Electronic Supplementary Material (ESI) for Energy and Environmental Science

Supplementary Information

Morphosynthesis of hierarchical MoO_2 nanoarchitectures as a binder-free anode for lithium-ion batteries

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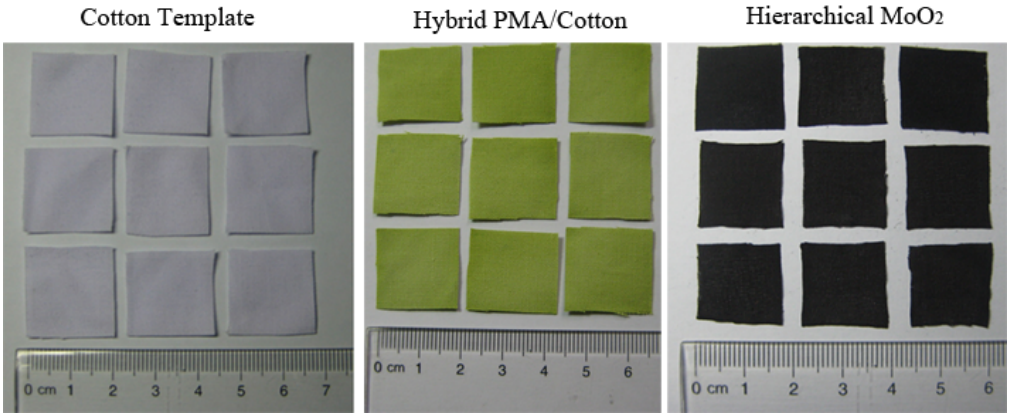

Fig. S1 Digital camera images for the cotton template, hybrid PMA/cotton, and hierarchical MoO_2.

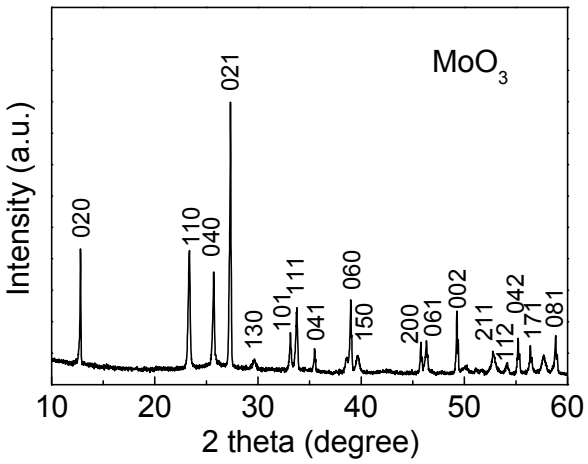

Fig. S2 A typical XRD pattern for the sample prepared by heating the cotton/PMA composite at 600 ºC for 4 h in air. The diffraction peaks could be well indexed to a pure orthorhombic phase MoO_3 [space group: *P*bnm (62)] (JCPDS No. 35-0609; a = 3.9630 Å, b = 13.8560 Å, c = 3.6966 Å).

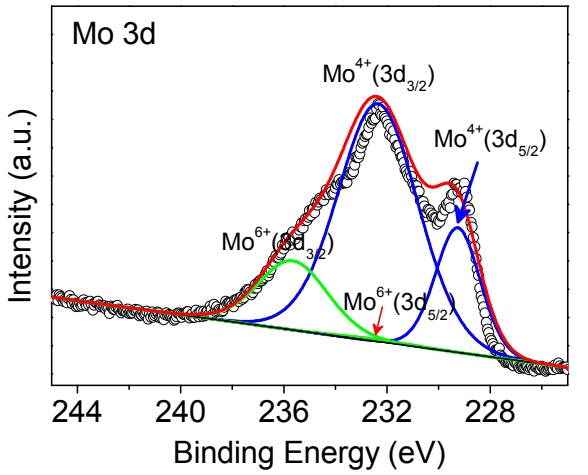

Fig. S3 High-resolution XPS Mo 3d spectrum of the final MoO_2 product.

