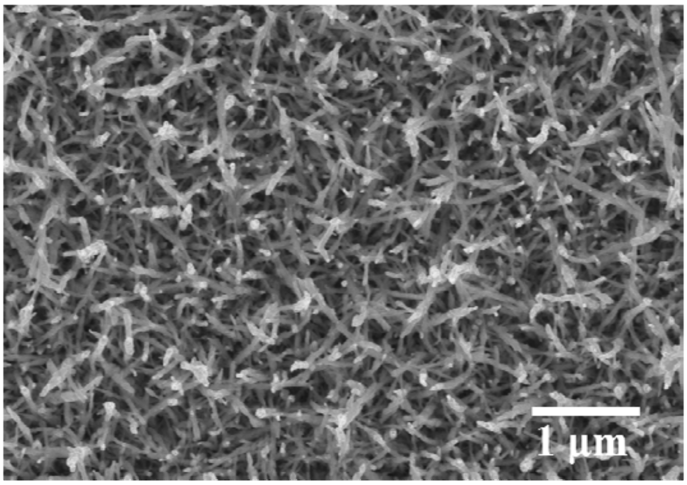

Fig. S2. SEM image of WO_3 film prepared without oxalic acid and urea.

To further understand the growth process of the unique flake-like WO_3 nanofabric, we examined the morphologies and structures of the intermediate products obtained at different reaction times. When the reaction was continued to 6 h, examination of the intermediate products showed that all of the nanowires were transformed into a flake-like nanofabric (Fig. S3). The size and distribution of the intermediate obtained at 6 h are irregular compared to those of the nanoflake obtained at 12 h.

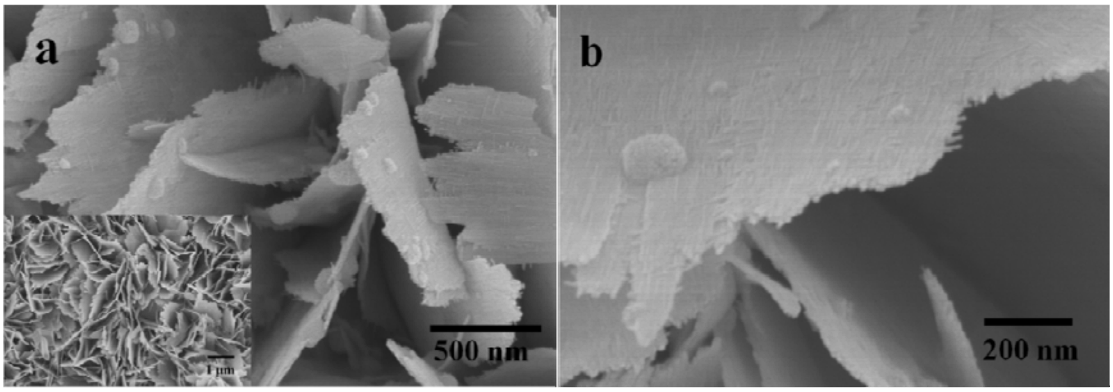

Fig. S3. (a,b) FESEM images of the sample obtained at 180 °C for 6 h.