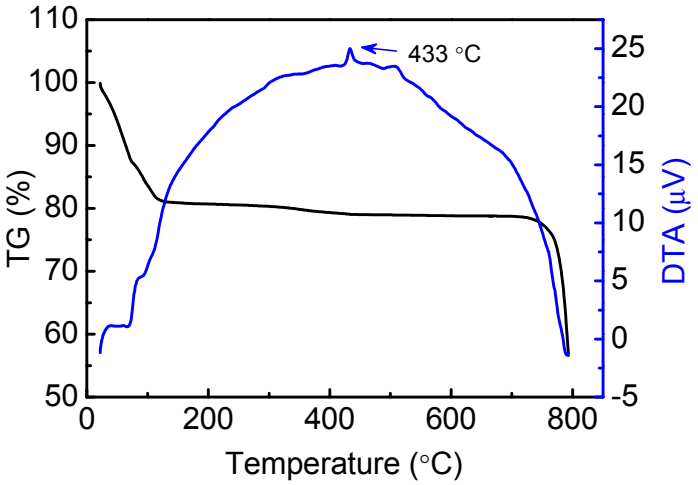

Fig. S4 TG and DTA curves of PMA. TG and DTA were measured at a heating rate of 10 ºC min^{-1} in a flowing air.

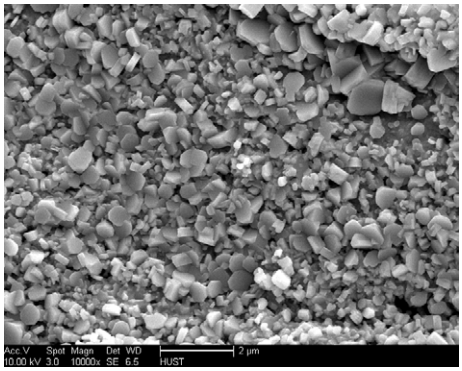

Fig. S5 A typical FESEM image of the MoO_3 product prepared by heating the cotton/PMA composite at 450 ºC for 4 h in air.

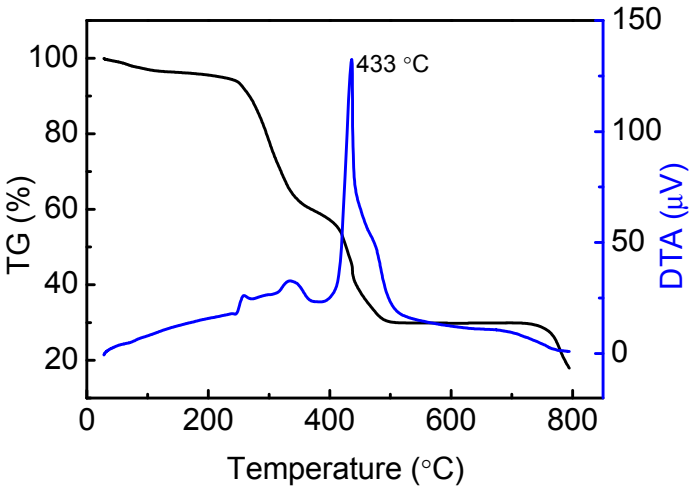

Fig. S6 TG/DTA curves of a typical PMA/cotton hybrid. The weight loss from room temperature to 200 °C in the TG curve is attributed to the existence of water in the composite. In the TG curve, the large weight loss about 65.38 wt% in the range of 200 to 500 °C may result from the cotton decomposition. The exothermic peak around 259 and 335 °C in the DTA curve may be assigned to the cotton decomposition. The exothermic peak around 433°C may arise from the decomposition of PMA to remove P-based substances, accompanied with the cotton decomposition. There is no obvious change in weight loss above 500 °C, indicating that the cotton is removed thoroughly.

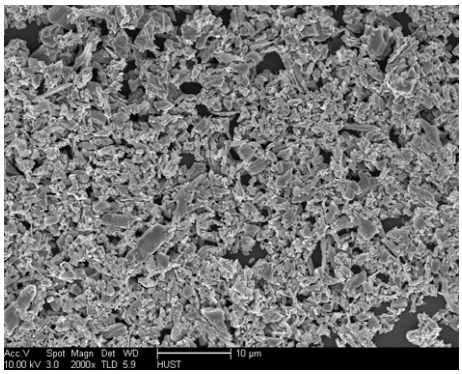

Fig. S7 A typical FESEM image of the MoO_2 product prepared by heating PMA at 600 ºC for 4 h in air and subsequently treating at 600 ºC for 5 h in 5% H_2/Ar.

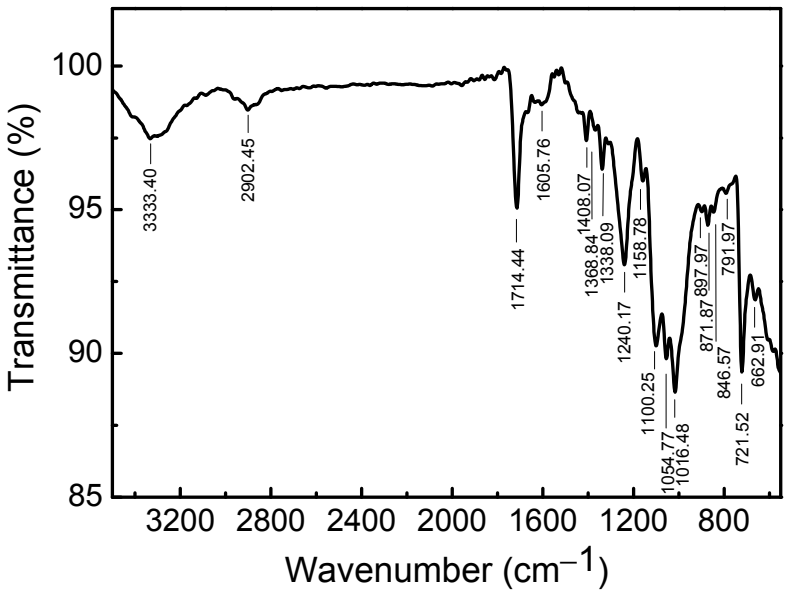

Fig. S8 FT-IR spectrum of the cotton fabric indicating the characteristic cellulose peaks around 1000–1200 cm^{-1}.[1] Other main characteristic bands related to the chemical structure of cellulose are 3550–3100 (ν-OH), 2902 cm^{-1} (ν-CH_2), 1714 cm^{-1} (ν-C=O), and 1606 cm^{-1} (ν-C-C in phenyl backbones).[2]

(1) J. Bouchard and M. J. Douek, *Wood Chem. Technol.*, 1993, **13**, 481.

(2) C. Chung, M. Lee and E. K. Choe, *Carbohyd. Polym.*, 2004, **58**, 417.

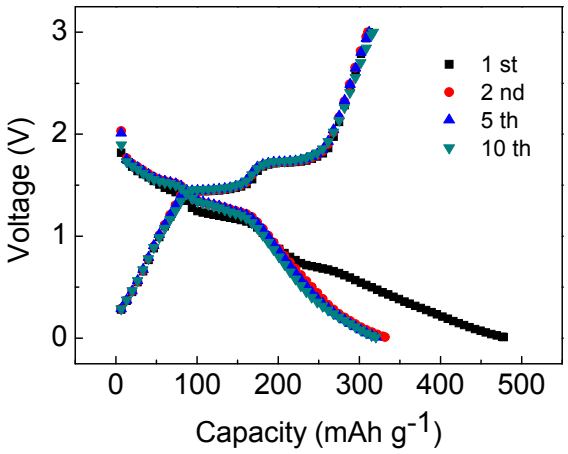

Fig. S9 Galvanostatic discharge and charge curves of the electrode made of MoO_2 particles (as shown in Fig. S7) cycled in the voltage range of 3–0.01 V vs Li at a current density of 200 mA g^{-1}.